SCORE! Sustainable Consumption Research Exchange

Proceedings:

Perspectives on Radical Changes to Sustainable Consumption and Production (SCP)

Edited by Maj Munch Andersen (RISØ) and Arnold Tukker (TNO)

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Chapter 1 Introduction to SCORE and the Workshop Concept

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1 The SCORE project

SCORE! (Sustainable Consumption Research Exchanges) is an EU-funded network project that supports the UN's 10 Year Framework of Programs on Sustainable Consumption and Production (SCP). It runs between 2005 and 2008, consists of 28 institutions, and aims to involve and structure a larger community of a few hundred professionals in this field, in the EU and beyond. Table 1 reviews the project participants.

The SCORE! philosophy assumes that sustainable consumption and production structures can only be realized if experts that understand **business development**, (**sustainable) solution design**, **consumer behaviour** and **system innovation policy** work together in shaping them. Furthermore, this should be linked with experiences of actors (industry, consumer groups, ecolabelling organisations) in real-life consumption areas: **Mobility, Agro-Food, and Energy/electronics.** These areas are responsible for 70% of the life cycle environmental impacts of Western societies. Broadly, this gives the following approach to our project (see figure 1, 2 and table 2):

- The first phase of the project wants to arrange a positive confrontation of conceptual insights developed in the four aforementioned science communities, of how 'radical' change to SCP can be governed and realised.
- The second phase puts the three consumption areas in centre stage. SCORE! Work package leaders will inventory cases 'that work' with examples of successful switches to SCP in their field. In a series of conferences and workshops, cases will be analysed on 'implementability', adapted where needed, and policy 'prescriptions' will be worked out that can support implementation.

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- Rolf Wustenhagen, University of St. Gallen, Switzerland
- Sean Blair, Spirit Of Creation, UK
- Tim Cooper, Sheffield Hallam University, UK

Table 1: Participants in the SCORE Project

2 Workshop concept

The main vehicle for the first phase is first SCORE Workshop, Thursday 20 and Friday 21 April 2006 hosted by Risoe with support of the EEA and ETC-WMF, in Copenhagen, Denmark. For this workshop, SCORE! invited particularly conceptual contributions about how to realise radical changes to sustainable consumption and production. There are 4 sessions of about 8 presentations, each dealing with one of the perspectives: business (with contributions mainly from business schools and business), sustainable design (with contributions mainly from design institutes), consumer behaviour (with contributions mainly from consumer scientists) and system innovation (with contributions mainly from experts in system innovation and governance for transitions). Participants in the workshop have a role as presenter or

discussant. In order to create a positive confrontation across the different scientific perspectives, we have deliberately linked where possible presenters with discussants that have roots in a different science field.

All papers presented are part of these Workshop proceedings (from some presentations only abstracts were available in time). These proceedings do not include the shorter general introductions during the plenary session. From each of the four fields, the 4-5 best papers will be selected for inclusion in an edited 'State of the Art' book on governance or radical changes to SCP. The SCORE Work Package/session leaders contribute with a state of the art review for each of the four perspectives. First draft reviews have been included in these proceedings, but they are meant as a first step only. The workshop itself will result in an agenda for a considerable elaboration and extension of these reviews. Furthermore, in the period after the workshop the full SCORE co-ordination team will produce an extensive concluding synthesis analysis on the question of governance approaches for SCP. These – in total five – chapters produced by the SCORE team will in the end for the backbone of the edited book.

Acknowledgements

The SCORE! team greatly acknowledges the support of the European Environment Agency (EEA) and the European Topic Centre on Resource and Waste Management (ETC-WRM), who kindly made available meeting rooms and technical equipment for the meeting.

Workshop 1	General platform for exchange of views how to realise sustainable consumption structures between the 33 Participants and Partners, from their own knowledge background.
Conference 1	Goals: Launch the network in the EU arena Provide a broad platform for conceptual exchange Provide a broad platform for SC case presentation s
Workshop 2	WS2-3 are organised giving consumption domains centre stage. WS2 starts with discussing 5-10 SCP cases per domain from the 4 knowledge perspectives, analysing success- and failure factures, re-design potential, and danger of rebound effects
Workshop 3	WS3 abstracts the lessons of WS2 to a higher level, leading to concepts models and case typologies of successful implementation approaches for sustainable consumption in relation to user awareness. The workshop focuses furhter on the implementation tools for successful approaches (e.g. how to organise information management for user awareness)
Conference 2	Conference 2 validates the results of the project and forms a first outreach to policy, industry, certification organisations and other bodies relevant for implementation

Table 2: Events in the SCORE project

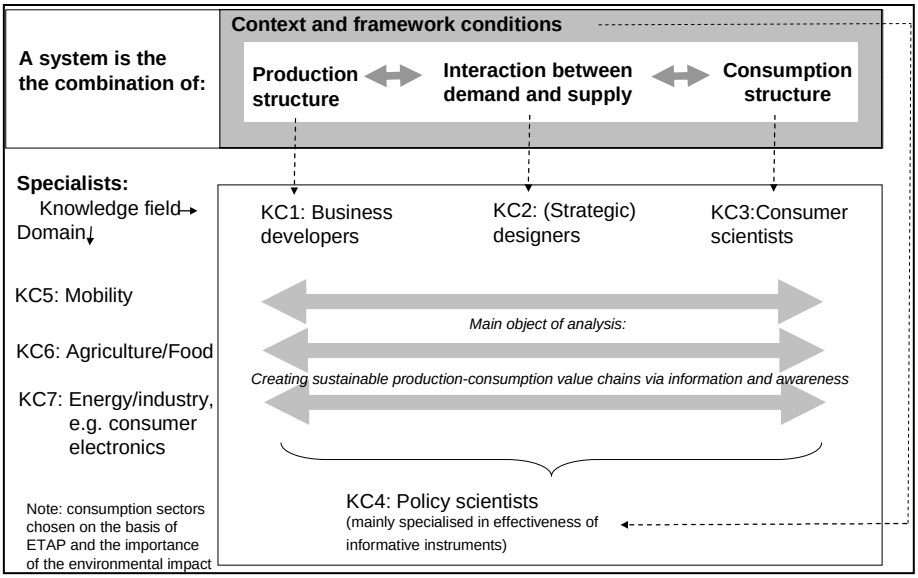

Figure 1: Knowledge communities involved in the SCORE project

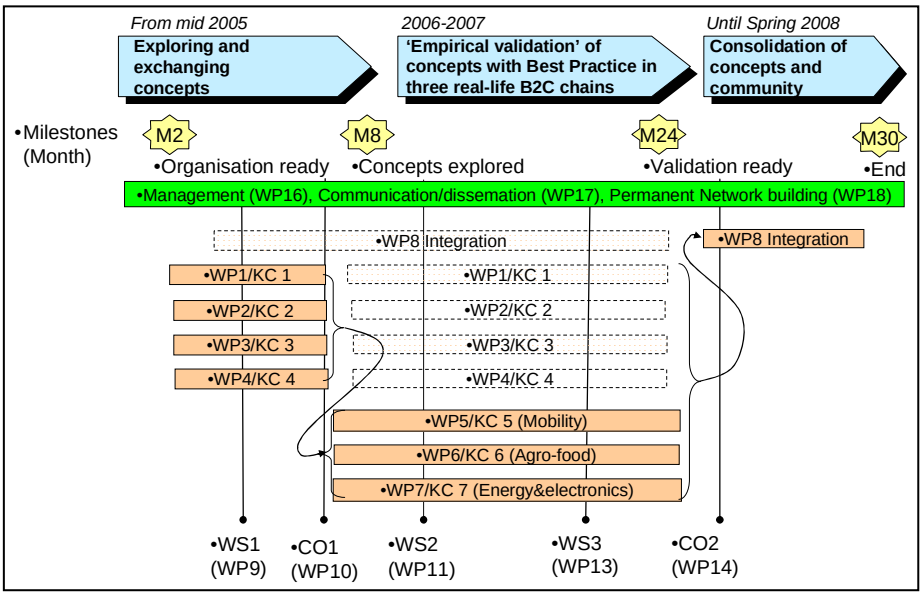

Figure 2: Structure and Time Table of SCORE!

Parallel session I: Consumer Research

Leader: Eivind Sto
Rapporteur: Theo Geerken

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Chapter 2 A multi-dimensional approach to the study of consumption in modern societies and the potentials for radical sustainable changes

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1 Introduction

The objective of this position paper is to develop a multidimensional understanding of the role of consumers and consumption in modern (or post-modern) societies, and use this understanding as a platform for suggesting sustainable changes.[1]

The phrase "sustainable consumption" was not much used until "Our Common Future", The Brundtland report, was issued in 1987. The concept was an immediate success, and the world "sustainable" has since been used in a number of contexts, more or less completely changing the rhetoric of environmentalism.

During the last decades we have witnessed a shift in the environmental focus from nature to society, and from the natural sciences to the social sciences. While the focus in the 70ties was placed on pollution and biodiversity it has more or less been replaced by eco-efficiency and energy use, within the concept of factor four or factor 10 (Weizsäcker et. al. 1997).

During this process the centre of attention has also gradually shifted from production processes and manufacturing towards consumption. Thus, the Oslo-declaration on sustainable consumption from 2005 has put the main challenge for a sustainable development on consumption and consumer praxis. The Japanese AIST's Research Centre for Life-Cycle Assessment (http://unit.aist.go.jp/lca-center/english/top.htm) has carried out a large three-year (2002 -2005) project on climate change and sustainable

[1] The paper gives a general overview of the main dimensions in the recent discussion of sustainable consumption. After the SCORE workshop in Copenhagen, April 20. – 21., 2006, the paper will be developed along two directions. First of all we will integrate all the consumption papers from the workshop into a new version of this text. Secondly we will expend the general references and give a broader and deeper overview of the state of art.

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consumption. The project addressed sustainable consumption as a way to reduce greenhouse gas emissions and developed and employed methods to evaluate the social acceptability and the effectiveness (Yagita et al. 2003; Ozawa et al. 2005).

Substantial progress has been made the last decade to measure and model the environmental impact of consumption in general, and related to energy more specifically. Indicators have been developed at the macro level, and a number of LCA studies have been carried out at the micro level for specific products (Frankl and Rubik 2000, Sonnemann et al. 2000, Heiskanen et al. 2002). There is work remaining; to develop more flexible indicators and to update LCA studies in line with product developments and innovations. But first of all we need indicators for change.

LCA studies have so far mainly been relevant for business. A challenge for further development is LCA approaches to sustainable consumption (Loerinik et al. 2005). The Dutch HOMES project represented a breakthrough in the measuring of the environmental impacts of households' consumption (Noorman and Uiterkamp 1998). This was done within a household metabolism approach, and the main focus was on direct and indirect energy use. It has later been developed further in a European context (Moll et al., 2005)

To some degree we have also recognised a shift from consumption, as an economic and material category, to consumers as economic and political actors. One reason behind this shift is the fact that eco-efficiency of products has been countered by increased consumption (Throne-Holst et al., 2006). The results have been that the environmental impact of consumption in many areas has increased, in spite of substantial technical innovations. This phenomenon is called the rebound effect in the economic literature (Musters, 1995; Greening et al.2000), but is also recognised within other disciplines. Uiterkamp (2000) has the following reference to the phenomenon: *"This seems to be a common finding: technological improvements are offset by volume effects resulting from behavioural, social or demographic factors"*. What this means is that consumers have a decisive part to play in the process towards sustainability: (changed) individual praxis from millions of consumers really matters.

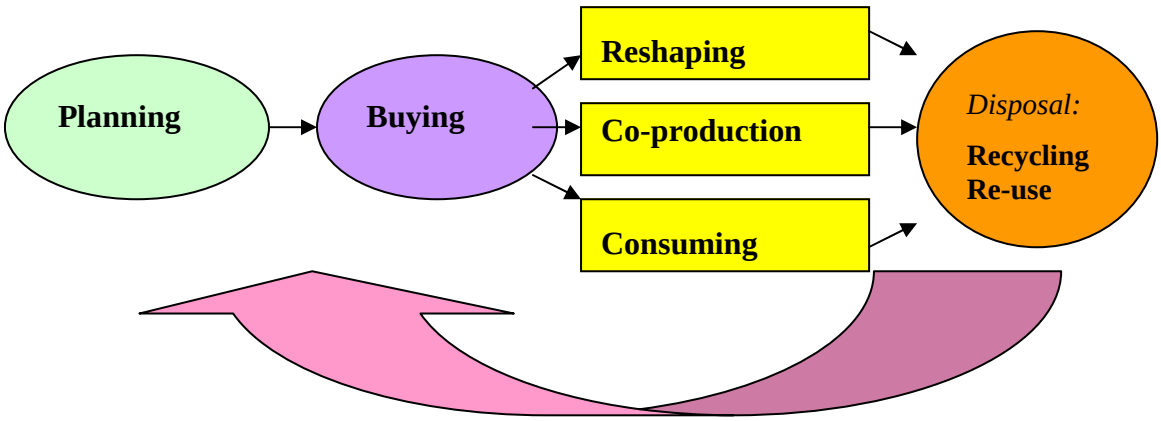
However, these shifts in focus from nature to society and from production to consumption and consumers do not mean that the environmental problems are solved or that the industrial pollution is under control; at least not in a global perspective. There is still a need for substantial technical innovations in production processes as well as in environmental quality of consumer products, and ecosystems around the globe are still under threat. But the main challenge in the future will probably be on the consumption side, and we can only succeed if individuals are mobilized in their roles as both consumers and voters in a bottom-up approach.

We will build this position paper around four theoretical discourses. They are all relevant for the political discussion about sustainable consumption:

- Consumption as process, not just demand (buying)
- Use value, exchange value and the symbolic value of consumption
- The tension between rational models and the routines of everyday life
- Consumers as actors in market and politics

2 Consumption as a process

Our first point of departure is that consumption is a process, illustrated below. This process includes at least 1) planning, 2) buying, 3) using and 4) disposal, illustrated in the figure below.



When we discuss the environmental impact of consumption it is imperative to include the entire consumption process. In the marketing literature the main focus has been on the planning and buying phases, while the use phase to a large degree has been neglected. Within this paradigm the normative goal has been formulated to help consumers to choose environmentally friendly products in the market, instead of more polluting or energy consuming goods. Labels, specific environmental information and tests are regarded as the main tools. To some degree this is also the case for modern consumer organisations. Their magazines are full of articles on “best buys” and “value for money”. A more radical approach within this paradigm would be to buy fewer products, and as such reduce the level of consumption. (Vittersø et al. 1998)

Within the sociological and anthropological tradition more emphasise have been put on the use phase, while the importance of the market phase has been underestimated. Consumption is first of all a matter of using products in different ways. Even though most of the goods in modern societies are bought in the market, we reshape and adjust them to our own values, needs and wants. There is also a substantial *production* taking place in modern households. This is related to food preparation, clothes maintenance and production, and renovation of houses and other household-related work. Translated to sustainability: The main focus has been on a sustainable use of the products. For many products and activities the use phase is far more important than the buying phase, such as the washing process. It is substantially more important *how* you do your laundry service, than what kind of washing machine you have bought and what kind of detergent you use (Rubik and Frankl, 2005: pp). The decisive variables are temperature and utilising the capacity of the washing machine. Other more culturally related values are tolerance towards dirt, and what does it mean to be clean? (Klepp, 2003; Klepp, 2005)

Our main message is that we have to consider all phases of consumption. This also includes the disposing phase when we recycle and prepare some of the products for re-use. Thus, not all products are consumed. In most of the green consumer guides we will find advices dealing with all phases of consumption. They focus on both the choices in the market and the use of products as well as the disposing.

3 Use value, exchange value and the meaning of consumption

For Marx the commodity has two aspects, the use-value and the exchange value, discussed in Grundrisse and The Capital). Use-value is the property of a commodity; which is capable of satisfying human needs. The exchange-value, on the other hand, expresses the rate at which one commodity exchanges with another (Marx 1976 pp 163-77).

The relationship between use-value and exchange value has been the main inspiration to modern consumer policy, as far as both consumer testing and consumer protection are concerned. The Consumer Rights developed by President Kennedy in his Consumer Message to the Congress and United Nations Consumer Guidelines are developed within this paradigm (President Kennedy, 1962; UN 19) The classical consumer policy has to a large degree been concentrated on *use value and exchange value* (the price of the products). Thus, we have taught consumer to use freezers and washing machines; and we have learned them to behave like (more or less) rational costumers in the market of goods and services.

However, this simple model of consumption in modern societies has been challenged by many authors. Baudrillard emphasis the symbol values:"The fundamental conceptual hypothesis for a sociological analysis of consumption is not use value, the relation to needs, but symbolic exchange value…" (Baudrillard 1981:30). This phenomenon was also recognised by Thorstein Veblen (1899/1925) for more than a hundred years ago, in the more recent writings of Bourdieu (1992) and in the post-modernistic "tradition" (Featherstone 1991).

Our main point here is not to forget the use value and the exchange value and replace it with symbol value and identity in the consumer research and consumer policy. On the other hand we will argue for a combination of these perspectives because consumption in modern – or post-modern – societies is a complex process.

4 The tension between rational models of consumer behaviour and models based upon routines and habits

Possibilities for changing consumer behaviour has been a central issue for policymakers as well as researchers since the early 1990ties when sustainable consumption was first put on the political agenda. Within the political discourse as well as in the scientific ones we find tensions between different views on behavioural changes. The main conflicts may be seen in

the emphasis on the role of the individual consumer in both consumers' responsibilities and possibilities for changing behaviour.

Some critics say that by focusing on individual behaviour the responsibility for sustainable development is taken away from politics and placed on the individual consumer. Other contributions question the effect of specific policy measures, such as consumer information, in changing consumer behaviour (Shove 2003). Bauman (1999) takes these critical arguments even further by stating that the influence by ordinary citizens as well as national governments is constantly diminishing.

Both psychologists and social scientists have engaged in the study of consumer behaviour in relation to sustainability. While the social psychologists emphasis the role of information in changing individual attitudes and consequently behaviour, the focus within environmental sociology has in general either been on individualistic or more structural theoretical models. In this section we will turn to the attitude-behaviour paradigm, before discussing different contributions from the field of environmental sociology.

The most influential theory of attitudes and behaviour is the Theory of Planned Behaviour (Ajzen and Fishbein, 1980). According to this, behaviour should be predicted from actors' attitudes and intentions. But the relationship is mediated by people's perceived behavioural control. This means that if a person believes he is unable to adapt the behaviour in question, he is unlikely to try to do so. Behavioural intentions could be predicted from attitudes, subjective norms and perceived behavioural control.

Economical-psychological studies have been conducted to examine why some people behave pro-environmentally while others do not, and how consumers might be persuaded to behave more pro-environmentally. These studies tend to concentrate on people's attitudes towards the environment. Most studies, however, find at best only weak correspondence between reported attitudes and actual behaviour. Kaiser, Wolfing and Fuhrer (1999) propose that the weak correlation between attitudes and behaviour results from three sources:

1) lack of a unified concept of attitude among researchers,
2) because of differences in the way attitudes and behaviours are measured
3) because some researchers fail to recognise the constraints on people's behaviour

Both Giddens (1991) and Beck (1992) discuss processes of individualisation in the modern society. Contrary to traditional societies where individual choice was limited and individuals were subordinated to the collective order of social norms, the modern man makes his own decisions with a greater degree of independence from norms and social structures.

In contrast to this view Miller (1998) argues that consumption is not primarily an individual activity, but framed by specific cultural and social contexts within and outside of the household. Within this perspective norms, habits and routines are decisive factors explaining consumption practices. Following the same lines Gronow and Warde (2001) have opened a debate relevant for our research questions: They claim that, during the nineties, the focus of consumer research went from spectacular to *ordinary* consumption.

Consumption is mainly about the everyday life of ordinary consumers, and this should be better reflected in contemporary research. Gronow & Warde use the history of consumer research to place their contribution within the main trends in social sciences.

5 Consumers as actors in markets and politics

This discussion will be inspired by a theoretical model that has been developed according to two fundamental scientific and political discussions (Kjærnes & Stø, 1996, Stø et al. 2005)):

1. The relationship between market and state in modern welfare societies
2. The relationship between micro and bottom-up activities on the one hand and macro and top-down initiatives on the other.

Post-war welfare states have witnessed an ongoing struggle between market and state (Lindblom, 1977). In the first two decades after World War II the modern welfare state represented the offensive power in this relationship, while the balance of power changed in the late seventies (Lindblom, 2001), and we are now talking about the regulatory state (Majone, 1996, 1999). Today the main competing strategies are the *maintaining welfare state* policy of the social democrats on the one hand, and the policy of *retrenching the welfare state* by the right wing parties, on the other (Mishra, 1990). This is also highly relevant for consumer policy in the Nordic countries (Ilmonen & Stø, 1997, Stø, 1995b, 1997).

The second relevant dimension is the tension between micro and macro strategies in politics in general, and in the specific consumer policy (Stø, 1979). This discussion includes two elements, namely, the democratic obligation to participate and the relation between participation of the individual and the authorities' right to govern. This is a discussion about the nature of modern social citizenship (Heater, 1990, Holmwood, 1997, Meehan, 1993). Secondly it is a discussion about the political relevance of consumerism (Stearns, 2001). On the one hand it is possible to argue that active and politically conscious consumers represent an enlargement of individual and collective political influence (Kjærnes & Stø, 1996, Micheletti, Follesdal & Stolle, 2004). On the other hand it is argued that this activity threatened the political democracy by introducing an individual economic paradigm into collective political arenas (Eriksen & Weigård, 1993).

Based on these two dimensions we have developed a model that distinguishes between individual or collective actions in markets and politics respectively (Figure 1). On the one hand consumers can choose between individual and collective strategies; on the other hand the individual can act strictly as a consumer in the market or move the questions beyond markets: into politics (Stø et al., 2005). This is an ideal, typical model that doesn't do justice to hybrid solutions – beyond market and state – such as the third sector and new governance models (Pestoff, 1999).

	Micro	Macro
Politics	Voters Voting behaviour Membership of political parties, organisations Articulation opinion polls articles in newspapers word of mouth Influence other voters Political consumers	Political parties Consumer organisations Environmental organisations Influence Government Parliaments Taxes Legal regulation Norms, education
Markets	Consumers Shopping behaviour Complaining process Individual boycotts word of mouth Influence other consumers	Consumer organisation Organised boycotts Influence Industry and trade Product development Competition

Figure *1*. Individual influence through micro and macro strategies in markets and politics

Based upon four case studies Stø et al (2005) have arrived to the conclusion that consumers have a substantial part to play in play, both in their role as classical consumers and in their new role as political consumers or citizens/voters. However, we have also reached to another joint conclusion: *The other actors in market and politics are of decisive importance.* Environmental goals will not succeed if the solution to the problem remains at micro level alone. In order to solve macro problems related to the environment, it is necessary to influence the macro decisions in the market and in politics. Thus, we need a movement from the micro to the macro level, and simultaneously, a development from market into politics.

6 Conclusions

Consumption has a crucial part to play in the development towards sustainable development. Without mobilizing individuals in their roles as consumers and voters in a bottom-up approach we will not succeed in reaching the goals.

However, the responsibility for a sustainable development cannot be put on the shoulders on consumer alone. We need a stakeholder approach where the behaviour of industries, retailers, NGOs and political authorities at local, national, regional and global level are even more important. Only when the actors work together and are committed will sustainability become reality. Thus, in the SCORE project consumption is only one of four relevant dimensions in the discussion of sustainable development. The others are businesses, design and political tools.

Thus, within this framework created by political authorities and businesses, consumers have a specific part to play.

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Chapter 3 How may consumer policy empower consumers for sustainable lifestyles?

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1 Abstract

Consumer policy can empower consumers for changing lifestyles by reducing personal constraints and limitations, but it should also attempt to loosen some of the external constraints that make changes towards a more sustainable lifestyle difficult. In terms of reducing consumers' subjectively felt restrictions on their ability to change lifestyle, the two approaches are equivalent. Policies that increase a feeling of empowerment may also have a positive effect on consumers' motivation to make an effort, thus amplifying its effects. In this paper both types of constraints on lifestyle changes in a sustainable direction are discussed as well as policies for reducing constraints. Possible motivational effects of the proposed policies are also outlined.

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Chapter 4 Do information and awareness work?

Mental compartmentalisation and consumers' behaviours

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1 Introduction

Thanks to a partial review of the sociological literature and with empirical evidence, this paper questions the long-lasting paradigm of consumers' rationality as well as its corresponding policy tool, the supply of information. In particular, how do consumers call up information on climate change, renewable energy and standby consumption as well as on housing labels in their energy-related practices and projects? To which conditions can this information be a lever for changing consumers' behaviours toward a more sustainable society?

A research on residential energy consumption, which is partly comparative between Belgium and Denmark, provides this paper with empirical evidence.

2 Conceptual framework

2.1 The rational-actor assumption

Analysing how "public bodies are seeking to implicate people in contributing towards a more sustainable future", P. Macnaghten and J. Urry (1998, p. 217-218) outline dominant assumptions, which "can be read as part of a modernist tradition". The main assumption is the following, according to P. Macnaghten and J. Urry: "People are presented as individual agents acting 'rationally' in response to information made available to them. Ignorance about environmental issues can be rectified by the provision of information; information will engender concern; and concern will translate into both personal and political behaviour changes…"

This contribution will show, like theirs, that this assumption is not supported by empirical evidence. Before presenting our results, this assumption is further discussed. Indeed, it echoes quite well the paradigm of rational action, which is best exemplified by two leading theories in social psychology, the theory of reasoned action (Ajzen and Fishbein, 1980) and the theory of planned behaviour (Ajzen, 1985). In summary, both theories predict behaviour by the intention to have this behaviour and by the attitudes towards it; in turn, the attitudes are predicted by the personal beliefs about

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the consequences of the behaviour and the evaluation of those consequences – a rational calculation thus – while the intention results from these attitudes and the subjective norms. The subjective norms are themselves explained by the beliefs on the expectations from significant others about this behaviour as well as by the motivation to comply and meet these expectations. Finally, and this is the addition of the theory of planned behaviour, both the intention and the behaviour itself are also determined by the perceived control over the obstacles and over facilitating elements.

On the whole, these researches stress individual preferences, consumers' choices and freedom. "People are primarily addressed as autonomous 'shoppers' whose choices, in the aggregate, determine the fate and future of the planet." (Shove, 2003b).

2.2 When is information efficient to change behaviours?

By placing the individual beliefs at the first step of the causal model of the behaviour, and especially the beliefs about the consequences of the behaviour, both theories award a central role to information, which can modify these beliefs and consequently the attitude and the intention to behave. In terms of policy, information, education and persuasion are the dominant policy tools, which can also include taxation and other price signals: governments and other agencies have invested heavily in overcoming the barrier of 'popular ignorance' (Ekins, 2003) and in providing consumers with information such as labels and advice "to inform consumers of the consequences of their actions and exhort them to behave differently" (Shove, 2003b).

However, several sociological studies on the changes of behaviours in an environmentally friendlier way have demonstrated that individuals are not just taking in as such new information or environmentally oriented advice and behaving accordingly. For example, E. Shove (2003b) shows that efforts to persuade householders to turn the heating down for the sake of global environment have not been strikingly successful. In fact, average temperatures in British homes have been rising steadily over the last thirty years, from around 17 to 21°C.

Researchers in sociology have indeed pointed out several conditions that are necessary for an efficient information: the necessity of bringing new knowledge from practical (and "hidden") to discursive consciousness (Hobson, 2003, following Giddens, 1984), the required "convergence and not the quantity of knowledge that determines its effectiveness in promoting ecological behaviour" (Goldblatt, 2003) as well as the important role in these respects played by the social support obtained from the individuals' social networks, either real, with familiar persons, or virtual, via the mass media (Gram-Hanssen *et al.*, forthcoming). Social support is associated with identity management (Caradec and Martucelli, 2004) and according to J.-C. Kaufmann (2004, p. 188)), "Self-esteem is at the origin of every change" "the demand for acknowledgement overcomes society. Everyone is on the lookout for approval, admiration, and love in the eyes of the others. (…) Without limitations. (…). The necessity of identity management seems indeed to be a powerful explanatory factor of behavioural change, even when it comes to household chores and every-day routines (Kaufmann, 1992, 1993 and 1997).

These factors – discursive consciousness, convergence of knowledge, social support and enhanced self-esteem – must be strong enough to compensate for the mental process of compartmentalisation, as explained below.

2.3 Mental compartmentalisation

As shown by T. Iversen (1996, cited by B. Halkier, 2001, p. 37), "consumption practices are characterised by compartmentalisation in relation to environmental consideration". Numerous rationales that underlie specific practices thus seem to the observer to be uncoordinated with respect to their environmental consequences. In a research on young Danes consuming organic food, B. Halkier met for example a young worker whose dream is to buy a car and a young lady who is very concerned about her food but "finds it tiresome to locate a bottle bank". Another example may be found in interviews realised in Belgium at the end of the nineties, when household waste sorting was becoming either mandatory or recommended in most Belgian municipalities: grocery shopping was unanimously disconnected from household-waste production and sorting practices (Dalla Valle *et al.*, 2001). Other example may be found in the field of energy consumption where numerous studies, summarised by Lutzenhiser (1993) and Shove et al. (1998), show that consumers are not often aware of the energy consumption that is required in their energy-related practices. This mental compartmentalisation is observable even with persons or families with a strong environmental concern who have changed several aspects of their daily practices (but not in communicating practices: Gram-Hanssen, 2005) or with persons whose profession is related to energy savings.[2]

For B. Halkier, compartmentalisation keeps "green reflections out of certain practices" and by doing so, makes it possible "to signal social normality" (p. 39). Another interpretation, rather consistent with Halkier's one, is that this compartmentalisation allows to avoid adding to oneself a new identity dimension – as someone concerned by environmental protection – whose management would require a supplementary and "never-ended physical and mental zapping" (Dortier, 1998). Yet, this zapping supposedly requires all the more energy that the dimensions to be conciliated are numerous (Bartiaux, 2002), whereas individuals are constantly choosing "strategies that are cognitively economical" (Kaufmann, 2001; Pacteau, 1999). Furthermore, individuals may feel that to add to its identity a new dimension of concerned by the environment would consequently require from them numerous changes in many areas of every-day life while the mental process of compartmentalisation offers a convenient way for avoiding this inconvenience (Bartiaux, 2002).

Still another interpretation, I argue elsewhere (Bartiaux, 2005), is that this mental compartmentalisation is a societal self-defence mechanism for non acknowledging the systemic characteristic of environmental issues and for avoiding a societal self-deception that would occur if our 'world socialisation scheme' of predation (Descola, 1999) were to be abandoned as well as corresponding societal values and lifestyles seen as quite important

[2] For example, several energy advisors (mostly female architects) 'discovered' that eating meat or tropical fruits requires for their production and transportation more energy than having a vegetarian diet with locally-grown products (Gembloux, Belgium, June 2003).

in our societies among which the "myth" of the mass-consumption society is prominent.

2.4 Summary

The rational-actor paradigm, derived from economics, is to be abandoned and the central role given to information as main policy tool has to be qualified, as information and advice are neither just taken in as such by consumers nor translated into corresponding practices. Mental compartmentalisation is indeed a powerful individual and societal self-defence mechanism for non acknowledging the systemic characteristic of environmental issues and, consequently, for not adopting 'green' lifestyles in consumerist societies, where norms of comfort and convenience (Shove, 2003a) are widely influencing every-day consumption practices.

3 Information on consumption and related practices

What is the knowledge in the Belgian public on standby consumption, climate change and renewable energies and how is this knowledge 'translated' into corresponding practices? These questions were the focus of a recently-ended research project on residential energy consumption in Belgium (the SEREC project[3]).

3.1 Data

During this research project, a phone-survey on energy-related practices and representations was realised on a representative sample of 1000 households in Belgium as well as more than twenty in-depth interviews. When indicated so, the following results are drawn from the final report of this research (Bartiaux, *et al.*, 2006).

In the SEREC questionnaire, several questions were asked to evaluate the level of knowledge in the Belgian public on three issues that are related to residential energy consumption: standby consumption[4], climate change[5] and renewable energies[6].

3.2 Knowledge on environment-related issues

81% know (or claim to know) that a television in standby mode consumes electricity. The same level of knowledge is not obtained on

[3] The SEREC research project (Socio-technical factors influencing Residential Energy Consumption) is a 2-year project associating the Institute of Demography of the University of Louvain (UCL), the Flemish Institute for Technological Research (Vito) and the Danish Building Research Institute (SBi). The Belgian Science Policy Office finances this project (2004-2005).

[4] The question was: "According to you, does a television that is s turned off from the remote control consume electricity? (Yes, no, doesn't know)".

[5] The score of knowledge on global warming is so constructed: the people who answer that the climate would be hotter in 20 years have three points. Moreover, every time the respondent correctly answers about the possible causes of the global warming, he gets one point. The presented causes are the automobile traffic, the pollution of underground water, domestic heating, nuclear power plants, to throw dangerous products in the dump, the smoke rejected by the factories, the deforestation of Amazonia.

[6] The questions were the following: "Have you heard of renewable energies?" (3 points), "Have you heard of solar energy?" (1 point), "Do you know the solar photovoltaic?"(1 point), "Do you know the solar thermic?"(1 point), "Have you heard of wind mills?"(2 points), "Have you heard of the biomass?"(2 points). Each question had to be answered with either yes or no and the weighted sum of 'yes' gives the final score.

renewable energies (5.8/10) in the SEREC survey, with easier questions though.[7] The mean score on knowledge about global warming and its causes is 7/10, which is much higher than in 1998 when the same score was on average 4.9/10 (Bartiaux, 2005). It can be hypothesised that the 2003 heat wave and the numerous interventions in the media on this topic have increased the Belgian public's awareness on climate change.

As a sociological study revealed (Boardman *et al.*, 2003), a majority of people are not concerned with climate change nor environmental issues, and for these authors, a general awareness at the level of CO_2 emissions is insufficient in Europe. Climate change is an increasing topic in daily citizens' conversation but it is not perceived as a most important of all environmental problems (Kasemir *et al*., 2000).

Whereas the general level of environmental knowledge is high or fairly high in Belgium, there are large variations between some socio-economic groups, these groups being defined according to household income, composition, age group and gender of the respondent. The higher the income is, the better the knowledge is on the three issues reviewed. Knowledge on environmental issues usually increases with household size and is (much) higher for men than for women. The age group often reveals significant differences: the youngest (18-29 years) are the least informed on climate change issue and factors and the best informed on renewable energies. On standby consumption, young people have the same level of knowledge as in their parents' generations (50-69 years) and they are less knowledgeable than them on climate change! Significant differences between regions are not observable for these three issues[8].

4 Information on energy and subsequent practices

Is people's knowledge on environmental issues an important motivation to change daily energy-related practices? This section will show that knowledge and practices are not often associated.[9]

4.1 Standby consumption

Even if 81% know (or claim to know) that a television in standby mode consumes electricity, the lack of information, namely on the share of nuclear energy used in electricity production in Belgium, is echoed in the following quote, which includes several hesitations that are unusual in the answers given by this teacher. *"Moreover… moreover, it seems to me that the electricity produced by … by other energies, namely nuclear ones and so forth, thus… it seems to me that I have seen a few [TV] programmes where they were explaining that if each inhabitant … limited his/her consumption, it would be possible… it would be possible to reduce the nuclear pollution and the like … in a rather considerable manner."* (Alexandre). Moreover, the results of pre-tests questionnaire revealed that everyone, even young people accustomed to computers, do not always know the concept of "standby mode". But that does not mean that these people do not use the "standby mode" function. This is why we asked the respondents having a television if they turn it off only from the remote control "always, often, sometimes or never" (Moreau & Wibrin, 2005).

[7] See note 3.
[8] Figures may be found in Bartiaux *et al.*, 2006, p. 31.
[9] This section comes from Bartiaux *et al.*, 2006.

Only 1% of the respondents do not have a television. Among all the others, 29% never leave it in standby mode, 17% do it sometimes, 17% often and 37% always do so. There are no statistically significant differences between male and female respondents, or between household types, but there is one between types of dwellings and another one between age groups[10]. If we add up the answers "always" and "often", respondents who are less than 30 years old are the ones who put their television in standby mode most regularly (67%). It seems also that the smaller the dwelling, the more frequent the TV is on standby mode (42% of the people in apartment always do so, whereas 31% of the people living in detached houses do). *"Yes, I switch it off always, well, there I just have [forgotten]… But usually, it is always off."* (Maria, 65 years old, is living in an apartment.)

"[We should] probably [try to] pay more attention, even more attention to the computers and the audiovisual equipments. Well, we try to be aware of [the fact that] when we switch them on, we really need to switch them on." José summarises the results displayed by Table 1: knowledge does not bring about appropriate practices by itself. One third of the respondents who know that a TV in standby consumes energy always turn off the television set only from the remote control while nearly half of those respondents who do not know about it always does so. A better knowledge is thus weakly and statistically not significantly associated to an energy-sound practice.

Table 1: Standby mode use according to knowledge on standby

Does a TV in standby mode consume electricity?	Total Sample (%)	TV in standby mode when not used (%)			
		Never	Sometimes	Often	Always
Yes	80.8	30.3	17.0	17.9	34.8
No	12.3	19.0	17.2	15.5	48.3
Does not know	6.9	30.8	15.4	13.8	40.0
Total	100.0	29.0	16.9	17.3	36.8
Sig (X^2)		0.099 (X^2)			

Source: SEREC Survey (2004), N = 962.

4.2 Climate-change knowledge and related practices

Few energy-related practices are significantly associated with the score for climate change knowledge, which means that practices are led by routines and social pressures for comfort, cleanliness and convenience (Shove, 2003a) that are strong enough to counterbalance a high level of awareness on climate change.

4.2.1 Bathing and showering

This interpretation gains support when it comes to bathing and showering, as no difference in knowledge is associated with a higher (or lower) number of baths or showers per week and per household nor per person for showers (Table 2). A slight effect, though not significant, exists for the number of baths per person – those having less than two baths per week being more knowledgeable than the others. Bathing and showering thus appear to be unrelated to environmental awareness and this result shows that an energy policy whose goal would be a reduction of sanitary hot water consumption could fail if it were presented as based on environmental protection.

[10] Figures may be found in Bartiaux *et al.*, 2006, p. 29.

Table 2: Knowledge on climate change and renewable energies according to bathing and showering practices

Energy-related Practices	% in total sample	Knowledge	
		Climate Change (mean score /10)	Renewable energies (mean score /10)
Total Sample	100.0	7.00	5.77
Number of baths per week and per household			
<= 4	68.3	7.06	5.75
> 4	31.7	6.88	5.80
Sig. (F)		0.134	0.794
Number of showers per week and per household			
<= 4	33.4	6.82	5.39
> 4	66.6	7.10	5.95
Sig. (F)		0.020	0.001

Source: SEREC Survey (2004), N = 962.

4.2.2 Heating-related practices

When it comes to heating-related practices, the respondents have a significantly better knowledge of climate change if they report that they lower the temperature during the night or during absences of several hours in the wintertime. There is no significant relationship, though, between the level of awareness about climate change and the estimated temperature in the living room during a winter day; nor is there one with the practice of turning off the heat while airing in the wintertime (Table 3).

Table 3: Knowledge on climate change and renewable energies according to heating practices

Energy-related Practices	% in total sample	Knowledge	
		Climate Change (mean score /10)	Renewable energies (mean score /10)
Total Sample	100.0	7.00	5.77
Estimated temperature (living room, winter day)			
<= 19°	14.9	7.16	5.77
20°	26.7	7.01	6.26
>= 21°	58.4	6.97	5.54
Sig. (F)		0.523	0.001
↓ temperature (absence of several hours, winter)			
Yes	82.6	7.06	5.86
No	17.4	6.67	5.37
Sig. (F)		0.008	0.027
↓ temperature during the night (winter)			
Yes	89.7	7.04	5.82
No	10.3	6.46	5.32
Sig. (F)		0.002	0.075
↓ temperature while airing			
Yes	59.9	6.90	5.90
No	40.1	7.10	5.60
Sig. (F)		0.078	0.083

Source: SEREC Survey (2004), N = 962.

4.2.3 Appliances' use

Concerning appliances (number and use), there are very few differences according to knowledge on climate change, except for the total number of large appliances in the household, the frequency of use of the washing machine and of the dishwasher: the more appliances and the higher usage, the better knowledge. Awareness is thus not enough to change daily routines and current definition of comfort and convenience.

Table 4: Knowledge on climate change and renewable energies according to electricity-related practices

Electricity-related Practices	% in total sample	Knowledge	
		Climate Change (mean score /10)	Renewable energies (mean score /10)
Total Sample	100.0	7.00	5.77
Switching off the light when leaving a room for 5 minutes			
Always	23.2	7.13	6.14
Often	13.4	7.11	6.27
Sometimes	20.9	7.12	5.89
Never	42.4	6.82	5.34
Sig. (F)		0.064	0.000
Has CFLs ("saving lamps")			
Yes	64.2	7.00	5.86
No	35.8	7.00	5.66
Sig. (F)		0.963	0.255
Has at least one appliance with label A or B			
Yes	74.3	7.06	6.12
No	25.7	6.86	4.94
Sig. (F)		0.135	0.000
Appliances: use			
Use of the washing machine /week*person	94.1		
less than 1 time	20.5	7.35	6.03
at least 1 time	79.5	6.91	5.72
Sig. (F)		0.002	0.143
Use of the dryer/week*person	64.9		
less than 1 time	51.4	7.10	5.69
at least 1 time	48.6	6.91	6.01
Sig. (F)		0.177	0.118
Use of the dishwasher/ week*person	57.3		
less than 1 time	29.5	7.44	5.91
at least 1 time	70.5	7.09	6.29
Sig. (F)		0.025	0.103
TV in standby mode			
Always	36.7	7.12	5.73
Often	17.3	7.10	5.97
Sometimes	17.1	6.82	5.50
Never	28.9	6.91	5.79
Sig. (F)		0.186	0.422

Source: SEREC Survey (2004), N = 962.

This apparent mental compartmentalisation is consistent with results found in other studies. In Sweden for example, 60% of the people consider themselves as having a good knowledge on energy saving, but the real

energy-saving behaviour is not in concordance with this result. I. Røpke discusses (2004) this global knowledge amongst the public and according to her opinion, most of the people are preoccupied with managing their everyday life and do not realise that they live in any kind of luxury.

4.3 Renewable energies

The pattern here is more confused than for climate change knowledge, as most tested relations between an energy-related practice and the score of knowledge on renewable energies are either non-significant or nonlinear: the conclusion is that a better knowledge on renewable energies is not associated with a practice that saves more energy. There are just a few exceptions to this result, exceptions that appear to be anecdotic: respondents are significantly more knowledgeable on renewable energies if they lower the temperature during absences of several hours in the winter time (but not during the night or while airing), if a lower energy consumption is a criterion when buying an appliance, if they often or always switch off the light when leaving a room, if they own more appliances, if they use the washing machine less frequently, when taking household size into account whereas… the reverse is observed for the dryer.

In the Swedish population, such a discrepancy between knowledge on renewable energies and energy-saving behaviours is also observed (Viklund, 2004). Swedes generally tend to be environmentally friendly and they are highly and openly concerned with perceived nuclear energy danger and CO2 emission causing global warming. With participating referendums, they strongly support wind and solar power as alternative energy sources but their energy-saving behaviours are not in concordance with their knowledge.

5 Customised information and subsequent practices

5.1 Few recommendations implemented

As part of the SEREC research project, 40 households volunteered to have a complete energy assessment of their dwelling[11]. At least half of them received recommendations on windows and doors or on the insulation of the distribution pipes, of the outer walls or of the roof as well as advices to replace the boiler or to install a solar one. Each of these recommendations would lead to a yearly saving of primary energy of 1000 to 6000 kWh (Bartiaux *et al.*, 2006).

To sum up, the more the advices are customised, the more the participants appreciate them: more general advices are not really used by the participants who seek information relative to their own energy consumption. This does not imply however that the participants use this customised information by implementing the recommendations that they have received. Indeed, this research clearly establishes that precise, professional and customised information does not often bring about many changes in energy consumption. Indeed, one year after the assessment, these volunteer households have actually implemented some 11% of all proposed measures. In general, these measures were the smallest interventions: insulation of distribution pipes or installation of saving showerheads. However, the

[11] It has to be stressed that due to the recruitment methods we used, all participants were interested in the topic of energy savings. Two tests undertaken during this research with (more) randomly selected samples brought about much less interest.

householders were still planning some 23% of the proposed measures. These measures could result in much larger energy savings, but they also required larger interventions in the house (Bartiaux *et al.*, 2006).

Why are so few recommendations implemented? Several potential reasons are given below. This analysis is based on twelve in-depth interviews, which were realised with some of these householders who volunteered for receiving a full energy assessment of their dwelling. They were interviewed two or three months after this assessment, during the winter 2004-2005.[12] The same study was done in Denmark and a comparison of the results obtained for the two countries may be found in Gram-Hanssen *et al.* (forthcoming).

5.2 Need of discursive consciousness

Having analysed the reactions of the participants to a program for changing daily behaviours in an environmentally friendlier way, K. Hobson (2003) has shown that the condition for implementing received advice is to transfer this advice from practical consciousness to discursive consciousness. To ensure this shift, practical and detailed information is needed. This is especially required for insulation techniques and was not always the case either in the report or during its oral presentation. Furthermore, some practical consciousness is previously required, which was not often true (dwellings in Belgium are the least insulated in Europe, according to EURIMA, 2005). This practical consciousness may also come from practical experience and physical perceptions. The following two quotes illustrate opposite situations, the first one being more widespread: *"We do not feel any discomfort [for not insulating the roof]" / "The usefulness of insulation, you feel it."*

The mental process of compartmentalisation helps understand why several interviewees had "already forgotten" advice they had received a few months earlier (Gram-Hanssen *et al.*, forthcoming). This forgetting clearly prevents discursive consciousness.

After the success of the household-waste sorting policies in '90s in Belgium, it may be hypothesised that a perceived obligation is a modality of discursive consciousness with the conversations between neighbours that these policies brought about.

5.3 Need of consistent information

Consistent information is also necessary to implement received advice, as illustrated by the two following situations. Two interviewees had an old boiler and in both cases, the energy expert recommended to replace it: *"he also said "gas" (…) and I myself have always had a good a-priori. (…) It's true that in "test-achats" [the journal of the main consumers' organisation], they also recommend gas boilers, if one is to replace it. (…) I have spoken to my father-in-law, who is an engineer and who is also always quite interested in these things. He also has gas (…)"* (Luc). This convergence in points of views is not found in Bernard's case and he won't replace his boiler: in fact, he had forgotten this recommendation, he found it when showing the report to the interviewer: *"the important stuffs: to replace the boiler by a new one. In fact, the boiler is the same (…) since 1973 and then, we have replaced the burner, 5 or 6 years ago, because the installer found that it was not*

[12] 3 interviews were done one year after the assessment.

necessary to replace the whole boiler." Goldblatt (2003) also points out the necessity of the consistency of the advice. It may be thus hypothesised that these comparisons and this search of consistency within someone's social networks are one mechanism through which new information is brought to discursive consciousness, the condition according to Hobson (2003) for questioning practices and bringing about changes.

It seems likely that this need of consistent information also requires to have heard something about the advice or the recommendation, even vaguely but before the assessment. For example, one woman didn't know that it was possible and energy-efficient to insulate the ceiling of a cellar and although she was certainly the most concerned person by the environment among our interviewees, she didn't consider following this advice, thinking that it was probably not worth doing it and that it was certainly too much work.

5.4 Necessity of social support

5.4.1 From the social network

All actions or new practices have to keep in the acceptability limits of the social environment of the individuals. Friends, colleagues, neighbours, family members, the media watched, read or listened are elements of the social support. In energy matters as in other matters, people are not acting as individuals, but as persons involved in various social relationships, and they are expecting support for their action from the persons, or the networks, they value the most.

For example, after the energy assessment, one interviewee (an executive in a big company) bought and installed a few CFLs and he was asked by some persons whether he would now *"light up with candles"*. His interest for new technologies and a mild environmental concern for *"protecting our blue planet as one says, isn't it?"* are probably not always sufficient to counteract the pressures of his social network for not showing a need for saving energy or a competence for it. This seems to be especially the case for the persons who had a rapid social upward mobility (Bartiaux, 2005, Bourdieu, 1979).

This in turn shows the necessity of justifying his or her saving-energy behaviour with socially legitimated rationale: for some interviewees, this rationale should be different from economical reasons and from environment concerns that are usually presented as 'the' reasons for saving energy. A young woman illustrates it by always explaining her practices with other reasons than an environment concern she does not have (she has no car because she lives nearby supermarkets and because her enterprise provides her with a seasonal train ticket, she has no dryer as she has a garden, she prefers showering for baths are boring her, and so on and so forth).

5.4.2 From the family

The support of family members is also quite important. For example, Clara is *"a little green"* and she *"thinks that she could do more"* to be better informed and to act up. But her husband is *"not (interested), he follows a little the move"* and does not offer her enough support to change their habits.

5.5 Enhanced self-esteem

For implementing a recommendation, dwellers need to integrate the required measures in their work plan and make this advice their own project.

This will enhance their self-esteem. For example, one dweller repeats twice: *the thermostat, that we planned to install anyway."* This repetition suggests the hypothesis that he wants to show himself as the master of 'his' work of renovation, despite the fact that his technical knowledge is somehow limited.

6 Conclusion

Individual consumers are neither just taking in new information or environmentally oriented advice as such nor behaving accordingly. In particular, a recent research has demonstrated the limits of "the information-barrier" line of thought and of the rational-actor paradigm: households that are better informed on climate-change issue and factors are not acting in an environmental-friendlier way, and often, for many practices, the reverse is true. Furthermore, volunteering and interested householders who receive customised and expert advice to save energy rarely follows this advice (11% of recommendations implemented after one year). Lack of consistent information, of discursive consciousness and of social and family support appear to explain this small effect of customised advice to change behaviours and undertake energy-saving works in the dwelling.

I would thus propose the hypothesis of a reversed relation: environmentally friendlier practices raise the openness to environmental information.

Finally, this research calls for the need for policies of sustainable consumption as these policies provide both discursive consciousness (via a perceived obligation) and social support and social legitimacy.

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Chapter 5 Product Service Systems

Taking a Functional and a Symbolic Perspective on Usership

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1 Introduction

Product service systems (PSS) have been one major concern of research into sustainable consumption for more than ten years (e.g., Stahel, 1994, Goedkoop et al. 1999, Mont, 2004). Usually, PSS are divided into services providing added value to the product life cycle, such as maintenance and up-grading, services providing enabling platforms for customers, such as renting or leasing, and services providing final results to the customers, such as mobility services or warmth delivery (UNEP, 2002, p. 8f.). In this paper, we will focus on PSS that replace ownership of products. Obenberger and Brown have denoted this category of consumption as "usership". They define it as "all types of consumption in which the consumer does not possess legal title to the product" (1976, p. 82).

Although usership has been addressed by marketing research on a few occasions (e.g., Berry and Maricle, 1973, Obenberger and Brown, 1976, Durgee and O'Connor, 1995, Johnson et al., 1998), there is still a lack of analysis of the consumer's response to the substitution of possessions by services. Only few studies have addressed this issue in the context of sustainability (e.g., Schrader, 1999, Cooper and Evans, 2000, Meijkamp, 2000, Hirschl et al., 2003, Behrendt et al. 2003).

In the following sections we will take a closer look at the conditions under which consumers might be inclined to accept a loss of ownership in consumption. We start with a discussion from a functional perspective that is informed by neo institutional economics. This analysis yields important insights into the nature of the transaction process between producers and consumers. It abstracts, however, from the social and symbolic qualities of consumption, which are examined in the second part of the paper and derived from current consumer research and socio-psychological thinking. After briefly introducing the idea of consumption as a social process, we pay attention to the different facets of symbolic meaning related to the ownership of consumer goods. This analysis provides a basic framework against which the symbolic meaning of usership is approached. In dealing with possible

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ways to enhance the symbolic properties of service consumption the paper presents preliminary recommendations on how to increase the connectivity of PSS with current consumption practices.

The paper is based on the author's ongoing dissertation project. It is work in progress and comments are highly appreciated.

2 Product service systems in a functional perspective

The functional perspective on PSS is based on neo institutional economics. This school of micro economics is a further development of neoclassical economics under more realistic suppositions (e.g., Williamson, 1975, Coase, 1984). It is assumed that 1) people strive to maximise their individual utility when deciding upon different consumption alternatives, 2) market information is not complete and information processing capacities are limited ("bounded rationality", e.g., Simon, 1957, North, 1978), and 3) individuals tend to display opportunistic behaviour, in particular in the case of asymmetric information (Williamson, 1990, p. 54).

Neo institutional economics includes property rights theory, information economics, transaction cost theory, and principal agent theory.

2.1 Property rights theory

The theory of property rights assumes that the behaviour of market actors is strongly influenced by the way in which property rights are allocated among market participants (e.g., Coase, 1960, Alchian, 1965, Alchian and Demsetz, 1972). Ownership is at the core of property rights theory. It represents a set of different single rights (Silver, 1989, p. 17f.): The *right to use* designates that individuals are free to decide upon the way, the frequency, and the time and place of use of their private property. The right to use is practically guaranteed by the *right to exclude* third parties from the use of property without approval from the owner.

Furthermore, the owner has the *right to change* her property the way she likes. This includes un-intentional wear and tear and also the conscious alteration of the material properties of goods, e.g., a change in colour. Moreover, the owner holds the *right to sell and dispose of* his private property. Finally, ownership encompasses the *right to appropriate* any income generated by the selling or renting of property.

In the case of consumer goods property rights may, at least partly, turn into duties (Schrader, 2001, p. 161ff.). The owner has to store her private property correctly in order to preserve its usability and protect third parties against unwanted contact with it. She has to maintain the owned goods to ensure their proper functioning and find suitable ways to dispose of the good in case her wish to use the good has terminated. And she has to bear all fixed and variable costs for purchase, storage, use, maintenance and disposal of the property. In addition to that, the owner bears the risk that the product he possesses becomes obsolete and that its full capacity may never be exploited (Berry and Maricle, 1973).

Hence, consumption without ownership, i.e. changing the allocation of property rights between supplier and customer, may provide several benefits to the consumer that arise from diminishing the duties and risks associated

with private property (e.g., Hockerts, 1995, p. 13ff., Berndt, 1998, p. 17ff., Bagschick, 1999, p. 158ff., Schrader, 2001, p. 78ff.).

2.2 Information economics

The analysis of information economics addresses the different qualities of market goods (e.g., Stigler, 1961, Nelson, 1970, Darby and Karni, 1973). *Search qualities* refer to those properties of goods that can be assessed prior to the market transaction, e.g. the processing speed of a computer or the opening hours of a tool rental. *Experience qualities* derive from those characteristics that can be evaluated during use of the good only, e.g. the taste of a pizza or the riding quality of a shared car. Those qualities that can be assessed neither a priori nor during use are called *credence qualities*, for instance, the environmental impacts of a launderette.

Services are characterised by a large amount of experience and credence qualities (Zeithaml, 1981, p. 186). Due to the ensuing assessment problems the customer normally bears a bigger purchasing risk in case of services than in the case of material goods.

Market actors can, however, take measures to reduce the information asymmetries in service markets. On the one hand, suppliers can engage in *signalling* strategies (e.g., Spence, 1973), i.e. they can start communicating credible quality information to their potential clients. Advertising, use of independent certification schemes and warranties are examples of signalling strategies. Suppliers will take such measures as long as the costs for signalling do not exceed the cost of offering inferior qualities, e.g., product take back and loss of reputation (Göbel, 2002, p. 111). On the other hand, consumers can do a market *screening*, e.g., through personal communication with actual clients, product trials, price comparisons, and reading of product tests.

In consumer oriented product service systems, neither signalling nor screening strategies have been employed on a large scale yet. One example is the German Blue Angel scheme for car sharing organisations.

2.3 Transaction cost theory

The exchange of market goods is at the core of the transaction cost approach (e.g., Coase, 1937, Alchian and Demsetz, 1972, Alchian and Woodward, 1988). The costs arising during co-ordination of these exchange processes are called transaction costs. They include the costs for initiating, agreeing upon and controlling the contractual arrangements between market participants, such as the effort required to find suitable contractors, the time needed for negotiations, or the measures taken to check compliance with agreed quality objectives, quantities, prices, etc.

Very often transactions are more complex in case of product service systems as compared to simple purchasing arrangements (e.g., Berndt, 1998, p. 22f., Schrader, 2001, p. 167ff.). Finding a suitable supplier may be more costly due to the novelty of the offer and the assessment problems mentioned above. Contractual negotiations may be more costly as well, if, for instance, securities have to be deposited. In addition, control costs may accrue, e.g., for booking the item to rent, for scrutinising its proper functionality, and for transporting it to the place of use and returning it to the rental company.

Hence, transaction costs are an important impediment to consumer acceptance of product service systems. Their analysis, however, discloses

possible ways to make usership more attractive: decentralising product pools, introducing delivery services, optimising the user interface, e.g., online booking, automatic settlement of accounts, etc.

2.4 Principal agent theory

In contrast to transaction cost theory which addresses the nature of the economic goods exchanged between producer and consumer, principal agent theory is about the behaviour of market actors in situations of asymmetric information (e.g., Jensen and Meckling, 1976, Arrow, 1985, Pratt and Zeckhauser, 1985). In this perspective, the principal faces a lack of information and the agent is inclined to display opportunistic behaviour. Opportunistic behaviour may result from *hidden characteristics* of the offer, i.e. those properties which are solely known to the agent (e.g., quality) and also from *hidden actions* of the agent, i.e. activities that are necessary to produce the offer and that cannot be assessed by the principal in advance. These two types of uncertainty are especially relevant to the market acceptance of product service systems.[13]

In the first case of hidden characteristics the customer bears the risk of choosing a service of minor quality. One can assume, however, that suppliers of leases or rentals do not always exploit this advantage, since customer transactions occur more often and at the end of every use period the customer may choose the exit option (Franck et al., 1999, p. 34, Berndt 1998, p. 29).

The second case of hidden actions can be illustrated with the example of consumer good sharing. The user takes the role of the agent and the supplier the role of the principal. Assuming that inadequate behaviour of the user cannot be sanctioned, she has an incentive to reduce any effort in proper use of the shared good and may tend over-use it. The supplier may respond in three different ways to this “moral hazard” (Franck et al., 1999, p. 37f.). She may try to immunize the rented object through a particularly robust product design (ex ante), she may seek to monitor the intensity of use during product utilisation (in situ), or she may attempt to detect misuse afterwards (ex post). However, the first option is costly, the second option is very often technically not feasible. Only ex post detection appears to be a suitable means to prevent the risk of moral hazard – provided that product faults from manufacturing and maintenance can be unequivocally separated from wear and tear due to improper use.

2.5 Conclusions from the functional analysis

The discussion of product service systems from a neo institutional perspective has revealed that renting and leasing might be beneficial alternatives to product ownership, in particular if ownership duties weigh heavily. It can also be concluded that market actors need to take up signalling and screening measures to reduce the risks resulting from experience and credence qualities of services. Finally, we have seen that product service systems need to be designed so as to minimise the cost of transaction and the risks of improper use.

The viewpoint of neo institutional economics, however, has a number of limitations. Individual preferences are treated as given and constant. Hence,

[13] In principal agent theory „hidden intentions“ of the agent may represent another source of uncertainty (e.g., Klein et al. 1978) which is, however, of little relevance to usership.

their formation and alteration is not part of the approach. Additionally, decision making is modelled as a cognitive process, so that affective rationales for consumption cannot be grasped with this approach. Finally, the neo institutional analysis neglects the fact that consumption is a social process and that consumer goods bear symbolic meaning.

The last shortcoming has an important implication: Even if one would be able to design and implement product services systems in a way that they are functionally equivalent to ownership-based consumption, i.e., generating no or little transaction costs, preventing customers from improper use, etc., usership arrangements may still lack the symbolic meanings resulting from ownership of goods.

To underpin this conclusion we will turn in the next section, after a brief discussion of the symbolic properties of consumption, to the symbolic meanings associated with ownership and usership respectively.

3 Product services systems in a symbolic perspective

3.1 The symbolic meaning of consumption

The functional or utilitarian perspective assumes a consumer who processes information effectively to maximize the utility that can be drawn from consuming a certain good or service. This perspective ignores, however, that people do consume goods and services not only for their functional properties. Symbolic qualities play a vital role as well when people buy and consume goods.

Thorstein Veblen was among the first to show that people consume in order to preserve or achieve a superior social status (Veblen, 1899). But products can be more than just status symbols. They can convey age, gender, ethnicity, and other symbolic information (Belk, 1995, p. 64). They can be regarded as "symbols for sale" (Levy, 1959) and contribute to the construction of our modern culturally constituted societies, "(…) because they are vital and tangible record of cultural meaning that is otherwise intangible" (McCracken, 1986, p. 73). In late capitalism these construction patterns have become more complex and more subtle, so that goods have increasingly transformed to material containers of social ambitions and mobility (e.g., Featherstone, 1991, Bocock, 1993). It does not matter here, whether we, as Bourdieu (1984) argues, regard consumption as the manifestation in which social class structure is reproduced ('we consume what we are') or whether we look at it, as claimed by Baudrillard (1998 [1970]), as mere consumption of signs and symbolic value through which social stratification emerges ('we are what we consume').[14] Rather, the

[14] The heated debate over the degree of freedom available to people in their consumption activities, as it is put forward in sociologies of consumption and (material) culture studies, cannot be fully reproduced here. While (post-)structuralist authors argue that consumption is (still) socially structured (e.g., Bourdieu 1984, Holt, 1998, Warde, 2004), post-modernist writings have emphasized individual autonomy in appropriating lifestyles as a means of constructing and expressing desired identities (e.g., Featherstone, 1991). More recently, the post-modernist or voluntaristic position has also been criticized with the argument that consumption is largely structured by everyday life, thus characterised by a "balance between creativity and constraint" (Mackay, 1997, p. 10), guided by routines and social conventions, and framed by sociotechnical systems (e.g., Campbell, 1995 and 1996, Shove and Warde, 1997, Wilk, 1999, Gronow and Warde, 2001, Shove, 2003).

decisive issue is to acknowledge that *commodities possess symbolic meaning and that this specific quality of consumption items plays an essential role in creating and maintaining personal and social identities*: "Our identity is made up by our consumption of goods – and their consumption and display constitutes our expression of taste" (Mackay, 1997, p. 4).

Identity is the answer to the question, "Who am I?" (Blasi, 1988, p. 226). It is the image the individual has of his or her self. It represents its personal and social characteristics. It is the mirror that reflects the self to the individual and the medium that signifies the self towards others (e.g., Baumeister, 1986, p. 246ff., Gentry et al., 1995, p. 413). Following the identity world view model of Robbins (1973), identity can be looked upon as "an accumulation of knowledge, codes, values, stores of experiences and guiding principles of action" (Dittmar, 1992, p. 73). Identity manifests itself at the micro level in terms of the multiple roles of the individual contributing to meaning in life. At the macro level it reflects the position of the individual within social institutions and entire societies (Weigart, 1983, p. 200). Identity is not a state, but rather a process that generates social inclusion and distinction, personal continuity and individual coherence (Habermas, 1996, p. 13ff.).

Identity is quite close to the notion of *self concept*, which is the „beliefs a person holds about his or her own attributes, and how he or she evaluates these qualities" (Solomon, 2002, p. 150). It is made up of multiple role identities, such as gender roles, occupational roles, family roles, etc. (e.g., Laverie et al., 2002). The self concept comprises those parts of the self that can be consciously reflected and, hence, can become subject to self evaluation processes (e.g., Frey and Benning, 1983). The positivity of the self concept is described by self-esteem and stands for people's endeavours to conserve and increase the value of their selves (e.g., Markus and Wurf, 1987).

People articulate their identities, to one's self and to others, not solely, but also through their material possessions (e.g., James, 1890, Beaglehole, 1932, Csikszentmihalyi and Rochberg-Halton, 1981, Prentice, 1987, Belk, 1988, Richins 1994). In their symbolic roles, possessions are the expressions of who somebody is, i.e., they reflect personal characteristics, such as personal values and personal history, and symbolise categorical evidence, such as group affiliations and social position (Dittmar 1992, p. 88ff.). Hence, ownership is strongly tied to a specific symbolic meaning contained in and conveyed through the material artefacts possessed.[15]

But what will happen to this symbolic meaning, when we turn from ownership to usership (Figure 1)? In order to shed light upon this question we first draw attention to the symbolic roles of possessions and then address the symbolic meanings conveyed in usership.

[15] Empirical evidence from a representative consumer survey is given, for instance, in Hirschl et al. (2003).

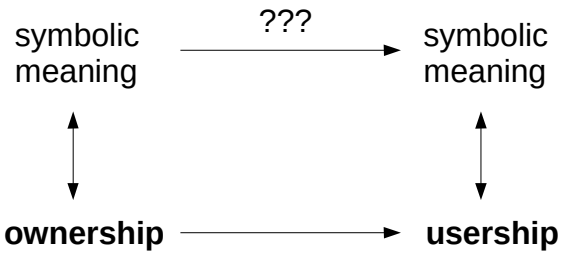

Figure 1: From ownership to usership

3.2 The symbolic meaning of ownership

According to Richins (1994, p. 505ff.) possessions bear a private and public meaning. The first dimension mirrors the subjective meanings an object holds for a particular individual and the latter stands for the collectively agreed upon elements of meaning associated with an object. Since private meanings "consist of (…) public meanings shaped by the private knowledge and experiences of the possessor with respect to the particular object he or she owns" (ibid., p. 517), the two dimensions are "distinct but related entities" (ibid.). Hence, separating them in the following discussion is mainly for analytical reason. In practice, the symbolic interaction between, on the one hand, the object and the individual (intra-personal dimension), and, on the other hand, the object, the individual and larger social entities (inter-personal meaning) will always be intertwined: A BMW sports car might be a sign of superior social status, and at the same time provide a feeling of privacy and autonomy to its owner.

It is important to note here that the symbolic meaning is not inherent to an object itself, but always a matter of perception and interpretation of an object by an individual. Meaning is attributed at the micro level through interaction between the individual and the artefact – what Csikszentmihalyi and Rochberg-Halton called "cultivation" (1981, p. 13) or what McCracken interpreted as "grooming" and "possession rituals" (1988, p. 85ff.).

3.2.1 Intra-personal meaning

There is plenty of evidence that possessions may serve as *symbols of control*. Hunt et al. (1990, p. 1102), for instance, have shown that individuals who believe life is a product of external forces rather than a result of personal endeavours (Rotter's, 1966, "external locus of control"), more often tend to have materialistic attitudes, that, according to Belk (1985), often go hand in hand with a tendency to maintain ownership of one's possessions. Furby (1978, p. 319) has shown in a number of studies that ownership is an expression of a person's ability to control the environment. Belk (1988, p. 140) referring to McClelland (1951) argues that people regard material objects as part of their "extended self" to the extent in which they are able to exercise control over them.

In another perspective, possessions can be considered as the *symbolic containers of our memories*. As they accompany us through our lives they become "a symbolic, yet concrete, collage of our personal history" (Dittmar 1992, p. 89). Possessions can be memories in a direct sense, as a souvenir, a

photograph album, or an heirloom (e.g., Belk, 1988, p. 148), and they can indirectly serve as triggers for memorable experiences, e.g., the first car one drove after receiving the driving licence, or the desk one sat at when having written the masters thesis. In this figurative sense, possessions contribute to ensuring continuity of a person with its self, with others, and with places (Habermas, 1996, p. 281). Clearly, the importance of this symbolic function of possessions increases with growing age of a person (e.g., Csikszentmihalyi and Rochberg-Halton, 1981, p. 193f., Kamptner, 1989, p. 166, 192, Csikszentmihalyi, 2001, p. 489f.).

Besides being the material record of our personal history, possessions can be a means to create continuity, especially in periods of change. Studying child development Winnicott (1971) worked out the notion of "*transition objects*" for artefacts, such as cuddly toys, that provide security and stability in an environment that, from the infant's point of view, alters rapidly. This stabilising role is relevant in adulthood as well (e.g., Kamptner 1989, p. 171.). In times of transition, e.g., when moving to a new place, when finalising the professional life, or when starting a family, the continuous use of owned objects may render the adjustment to new circumstances easier (e.g., Habermas, 1996, p. 164ff., Friese, 1998, p. 41f.).

Moreover, possessions can be a means of *symbolic self-completion* (Wicklund and Gollwitzer, 1982), i.e., they can be used to compensate for the experience of an incomplete self-definition. It could be shown, for example, that unsuccessful students of business administration disproportionately often adorned themselves with the symbols of success, such as brief cases, business suits, and flamboyant wristwatches (Gollwitzer, 1983). Through reciprocal processes of "self-symbolisation" and "registering" (Wicklund and Gollwitzer, 1982) individuals use symbols of their desired identities hoping that these 'completed' identities will be affirmed by others.[16]

This mechanism of registering alludes to the reflexive nature of the identity shaping process: self-completion through the use of possessions requires feedback from relevant others. This triadic interaction between the individual, the object and social groups will be discussed in the next section.

3.2.2 Inter-personal meaning

Status symbols are objects signifying the actual or the desired social position. It is not only commercial goods that can be used to mark an individual's social standing, but also abilities (e.g., language skills), professions (e.g., doctor), and material opportunities, such as being able to afford a housekeeper.

Since self-perception of an individual is, amongst others, dependent on the achieved locus within the social hierarchy, status symbols are an essential part of the individual's identity. They work like "trophies" providing the owner with information about his or her accomplishments (Csikszentmihalyi and Rochberg-Halton, 1981, p. 142) and they serve to maintain social order by visualising vertical differentiation among people (Dittmar, 1992, p. 96). Material things can turn to signifiers of status when

[16] Richins (1999, p. 92) points out that the meaning transfer from the commercial good to the individual identity may fail when there is no harmony between the possession and the possessor and/or when observers do not perceive such harmony, e.g. in case an apparently unathletic person tries to impress friends by showing up with a snowboard.

they are rare, expensive, visible and sought-after (Hörning, 1970, p. 109, Csikszentmihalyi and Rochberg-Halton, 1981, p. 30).

As mentioned before, Veblen (1899) addressed this issue fairly early. He analysed the consumption behaviour of the American nouveaux riches at the turn of the twentieth century. He found that this group displayed its superior social position through consumption of expensive goods with little or no utility – a phenomenon he referred to as 'conspicuous consumption'. Veblen's observations suggest that "all consumers attempt […] to 'keep up with the Joneses', mimicking or emulating the consumption habits of their social superiors" (Clark et al., 2003, p. 16).

Emulation, however, implies that the signifying effect of status symbols is – reinforced by greater abundance of, and access to, material goods – temporary in nature (e.g., Hirsch, 1980 [1972], p. 23, Blumberg, 1974, p. 482). Moreover, the assignment of status value to products, in particular in modern consumer societies, has become a pretty dynamic process (e.g., Schulze, 1990, p. 415, Holt, 1998, p. 3), so that status validation increasingly turns to an "exercise in 'applied semiotics' (…) (in which) the status-conscious actor must engage in an ongoing quest to identify those specific consumption events that will successfully yield social honor" (Solomon, 1999, p. 75).

The locatory function of possessions is not confined, however, to the vertical dimension of status. They may also serve – at a horizontal level – to indicate *membership to certain social groups* (e.g., Solomon, 1983, p. 324ff.).

Entering a group means taking a specific role. The various roles an individual adopts while acting in different social entities contribute to the manifestation of his or her self concept (e.g., Stahlberg et al., 1994). As regards the meaning of material possessions in this process of self definition Laverie et al. (2002, p. 668) found that a specific role identity is more important for shaping the individual's identity when more identity-relevant possessions are available to enact the identity well.

Group novices will more often tend to rely on the typical product symbols of a role and attach more importance to owning these symbols than in-group members (Solomon, 1983, p. 326, 1999, p. 76) – due to the fact that material symbols can be appropriated much easier than other signifiers of group membership, such as proper manners and adequate skills (Friese, 1998, p. 41f.). This mechanism is especially relevant in periods of role transition and identity development, as, for instance, in adolescence (Habermas, 1996, p. 103).

3.2.3 Conclusions

This brief overview has revealed that through their symbolic meaning possessions can convey different aspects of the owner's identity to self and others. The symbolic meaning is generated through both interaction between the individual and the object and interaction between the individual, the object and larger social entities. In a symbolic sense, possessions are a means to simultaneously ensure personal continuity and coherence, support individual autonomy, give a sense of uniqueness, and provide social affiliation.

This branch of research did not include the idea of consumption without ownership. As a consequence, the terms 'ownership' and 'possessions' are

used largely synonymously without any specification of the possibly temporary nature of possessing a thing – as in a renting or leasing arrangement.

3.3 The symbolic meaning of usership

Already forty years ago, Rathmell told us, that in the case of services "symbolism derives from performance rather than from possessions" (1966, p. 35). But until today, we face the situation that "research on consumer identity has largely focussed on the consumption of material possessions with comparatively limited attention being paid to the consumption of services" (Laing and Hogg, 2003, p. 11). In the following, we will try to shed a little light upon this blind spot.

We have argued above that ownership evokes symbolic meaning by contributing to the creation and maintenance of personal and social identities. Meaningful experiences are facilitated through communication between the material object, the owner, and the society. On an intrapersonal dimension, symbolic meaning emerges from the fact that possessions may enable control of the physical and social environment, that they materialise personal history and signify individual continuity, and that they can be applied as tools for symbolic self-completion. On an interpersonal dimension, ownership of material goods contributes to locating the individual in social-material terms, either as status symbols or as markers of group affiliations.

But what is – symbolically – left, when possessions have turned to a product service system, when your own car has been replaced by access to a car sharing fleet, when your own washing machine has been substituted by a launderette and/or a textile cleaning service, or when you have traded in your own pair of skis for the on-demand purchase of ski rentals?

One can suggest that the provision of a symbolic sense of control is far more difficult with ownership-replacing services than with possessions. Furthermore, it is hard to imagine that renting and leasing services or services providing final results may work as a container of personal memories the same way that souvenirs, heirlooms, and permanently used goods may do – for the 'container' being largely intangible. This argument also applies to the symbolic quality of possessions as transition objects or means of symbolic self-completion. But it may be less applicable to the interpersonal dimension of the symbolic meaning, i.e. one can principally envisage, that usership might be employed to signify social position and/or group affiliation. Imagine a consumer expressing her 'green' attitude by membership in a car sharing organisation or a customer of ski rentals communicating his skills to his peers by frequently using and perfectly mastering new, cutting-edge equipment.

Hence, exploring possible ways to enhance the symbolic meaning of usership means 1) to regain the intrapersonal symbolic qualities that have 'disappeared' along with the loss of ownership and 2) to strengthen the interpersonal symbolic qualities that might have been diluted in this transition as well. With regard to the first concern, we will focus on the aspect of symbolic control for the other issues, such as symbolic transition or self-completion, appear to be almost un-attainable by means of an essentially intangible offer.

To build a sound basis for the discussion of the two issues, we take a quick look at the very nature of services.

3.3.1 A three-dimensional conceptualisation of services

In service marketing, there has been and still is huge debate over the constituent factors of services relative to material goods (e.g., Vargo and Lusch, 2004 a/b, Lovelock and Gummesson, 2004). In many writings, however, intangibility, heterogeneity, inseparability, and perishability have been identified as the overriding characteristics of services (e.g., Zeithaml et al., 1985, Fisk et al., 1993, Kotler, 1997, Gabbott and Hogg, 1998). They indicate that

- services lack the physical properties of goods – as Shostak (1977) argued, 'airline' means air transportation and 'hotel' means lodging rental and these results are not palpable –,
- service outputs are relatively difficult to standardise owing to human involvement in the delivery and consumption of a service,
- service production and consumption are performed simultaneously as opposed to the sequential nature of product manufacture, purchase, and use,
- services cannot be inventoried.

The characterisation is appropriate as long as we regard a service as a one-dimensional entity. In contrast, if we divide service delivery into a resource-, process-, and result-dimension (e.g., Meyer, 1991, p. 197ff., Bullinger and Schreiner, 2003, p. 54ff.), the picture becomes somewhat different:

1. *Service as a resource*: This perspective focuses on the internal factors necessary to produce the service. They encompass tangible elements, such as facilities, infrastructure, and machines, and also intangible assets, such as the skills of the employees. The resource based view emphasises the supplier's ability to deliver the service.
2. *Service as a process*: During the process of service delivery the internal factors are combined with the external factor, i.e. the customer. The nature of the service encounter can be distinguished with respect to the type of external factor brought in, i.e., the customer herself as in health care services or in a taxi ride (person-oriented service) or a commodity of the customer as in repair services or in tax consultancy (goods-oriented service).
3. *Service as a result*: This dimension stresses the result of the service delivery process. One can differentiate between a direct result, e.g., a fixed car, and an indirect result, e.g., recovery of the car owner's mobility.

The three dimensional perspective uncovers that services may include tangible elements, such as the physical evidence required to deliver the service or the tangible results provided, for instance, by a repair shop. It also reveals that service production and consumption are inseparable only in the case of person-oriented services, that (partial) standardisation of, at least, service resources and services processes can be attained, e.g. by means of automation, and that the criterion of perishability does not fully apply to the service resources.

In the following, we use this conceptualisation of services to identify possible service-related factors shaping the symbolic meaning of usership. In Table 1, the three service dimensions – resources, process, and results – are juxtaposed to the two layers of symbolic meaning indicated above. That is the symbolic sense of control provocable in and through usership at an intrapersonal level and the categorical symbolic meaning that helps socially locating the individual at an interpersonal level. The different factors included in the cells of the matrix are discussed in the next sections.

Table 1: Service-related factors shaping the symbolic meaning of usership

	service resources	service process	service results
symbolic control (intrapersonal)	- *access* - *scope*	- *interaction* - *physical surrounding*	- *mastery of objects*
categorical symbolism (interpersonal)	- *service brand*	- *service brand*	- *service brand*

3.3.2 Symbolic control in and through usership

A perceived lack of control influences the behaviour of the customer in the service encounter (Bateson 1992, p. 126). It may be one important source of dissatisfaction with the service performance (e.g., ibid., Gupta and Vajic, 2001, p. 39, Diller et al. 2006, p. 109).

When moving from ownership to usership people give up their full control over the commercial good. To compensate for this confinement service resources should be designed so as to restore options of control for the customer. This can be achieved by maximising *ease of access to the service offer*, for instance, by means of flexible opening hours, online booking, and delivery services. Moreover, a sense of control can be rebuilt by *extending the scope of the service offer*. This may encompass various measures, such as

- increasing the amount of available rental goods to ensure that demand can be met properly,[17]
- enlarging the variety of rental goods to enhance fit with customer needs – as car sharing services do with a fleet covering small cars and limousines as well as cabriolets and vans,
- offering rental goods of superior quality that provide higher performance, etc.

When it comes to the process of service delivery the quality of the *interaction between the employee and the customer* is crucial for re-establishing symbolic control. Notwithstanding the huge variety of interaction modes in usership – imagine a ski rental company, a launderette, or a nappy service – a competent and friendly appearance of the contact personnel represents a generic response to the perceived loss of control. Moreover, Smith and Houston (1983) found that customers transpose repeated service encounters into stereotyped mental scripts. The scripts guide customer's experience of the service and can be regarded as a strategy of cognitive control (Bateson 1992, p. 128). Hence, matching the processes

[17] Of course, from the supplier's point of view, there is a trade-off between extension of the offer and utilisation of the fleet.

in the service encounter with the mental scripts of the customers may further enhance the perceived control of the process. One can conclude, that standardisation of the service process over time is another means to regain a sense of control in usership.

A similar effect might stem from the *physical surrounding* of the service. If customers perceive greater personal control in the "servicescape" (Bitner, 1992), the pleasure of the service experience is increased, and this in turn makes service entry more attractive to customers (ibid., Hui and Bateson, 1991). Environmental dimensions, such as, for instance, clear signage and good ventilation, in combination with proper spatial layout and good functionality of the servicescape may all contribute to perceptions of personal control (Bitner, 1992, p. 63ff.).

Another factor possibly evoking a sense of symbolic control in usership is *mastery of the object*. In particular, in services providing enabling platforms it is vital that the goods delivered for temporary use are self-explanatory and easy to operate. In the case of complex items and also when customers are unfamiliar with the rental good, a clear design of the product and plain instructions, provided either by the personnel or by simple manuals, can avoid a perceived loss of control and help make customers master the object more quickly.

3.3.3 Categorial symbolism in and through usership

When we looked at the interpersonal symbolic meaning of possessions we argued that individuals express their social identities, amongst others, through acquisition and use of material possessions. By so doing they seek to locate themselves – and are located by others – in social-material terms. Implicitly, this mechanism presumes that symbolic meaning is constructed socially. Meaning evolves from interaction of the individual with other individuals and with social institutions, such as the media. As a consequence, the symbolic meaning of possessions varies historically and socio-culturally – as we have denoted above with the increasingly volatile meaning of status symbols.

This discussion already suggested that the structure of modern societies is not adequately represented by the idea of vertical stratification based on socio-economic criteria, such as education, age, income, etc. Instead, modern societies are built from several different life styles by which people communicate their identities to themselves and others and articulate which groups they (do not) belong to and what social position they occupy or strive for (e.g., Hradil, 1987, Lüdtke, 1989, Chaney, 1996). A certain life style accrues from the socio-economic position of an individual, her mind set covering attitudes, values, and worldviews, and her performance in terms of consumption patterns and endowment with consumer goods (Reusswig, 2002, p. 158).

Shaping categorical symbolism in and through usership implies finding ways to better connect a product service system with the life styles of the envisaged target groups. This connection can be facilitated by a dedicated *service brand.* In general, a brand works as a symbolic resource carrying or portraying a set of social meanings associated with the consumption of the branded good (e.g., Elliott and Wattanasuwan, 1998). From the customer's point of view, a brand provides orientation, generates trust, and conveys

prestige. From the supplier's point of view, a service brand helps profiling the offer and communicating desired product images (Bruhn, 2001, p. 33).

Creating a brand for usership services comprises similar measures as in general service brand management. Focussing on the service resources, branding can be obtained by the brand quality of the service-related-products (e.g., Oelsnitz, 1997, p. 81), by choosing a brand name that is distinguishable, relevant, memorable, and flexible (Berry and Parasuraman, 1992, p. 143ff.), by applying the trademark to all physical evidence of the service according to a coherent corporate identity (Meffert and Bruhn, 2003, p. 401), etc. The brand identity may further be visualised during the service encounter by uniform clothing of the service personnel. As regards the service results the establishment of a brand can be supported by providing branded gifts and souvenirs or by offering service related products for sale, such as travelling bags sold in train shops (e.g., Stauss, 2001, p. 564). Thereby, customers are enabled to maintain symbolic contact to the service provider and to communicate service consumption towards relevant others (e.g., Graumann, 1983, p. 161f.).

4 Overall conclusion

The above discussion has shown that consumer acceptance of PSS is a complex issue that requires further attention. The analysis of PSS from a functional perspective provides evidence of the benefits of services providing enabling platforms or final results and also a number of recommendations as to the proper design and implementation of usership. This viewpoint neglects, however, that consumption of products and services is a social process. Correspondingly, the symbolic perspective reveals that material goods are part of the social fabric of our lives and that ownership essentially contributes to identity formation and social cohesion in modern societies.

Therefore, starting from the different layers of symbolic meaning that may emanate from possessions the paper presents an exploration into the symbolic properties connected with or connectable to product service systems. Possible ways to recover the symbolic meaning that is 'lost' when giving up ownership of material goods have been sketched. They refer to both the public and private self of consuming individuals.

Of course, the discussion is not exhaustive and only a first preliminary input to a more holistic analysis of consumer behaviour in the case of product service systems. A deepening of such analysis appears necessary, amongst others, to better exploit the sustainability potential of consumption without ownership.

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Chapter 6 Food Consumption as a Principle of Classification and Identification.

Organic and Natural Food Consumers in France

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1 Introduction

In the current French sociological literature, sustainable development is poorly represented, not to speak about sustainable consumption, or sustainable consumers. The latter are absent from statistics and may appear in nutritional classifications where so-called natural food movements or even organic food consumers are mainly subjected to normative evaluations. Facing such a vacuum of representation and classifications, only the indigenous definitions of the sustainable development' advocates are made available. Organic food for instance, which can symbolise at once the alternative, ecological and sustainable consumption - because of its historical origination (in France at least) among pioneers of sustainability in production in consumption, namely the post-May 1968 nature utopians – appears frequently as a philosophy of life, characterised by the rejection of humane "abusive" action over the natural resources, including an acute awareness for health and love of nature; with the result that choosing to consume organic proceeds, according those definitions, proceeds from an exclusive moral choice, which, even though an usual privilege of the elite, remain stay open to everybody. In such a context, this paper aims at showing that organic food choice nor sustainable development that embedded it can not be reduced into a moral choice: it is an important social fact that entertains close relations with people conditions of living, social aspirations, and with the modes of socialization of tastes.

Instead of deploying a theoretical framework, I preferred to proof organic food consumption against existing sociological theories, such as anomie, legitimacy, habitus, conspicuous consumption, disenchantment, etc. by confronting their underlying meanings and definitions with the material collected empirically. Of course, organic food is a good example such a confrontation because it resisted to all evidences: to the naïve one considering it as special symbolic item and then only deemed to legitimate

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sociology of taste in Bourdieu's style; to the learned other that may identify it as a "healthy" product and then selecting consumers according to one exclusive criteria. We should add the fact that it remains an expensive and rare food product market, so it may select consumers according to their revenues also. In choosing to unveil the hidden social mechanisms that are at the origin of organic food consumption, as at that of any symbolic production, the sociologist postulates implicitly that beliefs, opinions, political, esthetical or moral choices are mere illusions. Wasn't that the case, for example, of the Weberian analysis of legitimacy? When Weber asks "why and in which conditions" the "dominated people submitted themselves to the authority vindicated by the dominators" (Weber 1963: 81- 82), his question is worthy of that of a non believer, an profoundly non reverential.

2 There is no single route to sustainable consumption, but many routes

There is no single definition of organic food consumption, but many which relate to very contrasted determinations. Organic food consumption is not a unique philosophy, which is diversely applied. Taken as a theory or a practice "natural" way of eating, organic food is a convenient but inexact appellation. In reality, it is a polemical appellation, and a rallying flag: in an industrial society, vindicating "alternative" way of eating, is to refuse the current food, at least as much to accept the "alternative". One can then understand that available statistics on organic food consumption, is collected more often under the banners of specialised associations or food retailers. Aiming at the promotion of the alternative market of organic food, such statistics can just grasp the individuals the more predisposed to divulgate their adhesion to the anti-industrial ideology. It ignores the others.

3 Organic food consumption in the different social groups

The questionnaire survey shows extreme social diversity of organic food consumption. Put in relation with their respective weight in the different departments from where they come, the consumers from the higher social grades are over represented in organic food consumption. That is the case for the executives, the intermediary professions (teachers, nurses, social organizers), employees. Contrary to that, artisan-merchants and workers are under represented in organic food consumption among their homologous of the different departments.

These differences appear even more neatly when one observes the social composition of the respondents: preponderance of the group of executives, intermediary professions compared to that of employees, workers and artisan-merchants. Organic food consumption remains undoubtedly the apanage of the middle and higher categories, so that the presence of popular categories has to be considered as an indicator of the social diffusion of the ideologies conveying the alternative, the ecological, the sustainable way of living and eating.

In comparison with the overall French population, the proportion of men and women is different: the part of men is higher among artisan-merchant organic food consumers, and among the employees; on the other side the share of women is higher to that of men among executives and intermediary professions. At last, the organic food consumers, all social categories mixed, are at the same time more graduate and over graduate than the national average.

The relation to organic food products of the subjects belonging to the popular social categories (i.e artisan-merchants, employees, workers) and that of subjects from higher categories distinguish each from the other by a set of systematic features. In the first group, the proportion of men, unmarried is higher; consumption of organic products starts early in the life-cycle, among the 18-24 years old in commercial employees' group; ages are contracted, around the 25-29 years old group (which the modal age of the respondents), the 30-39 y/o, at the time where the members of these groups seem to feel the more the effects of the dissatisfactions bound to the industrial food offer, to available leisure, to the nature of their existence; while the ages are more stretched out among the higher categories, continuing above the age of 50 among the intermediary professions and above 60 among the executives; the discovery or the encounter of organic food seems more recent in the popular categories (in average, since 3 to 5 years) even though many members of these categories are inserted since longer in the networks of sustainable development throughout their regional or living area networks. On the other side, the consumption of organic food is formerly installed among the higher categories (since 10 to 15 years).

The consumption of organic food product among the popular categories is closely associated with complete urban acculturation or with a type of uprooting (birth abroad among skilled workers of artisanal type) and, in the higher categories, with existence with ties in rural setting which reveals the childhoold in the country or the fact of receiving fresh food produce and hand made preserve from the country; organic food products are associated by many popular categories to the products they used to consume when they were kids; they temporarily go organic shops to buy the few samples of fresh vegetables that they cannot find in supermarkets; on the other side, the higher categories tend to use the organic shops as supermarkets, buying there any kinds of products, and associating organic products to products suited to their lifestyles. Organic shops are therefore places for profound social and symbolic demarcation, the ones identifying themselves are the "inner" natural, referring their behaviour to their origins and praising the "local", the "traditional" way of production, the others as the most "legitimate" natural, referring their behaviour to their social and modern ecological identity, that can be displayed above their eating practices, i.e attitudes towards animals, and the natural environment.

In particular, the observance of the meat taboo, which characterises the former utopian communities of post-May 68 organic food consumers, is stricter among the popular categories than among the higher ones, where freedom is taken towards such prescriptions, so that the transgression of the meat prohibition constitutes an important motive of differentiation between the groups of consumers. In the same way, the relation to the alternative food among the popular categories shows solidarity with greater mistrust towards

the biomedicine to the benefit of alternative medicine, while the higher categories tend to turn more often to biomedicine.

In the popular categories, the relation to alternative food is less often associated with many intellectual motivations (i.e ecology, politics, history, psychology, psychanalysis) and is more strongly connected to philosophical schools of thought of spiritual type like Buddhism; on the other side, that of the higher categories is supported by a variety of intellectual and political interests and more often tied up to school of thought of hygienic type, like hygienism or naturopathy; at last, the relation to organic food among the popular categories reveals to be rough with the absence of culinary references, compared with that of the higher categories, which is oriented by dietetic sensibility, where specific modes of cooking vegetables are valorized (raw, steam notably) going hand on hand with a vegetarian enculturation achieved by reading specialized journals; in the latter groups are also the therapeutic virtues the most attributed to food.

The analysis of interviews reveals that in the popular social categories, the relation to organic food can be interpreted as a possible consequence of the conditions of life and leisure, resulting from the dissatisfactions bound to loneliness, to the situation of migration, that always lead the sought and to the discover of alternative food circuits and networks, and to new sociabilities. The features characteristic to this type of food nonconformism, male, lonely, premature, austere, recent, die down as one raises in the social hierarchy, and reveal its relative homogeneity. On the other side, the food nonconformism in the higher categories, immoderate, appears like a convenient outlet to the effects of the dissatisfaction which effects these groups feel with acuteness towards the standard food offer. From old adoption, the consumption of organic food is rooted in domestic cultures and adjusted to lifestyles. The same causes – dissatisfaction – does not lead to the same attitudes, including among the same sections of the population, so it is less a matter of the habitus which is here at work than the series of encounters that the individuals may have to do in their lives, negociating each path of their position and trajectory with the constraints of the social norms.

4 Individuals with “atypical” profiles

Of course, one needs to agree with the limits of the material collected, which entails disenchantment with regards to the subject matter. Here, the respondents, all social categories mixed, have in common, atypical social profiles: in addition to the unequal representation of gender in the consumption of organic food products in comparison to the overall French population, one points out that the consumers are overgraduate in relation to their homologous in the general French population; more complete data on wages should show lower revenues, among the organic food consumers compared with their homologous in the general population, at equal degree.

The analysis of jobs suggests another dimension “anomie” within the respondents. One notices for example, in the popular social categories, the frequency of labourers (among the workers), of technical professions or, especially, commercial professions (among the employees), and within the higher social categories, the preponderance of sales representatives, estate agents (among the intermediary professions), of intermittent of the show

business, like jugglers, stage-designers (among the executives notably), all professions which, because not entailing or few stability in the job position, few statutory guarantees, exclude an orderly unrolling, the formation of regular career perspectives, to be brief the establishment of principles of order that could contribute to regulate the existence and the projects. All that shows that, for those consumers whose statutory and social identity is threatened, food nonconformism constitutes an outlet, an ideology which permitted to meet meaning again, references, by favouring the immersion, the affiliation to a social group. Associations, various gatherings devoted to the promotion of the alternative life, to sustainability are numerous, and many, including the yearly thematic exhibitions (organic food, alternative medicine) held in the country, play this role, and are usually the channels that lead people to the organic food shops.

On notices, relying on the most refined level of the social categories built by the National statistic organisation (INSEE, position 42), that the social mobility - (downward, to the identical, upward), obtained by crossing the profession at arrival of the respondent with that of his/her father – constitutes a pertinent indicator for understanding the specific forms of the receptivity of organic food and the alternative mode of living that comes with it in the different social groups. Hence for instance, we find among the administrative employee, where the mobility is mainly achieved to the identical, that organic food consumption is associated with an ethical concern, with spiritual preoccupations. It looks like some divergence between the status at the arrival and the career of aspiration was at the origin of an overinvestment in the alternative ideology, with the exploration of the philosophy, which often prepares for a militant career, as verified by the interviews.

A complete examination of the practices among the teachers and assimilated (where the downward mobility is important) whose fathers were mostly executive in the civil service, should reveal that the same principles of adhesion to the spiritual philosophies associated with the alternative food are at work; this feature is obviously in opposition with the example of the sections of the intermediary professions in social ascension, who seem to entertain a laxer, more distant relation to the initial prescriptions and values that embedded organic food consumption, especially among the post-1968 communities.

The social position, in the case of downward trajectory, results from failures and burstings in comparison with the course followed by the majority of the members of the group of belonging, and accounts for the fact that all the conducts and beliefs of the individuals are affected by the images of these failures. In the particular case of the intellectual professions, the ecological ideology, through its critical propensity, puts at the disposal of the subjects the practical and intellectual elements of compensation.

On the other side, the organic food reveals equally to be fitted to appropriation by the groups in social ascension. In the exclusive cases of upward mobility like with the executive and intellectual professions of the sample, organic food products are subjected to free usages, that define the privileged type of relation the non standard food: the variables of length of service in the consumption, of high revenues, high degrees, which are constitutive of the social prestige, seem reactivated with more strength in

organic food consumption. These groups define its forms of uses, as they fix the boundaries to be followed by the new entrants.

5 Sustainable consumption and socialisations

How to interpret the effects of sustainable development, what makes its ideology, when translated into food consumption and daily practices, an « interesting » object for adhesion and appropriation ? In the vicinity of the middle and higher categories where organic food consumption is preponderant, can we content ourselves with seeing there a mere convergence between the social and ethical dispositions of these groups and the critical ideology that embedded the discourse of the sustainable development? It is true that the current discourse of sustainable development conveys countless motives of dissatisfaction – protest against commercialization and consumption of industrial products judged as 'poisonous', 'dangerous', 'altered', 'denatured', 'tasteless', denunciation of the industrialisation 'polluting', rejection of the oppression in all forms, attention to local development and employment, interest for development in solidarity here and there between peoples, through encouragement of fair trade, etc. – which are characteristic of this learned variant of the food unease that voice particularly the intellectual professions of the middle and upper categories.

One observes also that the rules of the ethical consumptions, although they present themselves under the form of prohibitions (negative rites according to Durkheim), reveal to be less constraining than one could think at first sight, and lend oneself easily, especially among the higher categories, to reinterpretation, the latter modifying them and adjusting them sovereignly in relation to their own somatic, leisured or medical values.

To which extent the way the apprenticeships of the "normal" food behaviours organised in a specific social group, can partially breed behaviours that come to be opposed to these internal norms? For example, can we explain the precocity of the consumption of organic food products among the employees by the difference of norms of domestic socialization of taste, of social conducts of leisure, etc., compared with the other social categories?

The earliness of organic food consumption in the popular categories and the cessation of their consumption, after the age of 50, may be a generation effect; but it certainly conveys a different representation of the body, in relation with the different social conditions of its usages, and consequently to the conditions of life and work. Entering earlier in the active life, the members of popular classes are also led to represent earlier to themselves the conditions of the preservation of a healthy body, and to adopt the appropriated conducts, of which the organic food product consumption may be a legitimate part. They are twofold a legitimate mean for the health ends pursued; first especially because they are legitimated by the reference categories, situated just above; second because they can often be associated to the "healthy" and "traditional" food eaten in the childhoold. Organic food appears as one of the forms of those conducts of anticipation, of prevention of vital health.

In the higher social categories, the prolongation of organic food consumption after the age of 60 tends to display a longer social and symbolic

usage of the healthy body, a steady attention towards the preventive methods, and a greater conformity to the values of the time: ecological life and practices, careful listening to the dominant discourses of sustainable development advocates about the future of the environment, etc.

The choice of consumption of organic food products is socially determined. The strong links that join these consumptions to the social mobility, to the social logics of construction of identity, reveal the genuine forms of appropriations and reinterpretations to which it gives room, at the same time that they translate the social and cultural stakes of this variant of the ideologies of nonconformism.

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Chapter 7 Social capital, lifestyles and consumption patterns

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1 Introduction

The continuous social, economic and environmental transformations that are a feature of European cities force us to reflect upon the meaning of the Quality of Life and on the challenges that will be faced in the future. The aim of this paper is to analyse the strategies that could be adopted to improve the quality of life of city and town dwellers in terms of ecological sustainability. This paper illustrates a study carried out, in the city of Padova, in which the existing relationships between the quality of the urban environment, the nature of social relations and the consumption patterns in two different areas of the city have been analysed. The data gathered by means of focus groups that were set up in the two areas could help in developing a model of sustainable urban living. This study has highlighted citizens' widespread knowledge, on the basis of which the quality of the natural capital present in the urban environment deeply influences their own quality of life. Furthermore, the study has been able to identify the nature of social relations which are a crucial element not only in 'living better' but also in putting strategies to deal with environmental risks. The concept of social capital becomes a means of explaining a considerable part of the social actions and transactions of individuals' daily lives. This study seeks to evaluate the potential of the social capital, as vector to promote mechanisms aimed to drive consumption patterns and lifestyles of householders toward sustainability (Chiarello F., 2001). In the paper we reconstruct the following aspects:

- The perceived quality of life of residents.
- The quality of social bonds, trust and social capital inside the neighbourhood.
- The perception of environmental risks that people deal with them.
- The sustainable consumption strategies to face them.

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2 Methodological and normative aspects

2.1 Methodology

The research used the "focus group" methodology. In both of the areas studied, the people who were invited to become part of the focus group were those who had previously been identified as "nodes" in the local relationship network. It was not difficult, in both areas, to identify the people who played the role of nodes, of hubs, within the network of resident's relationships. However, although it was relatively simple to identify the "key" figures it was much harder to discern and decipher the relationships between these figures, the "configurations" they were a part of. As regards the method used for the focus group, we tried to use the scenarios backcasting approach as described by Karl Dreborg (1996). The main interest here is not what will happen in the future, but rather which direction does society want to move in. In this case the scenarios may show either the possible path, or the desirable path, that social development should take. In short, because the scenario approach (not the forecasting) is clearly in the utopian tradition it can offer different options for the future development of society (van Steenbergen, 1983, pp. 376-386).

Firstly, participants described their situation by focusing on the most unpleasant aspects of their neighbourhood. This constituted the largest part of the focus group work. Subsequently, we developed scenarios which were suggested by the participants. Often these were not very probable scenarios but they did show how important social problems could be copied with and solved. Starting with desirable futures, which in our case did not often reach a very high level of imagination, we tried to outline ways of achieving these goals, usually through political and institutional measures, but also by means of a shift, a change, in the quality of social networks and connections.

2.2 The Features of the Neighbourhoods

The urban areas where we set up the focus group are very different one from another. The urban area includes the housing complex of Via Maroncelli, where 120 families live there, and its neighbourhood called Pio X, which contains a large settlement, mainly occupied by foreign immigrants. The area around Via Maroncelli is a semi-suburban area, near an area of large commercial structures, shopping centres and offices, which have little to do with the everyday life of the zone, it is daily subjected to heavy traffic, many different social classes mingle and there are few essential services.

The urban area around Via Pinelli is very different. This is on the southern outskirts of the city but it is a long way both from major roads and from shopping centres and other facilities. About 250 families live in the area distributed among a group of buildings constructed in diverse periods. The oldest buildings date from the 1970s, the others were built in the early nineties, while the most recent were put up a few years ago and were designed and built to meet environment friendly criteria. The zone is largely cut off from the city itself, and from other urban settlements, thus, until about one year ago there was neither much pollution not noise. However, such isolation also means that there will be a lack of accessible urban

services near at hand. But, as we shall see, people prefer to breathe better quality air than to have shops.

3 Sustainable urban life and social capital

For people, social relations and bonds, which have been built, developed but also shattered over time, play a crucial role. The quality of these relationships depends, in part, on economic conditions, the social stigma that may lie upon the neighbourhood and the spatial distribution of personal and collective spaces. Usually we think that in such housing spaces "bonding" social capital prevails. But, as we shall see below, to produce improvements in quality of life and social cohesion people often need a "bridging" social capital. Our research on two of such neighbourhoods shows that people are endowed with a mix of "bonding" and "bridging" connections. It means that social changes, also in the field of consumption, are possible.

3.1 What is Social Capital?

Crucial to implement the research has been the concept of social capital. In recent years, increasing interest has been shown in the notion of "social capital". The term captures the idea that social bonds and social norms play an important part in sustainable livelihoods. The value of this concept was identified by Jane Jacobs (1961) when examining social life in urban neighbourhoods; by Glen Loury (1987) when studying the labour market; by Pierre (1979b) and later given a clear theoretical framework by James Coleman. As Bourdieu suggests, social capital is a network of relationships, which is the product, intentional or unintentional, of social investment strategies aimed at the building and reproduction of durable and useful social relationships able to offer material and symbolic benefits. These relationships enlarge the individual or collective actors' action capabilities and, if extended enough, the social system's action capabilities too. From the point of view of Coleman, social capital inheres in the structure of relations between actors and among actors. It is not lodged either in the actors themselves or in physical implements of production (Coleman, 1988, 1990). In short, social capital is a public good shared by a number of individuals. Robert Putnam (1993) and Francis Fukuyama (1995) have also stressed the role of civic participation in implementing democracy and social cohesion, and applied the concept at both the national and the regional level.

3.2 Forms of Social Capital and Networks

The idea of social capital is associated with that of "network of relations". All societies are built from social groups rather than individuals, and these groups determine attitudes, beliefs, identities and values, as well as access to resources, opportunities, and power. There may be high social capital within a group ("bonding" social capital) which helps members, but they may be excluded from other groups because they lack "bridging" social capital. Cross-cutting ties between groups open up different opportunities to all members. They also build social cohesion, which requires not only high social capital within groups but abundant "weak" cross-cutting ties among groups. Several writes have pointed out the importance of ties outside the

primary network as a means of getting access to resources and power outside the group. Mark Granovetter (1973) emphasised the "strength of weak ties", highlighting the importance of those ties which run beyond the immediate circle of small family or neighbourhood dwellers, giving actors richer resources to achieve a better quality of life. For certain individuals or groups, these kinds of networks can create a competitive advantage in pursuing their ends. Ronald Burt has drawn attention to the fact that actors who bridge between subgroups have access to unique resources and information that makes them powerful brokers in a system (Burt, 1992). Three basic forms of social capital have been identified (Woolcock, 1999):

- Bonding social capital refers to the relations between family members and members of ethnic groups.
- Bridging social capital refers to relations with distant friends, associates and colleagues.
- Linking social capital refers to relations between different social strata in a hierarchy where power, social status and wealth, are accessed by different groups. Woolcock relates linking social capital to the capacity of individuals and communities to control resources, ideas and information from formal institutions beyond the immediate community radius (Woolcock, 2001).

Although strong bonding ties give particular groups a sense of identity and common purpose, without "bridging" ties that transcend various social divides, bonding ties can became a basis for the pursuit of narrow interests and can actively exclude outsiders. Relatively homogeneous groups may be characterised by strong trust and co-operative norms within the group and by low trust and co-operation with the rest of society. Thus some forms of exclusive bonding can constitute a barrier to social cohesion and personal development. These are examples of weak bridging but strong bonding. A restricted radius of trust within a tightly knit group, such as family members or closed circles of friends, can promote forms of social interaction that are inward-seeking and less orientated to trust and co-operation at the wider community level (Portes and Landolt, 1996). An exclusive focus on group interests, to the neglect of wider public interests, can promote socially destructive "rent-seeking" activities. In this respect, social capital is no different from other forms of capital: it may be used to serve different ends, not all necessarily desirable for the community at large.

3.3 Sources of social capital

The social capital is characterised by different kinds of social conditions. We have identified the following:

3.3.1 Participation in networks and groups

Key to all uses of the concept of "social capital" is the notion of more or less interlocking networks of relationships between individuals and groups. People engage with others through a variety of lateral associations. These associations must be both voluntary and equal. Individuals acting on their own cannot generate social capital. It depends on a propensity for sociability, a capacity to form new associations and networks. Connectedness, networks, and groups and the nature of relationships are a vital aspect of social capital. There may be many different types of connection between groups (trading goods, exchange of information, mutual help, provision of loans, common celebrations). Connectedness manifests itself in different types of groups at

the local level and it also implies connections to other groups in society, at both micro and macro levels.

3.3.2 Reciprocity and exchanges

Social capital does not imply the immediate and formally accounted exchange of the legal or business contract, but a combination of short-term altruism and long-term self-interest. The individual provides a service to others, or acts for the benefit of others at a personal cost, but in the general expectation that this kindness will be returned at some undefined time in the future when he/she a service. In a community where reciprocity is strong, people look after each other's interests. Reciprocity and exchanges increase trust. Usually, there are two types of reciprocity. "Specific reciprocity" refers to simultaneous exchanges of items of roughly equal value; and "diffuse reciprocity" refers to a continuing relationship of exchange that at any given time may be unrequited, but over time is repaid and balanced. Reciprocity contributes to the development of long-term obligations between people, which can be an important aspect of achieving positive environmental outcomes.

3.3.3 Relations of trust

Trust entails a willingness to take risks in a social context based on a sense of confidence that others will respond as expected and will act in mutually supportive ways, or at least that others do not intend harm. Trust lubricates co-operation. It reduces the transaction costs between people, and so liberates resources. Instead of having to invest in monitoring others, individuals are able to trust them to act as expected. It can also create a social obligation – trusting someone engenders reciprocal trust. Three different dimensions form the concept of trust: the trust we have in individuals whom we know very well (parents/family, colleagues, neighbours); the trust we have in others (strangers and unknown) we do not know or inter-subjective trust; the trust we have in the institutions or systemic trust. The combination of these three elements provides a concept of trust, which fits into social capital. Trust is, at the same time, both the source and the outcome of social capital. Trust take times to build up, and it is easily broken. The presence of the norm of trusting reduces the uncertainties present in social life, making sure individuals of social equilibrium when they are facing the everyday risks. In this sense trust becomes an indicator of social sustainability.

3.3.4 Social Norms

Common rules and social norms are the mutually agreed norms of behaviour that place group interests above those of individuals. They give individuals the confidence to invest in collective or group activities, knowing that others will do so too. Individuals can take responsibility and can ensure their rights are not infringed. Social norms are sometimes called the rules of the game, or the internal morality of a social system, the cement of society. They reflect the degree to which individuals agree to mediate or to control their own behaviour. Formal rules are those set out by authorities, while informal ones are those individuals use to shape their own everyday behaviour. Social norms usually provide a form of informal social control that obviates the necessity for more formal, institutionalized legal sanctions. Social norms are usually unwritten but commonly understood formulae for

both determining what patterns of behaviour are expected in a given social context, and for defining what forms of behaviour are valued or socially approved.

3.3.5 The Commons

The combined effect of trust, networks, norms and reciprocity creates a good community, with shared ownership over resource known as the "commons". The "commons" refers to the creation of a pooled community resource, owned by no-one, but used by all (Hardin, 1968; Ostrom, 1990; Goldman, 1998). The short-term self-interest of each, if unchecked, would render the common resources overused, and in the long term it would be destroyed. Only where there is a strong ethos of trust, mutuality and effective informal sanctions against "free-riders" can the commons be maintained indefinitely and to the mutual advantage of all. To maintain the commons the presence of a sense of personal and collective efficacy is needed.

4 Social services, social networks and the Quality of Life

4.1 Social services and housing in the two areas

In this step we examined the quality of life in the two areas in relation to the existence, or absence, of urban social services. Most of the participants living in via Maroncelli focussed on the absence of such services or, more specifically, on the lack of five types of services:

- Structural social services, such as a Chemist's, a Post Office, more efficient public transport.
- Services concerned with looking after people, caring, again elderly people are often alone, looking after themselves or dependent on care from outside or within their family, or services for youth, as groups of young people are often seem wandering around the area with nothing to do. Social mediation was requested in order to resolve some local conflicts.
- Services designed to improve the quality of urban life, such as green areas, parks, traffic reduction, street cleaning and general maintenance of public places and areas.
- Services concerned with law and order, city police, who are not able to control anti-social behaviour in the area. Participants complained about the lack of any consistent police presence in the area and also criticised the use of the so-called "*vigile di quartiere*" (neighbourhood policeman), who were considered to be useless and inefficient.
- Spaces for local residents to socialise in. Whether there are or are not meeting points available in a neighbourhood is really important for the quality of life of the people living there. Most housing projects are paradoxically designed in order to minimize, or even prevent, any chance of communication between residents, to stop informal meetings and to provide minimum facilities for formal gatherings of people. Ideally housing complex design should help people to become less "strange" and to help them to trust each other. Luckily, in this public housing complex there is a meeting point which has and is working, over time, to bring residents together, but outside the settlement there is nothing like it.

Unlike the former, residents in Via Pinelli felt that the overall quality of life in their neighbourhood was relatively good, mainly thanks to the low density of housing in the area, to the fact that there are green spaces and very little traffic pollution. Unlike the residents of Via Maroncelli (who were on average older), people in Via Pinelli are willing to go without the convenience of having certain services and facilities "close by" (shops, schools, offices, means of transport) in order to benefit from "silence", "clean air" and a traffic free life. The main problem that residents in Via Pinelli are becoming more and more concerned about is the increasingly fast and unregulated process of urbanisation they see around them. Many buildings, including a huge shopping centre are currently being built very near to their neighbourhood, thousands of cubic metres of concrete which do more to satisfy speculators than to meet real social needs. Moreover, there are also problems of organising both Municipal services (grass cutting, rubbish collection, etc.) and of managing public spaces and areas, for example, the tale of the public meeting areas on the ground floor, which is told below.

4.2 Unsafety and insecurity

In both the neighbourhoods some of the participants claimed the lack of personal safety in the area due to the fact that there is a low level of social control exercised by the police there. But there were considerable differences between the two groups of people.

Our witnesses from Via Maroncelli complained of the fact that bands of drug dealers (usually foreigners) operated in the area; that there are prostitutes on the streets, groups of youths who behave in an anti-social manner and show little respect for other people, and bands of petty criminals who commit various kinds of crimes. They also complained about the lack of any official agencies, methods or concrete action taken to control these situations, particularly as they were increasingly aware of the powerlessness of any private attempts to enforce some sort of social control. There was a general feeling of being abandoned by the institutions. The problem of security and of personal safety seems to have become one of the main themes in the context of the quality of life in the city in general. I have already examined this problem in an earlier piece of research which showed that concern about personal and social safety should be interpreted (Mosconi, Padovan, 2004). Often it is neither related to any specific crime that may have taken place within the area, nor to any episodes of victimisation or attacks undergone by the residents. Rather the roots of this feeling of non-safety can be found in the types of relationships in the area and in the poor quality of the environment. Even though images referring to "conquering the area", to "invasion" by groups of foreigners did emerge from the focus group, such fears are only partly attributable to the problem of the "other". These fears show, on the one hand, that a sense of belonging may develop as a reaction to the arrival of outsiders and, on the other, that this identity tends to blame the "other" for all the social frustrations of the absence of institutions and unsatisfactory, or non-existent, social relationships. People feel that they have been left to fend for themselves and this is the main cause of existential uncertainty and personal insecurity.

The people who live in Via Pinelli are less concerned about insecurity and unsafety. This is probably due to the fact that the neighbourhood is fairly isolated, cut off, from other areas, that people do know each other and that the terraced houses, built according to bio-architecture standards, are mainly occupied by professional security workers (policemen and policewomen, prison warders, tax police). However, apart from these generic complaints, criminal activity is considered to be a minor problem by residents in the area, certainly not one of their main worries. There was some concern expressed about crime but this seemed to depend more on the fears stirred up by the alarmism of the mass media than on perceived criminal activity in the neighbourhood.

4.3 Social networks and reciprocity

What is interesting in the outcomes from the focus group of Via Maroncelli is that there are no prevalent social networks in the neighbourhood. Both weak and strong connections are at work there. Using the former classification we can identify both "bonding" relations among members of local groups or between residents in the housing complex and "bridging" relations among neighbours and distant friends, associates and colleagues. What is weak is the "linking social capital" or, in other words, the capacity of both individuals and the community to control resources, ideas and information from formal institutions beyond the immediate area of the community. This weakness is the result of a low level of participation in common local issues. What could be very useful for the people living there, are networks with weak connections. These weak ties serve to connect different groups, allowing these latter to pursue professional, economic, political and cultural goals. They also increase the social cohesion within the neighbourhood, reinforcing collective action and opening up new horizons for public housing tenants (Granovetter, 1973). When discussing the quality of the social relationships in the area, participants showed three distinct types of attitudes.

- Firstly, they complained about the limited nature of their social bonds, revealing a sense of spatial isolation which may well be partly due to the way the area was initially laid out: it is bounded, cut off, on at least three sides by busy roads and by big commercial and industrial buildings. Thus it would seem that there is the desire to set up a large network of people who would be able to develop joint, communal actions for the good of the local inhabitants and, furthermore, that the links formed could then be loosened or broken so as to exclude those who neither fit in nor inspire trust.
- Secondly, the group members had noted how weak links, for instance those marked by indifference, sometimes create awkward situations and social distance for some categories of people, especially the elderly and children. Usually, distance in relationships allows only for a limited degree of reciprocity, an accumulation of "chits" which the actors hope will permit such reciprocity. But this type of relation based on a "utilitarian" exchange was not enough for our witnesses who wanted bonds based on deeper shared meanings and values. It is easy to identify the desire to exchange freely without forming "debts". Rather, witnesses would like to see a more widespread, "diffuse" reciprocity, one which allows for a continuous series of exchanges. In this latter case, the favour

does not have to be repaid immediately or the debt instantly paid off. We could call this behaviour as "something for nothing" (Gouldner, 1975).

- The third, and perhaps most commonly held attitude that emerged during the focus group meeting, concerns participants' overall satisfaction with their existing social relations. This satisfaction would suggest that the general, widespread, reciprocity described above does, to some extent, already exist.

What is clear from the above is that most people think that they do have good social relations. To a certain extent they do trust their neighbours and acquaintances, they do help each other, leave keys with each other, and meet up, but these interpersonal links do not necessarily develop into social activities which require a certain degree of willingness to take part in actions for the public good.

In Via Pinelli the relationship model at work is different from that of Via Maroncelli. In Via Pinelli there are two groups of tenants each of which are based on rather different relations, bonds of friendship and collaboration. The two groups have formed around the key persons on the estate who we identified and then invited to the focus groups. The two groups are also physically separated in two different sets of buildings. If one were to describe the style adopted by the two groups one could say that one group is characterised by the spontaneity of its relations, "Rabelaisian" type friendships, while the other is marked by a far more rational, or better "reasonable" conception of rights and duties, as in the reciprocity found in common action. In Weberian terms one could say that the first group privileges values of friendship and solidarity, reinforced by specific and declared class membership (the members of this group declare themselves to be left wing and workers), while the second group is closer to the rationality of the aims where the aims and the results are more important and not shared values.

The "rationalist" group is made up of 19 family nuclei all of whom live in the same block and who are united by their common efforts to manage and run the block. Because there is no formally appointed administration for the block the tenants have organised themselves by allocating agreed, set roles to each person. This means not only that they have organised the maintenance of common areas (cleaning stairs and corridors, seeing to lighting on the stairs, landings and in the entrance hall, garden maintenance) but also that they have agreed upon common rules regarding how common spaces should be used (times when noise is permitted and when it is not, time and place for other work and managing the heating system). This system of rules covers almost everything and offers the basis for mediating the conflicts that used to arise before the code of behaviour was agreed on. The system also means that maintenance costs less in the long run and certain forms of energy are being used more rationally. The members of the group are held together by a minimal and negotiated link. Bonds based on such negotiation mean that living in the community does not require the individual to belong or to make any emotional investment in relations; rather the community is merely a space for supporting social interactions and resolving common problems.

The "Rabelaisian" group aims to create the situation where people *live well together*, that is, it is based on sharing and on the consolidation of inter-

personal relationships. In this latter case there is no specific allocation of tasks and duties, nor are there explicit rules. One of the most usual ways of meeting is over a hand of cards, which is, however, only an excuse for meeting. This group is largely made up of pensioners, blue-collar workers and people, often disabled, who receive assistance from Social Services. Their day revolves around life within the confines of the neighbourhood, as many of them are unable to move around unaided (either because they have no means of doing so, no driving license, or for reasons of age or invalidity). Contacts within this group are based on interpersonal relationships and people find many reasons for meeting: whether it be for a game of cards, for dinner, just to chat, or to help those who need moral of personal support for some reason, they'll find a reason to meet.

We could say that the two lifestyles expressed in the two groups do produce different *habitus*, that is, different "systems of generating models that are likely to be applied, by simple transference, to very different practical situations" (Bourdieu, 1979a, p. 175). Life-styles are the systematic products of diverse *habitus* that, perceived through their reciprocal relationships, on the basis of *habitus* models, become the system of signals based on social position. The dialectic between conditions and *habitus* is the catalyst for the alchemy that transforms the distribution of social capital into a system of perceived differences (Bourdieu, 1979a, p. 177). The fact of belonging to one group and not to another is not an accident and it becomes especially clear in this case where a lot of energy is put into highlighting the "differential distances".

Given the differences we found, it is not hard to see why, in Via Pinelli, there is no Residents committee like that in Via Maroncelli: setting up a committee means electing representatives who are able to mediate and find ways of getting residents to agree. The fact that in Via Pinelli there a variety of different points of view, which we have simplified into two main models, makes such unity impossible, or rather, it is not seen a priority by the residents concerned.

4.4 Systemic and interpersonal trust

Another aspect which emerged from the discussion in both of the neighbourhoods is that of trust and diffidence. There are two types of trust: "institutional or systemic trust" and "interpersonal trust" (Mutti, 1998, p. 38; Luhmann, 2002). By "institutional trust" we mean the trust that citizens have in social institutions for as long as these institutions continue to offer concrete responses to their demands, to take decisions and, to put such decisions into practise so as to guarantee a certain degree of existential stability, A lack of institutional or systemic trust reveals the instability of the natural or social order subjects are involved in and, obviously, implies that there is a certain degree of uncertainty about the routine events of daily life. Interpersonal trust corresponds to the expectation that *Alter* (the other) will not manipulate communication, will give a real, and not biased, representation of his own role and behaviour and of his real identity. Basically, the expectations of *Ego* concern the sincerity and credibility of *Alter*, that is, expectations of transparency and abstention from lying, fraud and trickery (Goffman, 1971).

Trust, as Harold Garfinkel suggests, is "a person's compliance with the expectancies of attitude of daily life as a morality". Acting in accordance

with a rule of doubt directed to the correspondence between appearances and the objects that appearances are appearances of, is only one way of specifying "distrust". Trust ensures that the routine elements of a situation are confirmed, which permits the "rational action" of the actor. If there is no trust then this social resource breaks down, revealing the uncertainties of the rules of the social game and putting the regularity and the stability of the world with which the actor daily interacts in crisis. Thus the lack of systemic trust weakens the elements of our daily life that we "take for granted", creating confusion, anomie and neurotic aggressive and discriminatory attitudes (Garfinkel, 1967, pp. 50-51 and p. 173; Garfinkel, 1963, p. 219).

The existence of systemic and interpersonal trust in an area is a basic requirement for a better quality of life, but it is relatively rare in the neighbourhood. The type of situation described by the focus group is not unusual in public housing complexes because there is always the possibility that a new occupant will arrive who will upset the existing social balance in the neighbourhood. Distrust and diffidence develop when people begin to fear others, who try to dominate or are violent. Such fear develops when the "others" come to live in, or visit, the neighbourhood. Such people, who do not fit in, indeed often do not accept, indeed even resist, the existing tacitly shared norms of the previous residents. From this point of view, one could say that "all actions as perceived events may have a constitutive structure, and that perhaps it is the threat to the normative order of events as such, that is the critical variable in evoking indignation, and not the breach of the "sacredness" of the rules" (Garfinkel H., 1963, p. 198).

As people begin to feel more and more abandoned by institutions, so do distrust and diffidence gradually develop between them. Residents from Via Pinelli said much the same about the degree of trust they felt in institutions. Residents, even though they are willing to do voluntary social work, reap no benefits from their efforts or, worse, meet with indifference and disinterest on the part of the official organs which should be able to offer clear answers to legitimate demands. Thus self-organisation is necessary, not so that social subjects can cooperate better with the institutions, but rather it becomes the only way in which these same actors can find meaning in some segments of collective, everyday life. On the other hand, the poor performance of institutions does not help to reduce local and neighbourhood conflicts.

The trust in institutions has been examined in depth in both sociological and political literature, and all agree that such trust is fundamental for the success of both local and national society. The part played by social capital is crucial for the effective functioning of institutions. Social organisation is more efficient when there is trust, norms that regulate communal living, networks of associations, that is when there is a positive stock of social capital. These sources of social capital are "moral resources" which cut down on the betrayals and behaviours of "free riders". Consequently, trust in the institutions of social life is essential. This is because these institutions not only forge the politics but also the identity of citizens, their public and private behaviour and the norms of communal living. Furthermore, the institutions are directly responsible for many aspects of social and public life. Institutions regulate and control economic life, the environment (e.g. traffic) technological innovation, the general culture and education or training. These institutions are perhaps the main public good on which actors depend in order to delineate their life plans (Donolo, 1997, p. 14).

The rising up of systemic distrust is connected to the development of an asymmetry of power relations in society. The perception of environmental risks highlights the fact that corporate actors (firms, Nation States, industrial groups, local institutions) are largely responsible for the ecological problems that threaten the people's daily life. To be conscious of ecological risks means underlining the role, the responsibility, of the big corporate actors in creating many of the dangers faced by natural persons, by single individuals. The increase in social awareness of environmental risks depends on the asymmetry of the power relations between corporate actors and natural persons within society (Coleman, 1982, p. 88).

The attitudes and opinions expressed during the course of the focus group made us reflect on the impact such ideas will have on the way in which public goods are consumed. The degree of attention and responsibility residents show as regards public goods is, interestingly, reflected in the level of responsibility, of awareness, they show in relation to the consumption of energy resources. The same care and attention they pay to cultural resources, to public spaces and to their sociality is reflected in their responsible management of energy resources used heating, of water consumption, of rubbish recycling and of electricity in stairwells and entrances.

5 Environmental risks and strategies for facing them

During the first part of the focus groups more social questions, such as trust, the quality of relationships, political participation, satisfaction with the services provided were taken up. In the second part the aspects were related to environmental risks and the discussion centred on the individual and collective strategies that could be adopted to face such environmental questions.

The concept of environmental risk is used to refer to risks to human health and ecosystems posed by the use of certain technologies which lead, more or less directly, to deterioration of the environment and an increase in natural disasters (Beck, 1986; Schwarz and Thompson, 1993; Mela, Belloni, Davico, 1998; Lupton, 1999; De Marchi, Pellizzoni, Ungaro, 2001). From the greenhouse effect to the loss of biodiversity, from desertification to floods, the list of the phenomena that threaten our lives is getting longer and longer all the time. In this research we have looked in particular at the way in which people and local society deal with environmental risks. The way in which they take up the problem depends, obviously, on a complex set of inextricably linked factors, but what is certain is that the quality of social relationships, cultural awareness, the ability to mobilise and put political pressure on *policy makers*, radically affect behaviour in the face of any risks. A sociological approach to the question of environmental risk and the actions taken to reduce such risks, suggests that it is both the overall social system and, above all, the local social systems that mediate "physical" and "natural" events both amplifying them and containing the consequences.

Eivind Stø, Harald Throne-Holst and Gunnar Vittersø Eivind have suggested that, in this post-modern period, individuals play an important part in the measures and goals of environmental policy, whether it be in their role as citizens, employees or consumers. This is not unlike the situation as regards policies on health, nutrition and alcohol. Here too, Governments can make laws and emit directives, they can tax production and consumption of

some products and subsidise others. But it is the individuals themselves who have the last word. It is an individual, personal matter whether to start or stop jogging, drinking alcohol or make a consumer choice in the food market e.g. in order to reduce individual consumption of fat. In short, consumers can choose between individual and collective strategies, and individuals can act strictly as a consumer in the market or also tackle the questions that go beyond markets: into politics (Stø, Throne-Holst and Vittersø, 2001).

We do broadly agree with this argument even though the problem of institutions is, in part, ignored. On the basis of the data gathered through the focus groups, it would seem that if individuals are to modify their attitudes in such a way as to promote environmental sustainability then they must be put into a position whereby they will be able to act in a suitable manner. As we have seen, individual actions depend on the one hand, on the quality of the inter-subject relations in which people are embedded and, on the other, on the degree of trust they have in institutional actions. Basically, there must be certain types of social capital available in order to predict and direct sustainable behaviour. One could say that different types of sustainable behaviour are guided by different actors. In some cases, certain attitudes depend, to a large extent, on institutional actions, in other cases they depend on the quality of relationships and on social position, in yet others, they are the result of more personal, individual choices. When trust in institutions, or in others, is limited, or when people are too closed and cut off, then decisions about what to consume and how to consume it are often seen as unimportant and thus neglected. When, however, individual action is perceived as part of a broader collective action which decides about the quality and the way in which "commons" will be used, in this case any decision taken will have a moral force which makes it efficacious and a source of inspiration to others. When discussing factors and actions that are seen as environmental risks, our focus groups' participants concentrated on the following problems:

5.1 Traffic pollution

The question of air pollution is one of the most pressing and most widely perceived environmental risks. It is usually associated with traffic. According to Via Maroncelli witnesses, air pollution is largely an urban problem and is seen as a threat to health. Traffic is probably the biggest problem in Padova from the point of view of environmental sustainability. In the decade 1981-1991 overall mobility in Padova rose. However, while the use of private means of transport increased dramatically, public transport provision decreased to a large extent. In recent years it would seem that people's attitudes have begun to change as they are becoming more aware of the hazards traffic poses for the environment. Indeed, people seem to blame traffic above all else for air pollution and this is now one of the hottest ongoing debates between environmental associations and the City Council administration. In Via Pinelli the problem of traffic and pollution hardly exists because, as has been said, the area is fairly isolated and a long way from main roads.

5.2 The spread of buildings and uncontrolled urbanisation

The question of uncontrolled building and urbanisation is, in the eyes of the focus group members of both the neighbourhoods, another important risk factor for the environment. In Padova, only 2% of the entire urban territory

is destined for green areas, this effectively means that Padovans have only 9.5 square metres per capita of green space. Focus group members of Via Maroncelli think that uncontrolled urbanization is one of the most serious threats to environmental sustainability. They are also conscious of it because the City Council is planning to increase the overall level of urbanization (the so-called Peep blueprint) in many neighbourhoods. This means that the few green areas still in existence will soon disappear under new buildings, houses and apartments, which are to be provided for thousands of potential occupiers. In Via Pinelli the problem of urbanisation, and of uncontrolled construction and development, is perhaps the question that most worries people. As described above, the area around the Via Pinelli housing development is an oasis of green space, with very little traffic and little air and noise pollution. Until recently the problem of uncontrolled urban development, which has been affecting many other areas of the city, simply did not arise. Some of the members of the focus group, who moved to Via Pinelli from other, more polluted, areas of Padova, highlighted the fact that since moving their health had improved because of the lower levels of pollution. These people in particular expressed concern about projected future developments in the area where new housing developments and commercial centres are currently under construction.

5.3 Electromagnetic fields

Another environmental risk often mentioned by the focus group members in both areas is that relating to the electromagnetic fields produced by high tension electric cables and by mobile phone antennae. Via Pinelli residents pointed out that high tension electric cables actually cross their housing development and generate dangerous electromagnetic fields that can affect people's health. Indeed, the local kindergarten has had to be closed because the emissions from the electricity lines were well above permitted levels. The dangers of electromagnetic fields encouraged both Via Pinelli residents and people from other areas to support a petition asking for the electricity lines to be put underground but, so far, their pleas have gone unanswered partly because no-one has yet established what exactly the consequences of this type of pollution are.

As is clear this type of environmental risks can only be dealt with by institutions. In order to reduce the dangers of such risks, citizens must use every available means of putting pressure on both institutions and on other economic interests in order to force them to act and to protect "natural persons". Like traffic and air pollution, electromagnetic pollution, too, threatens a public good: health. Through their own actions, individuals can help to reduce such risks but their activities must be co-ordinated at an institutional level. However, the real problem that arises when facing these, and similar, risks is that of official planning policies. Such policies necessitate a very rational policy and administrative approach, a high level of internal coherence and external synergy; they require "usable knowledge" and a level of "consistency", of stability and coherence, over time, all of which are indispensable for social learning. Urban planning policies are essentially a part of those social and institutional processes that should offer certainties and stable interactions, they should also reduce uncertainty and risk and promote clear communication. But such processes only emerge when there is a relationship of trust between the actors involved and it is

possible to overcome the resistance, the power, of natural inertia, as in the case of traffic where social inertia and everyday collective behaviour are taken for granted. One factor that implicitly, but consistently, emerged from the focus groups was that people do perceive the need to define new rules and regulations, for example in the field of environmental sustainability. If there are no clear rules then it becomes difficult, if not impossible, for institutions, economic actors and citizens to work together, to cooperate.

6 Consumption and lifestyles from the point of view of environmental sustainability

6.1 Recycling garbage

The practice of garbage management is the institutional response to the environmental threat in the context of the risk society (Beck, 1986). Formulating, identifying, a risk implies that there is a threat. Garbage management regulates the excesses of consumerist society containing that risk and threat. The business of garbage management is not just about dealing with the garbage itself, it is also about the cognitive structures which allow our society to function. The institutionalisation of such practices acts as a neutralising agency and assists in maintaining the status quo of consumption and production. But often, this management and the local government fail to maintain unity in the public sphere, causing breakdown, tensions and conflicts in both the institutional and the social fields (Broderick, 1997; Viale, 1999; Osti, 2002).

The participants in the focus group of Via Maroncelli all showed that they were well aware of the positive impact garbage recycling has on the environment. Their comments revealed a high degree of willingness to take positive action in order to reduce one of the causes of current environmental problems. Moreover, they also mentioned the ethical questions that the economy should face as regards both society and the environment. Their criticism of the economic rationale that underlies garbage recycling is very important because it takes up the problem of the social distribution of the benefits of collective action and solidarity.

One piece of research carried out in Dhaka (Bangladesh) showed that social capital plays a role in the community-based provision of a public good such as garbage collection (Pargal, Huq, Gilligan, 1999). Social capital and networks are vitally important because garbage collection involves positive externalities leading to limited incentives for individual action. Also, garbage collection is an activity wherein one individual's actions alone would not have much impact, so collective action is necessary, even more so in the case of differentiated garbage collection. Why are some communities better able to organize themselves for the collective good than others? What specific characteristics within a local community give rise to activism, cooperation and pro-activity in some neighbourhoods and not in others?

We think that "social capital" is a crucial determinant of such collective action, where we equate social capital with good interactions between, stakeholders and public authorities, interactions based on trust, shared norms, reciprocity and participation. When these characteristics are lacking a differentiated garbage collection project will probably fail. The social capital of both the family and the neighbourhood help to transform an initially difficult and unlikely action into an everyday habit which, as time goes by,

becomes easier and easier to do. Our witnesses are well aware that so long as differentiated garbage collection is successful then there will be a trust relation between the public institutions and citizens. In short, a relationship based on trust in public institutions is crucial even for an apparently simple problem like differentiated garbage collection. Obviously lack of trust in the institutions is not only a question of people's prejudices on institutions, rather it stems from the real perceived shortfalls and deficiencies of the institutions themselves. Furthermore, trust is not encouraged when the ordinary citizens involved who agree to collaborate as a collectivity in order to make a public service function or to improve a public good, feel that they are being cheated of the benefits that their cooperation produces.

Here, the link that exists between the public economy, the surplus and profits that can be privatised and the collective good is crucial. If the APS, the agency which organises garbage collection, makes money as a result of the efforts of citizens then they should pass back some of these benefits to the people, for example by reducing the costs of the service to consumers and/or by improving the service itself. However, differentiated rubbish collection has at times been used to justify imposing higher costs (rates) for this service or to improve the situation of APS shares on the stock market. This one could say that public managers have failed and now risk alienating the social actors involved and discouraging them from doing something that is vital if we are to save our environment.

In Via Pinelli, most of the focus group participants were already separating their refuse even before it became official City policy. They now hope that as separation is official it will become easier because of the new special public bins. Basically people are not satisfied with the service, their willingness to cooperate and to separate refuse is being discouraged by the attitude of the very institutions that should be doing quite the opposite: encouraging, promoting and welcoming such cooperation. Service is equally poor at diverse levels, even though the local tax levied to pay for refuse collection have risen a lot of late, not only for retailers and other businesses but for ordinary householders too. There is also a pressing need for the individual's efforts and commitment to separated refuse collection to be recognised by the authorities. The best thing would be tax cuts or discounts, or, at the very least, some improvement in the quality of the service offered to citizens.

6.2 Consumption of organic products

The question of organic and whole food products is inextricably linked to the question of trust in the market. All the participants in the focus groups were rather sceptical about the quality (and veracity) of the true quality of organic products (be they vegetables or meat), because they did not trust either eco-labels, the certification system or the declarations made about the quality and benefits of the goods themselves. This distrust has long been studied by both economists and sociologists. It would seem that consumers' past disappointments with goods, because of pollution, poisons or other risks, have encouraged many of them to change their purchasing patterns/attitudes to everyday products. After the mad cow scandal almost one million Italian consumers started to buy only organically produced meat or even, in some cases, stopped eating meat altogether. This, obviously, greatly befitted the producers and distributors of organic foods. However,

the momentary panic was not sufficient to convert people to organic products, not only because there are still not enough producers to satisfy potential demand but also because people always develop preferences during their interactions on the market: they look at prices, quality, brand, ecological standards, they have their habits but, in the end, can only buy what their income will allow them to. It is also true that the new organizations which put eco-labels on the market are more vulnerable because of that lack of trust between suppliers and customers that only develops over time. The longer an organization can survive, the more widely it becomes known and trusted among customers (Burt, 1992, p. 215).

At the level of daily life/habit, consumers are probably affected by other mechanisms that have nothing to do with trust in the market and in its ability to react to shifts in consumer preferences, but rather can be correlated with the social networks the consumers themselves are caught up in. As Ronald Burt observes, consumers must have information on the goods, sellers, buyers and prices available when they are selecting the best exchange. This is the point at which network mechanisms enter the analysis. The structure of previous relations among people and organizations in a market can affect, or replace, information. Replacement happens when market information is so ambiguous that people use network structures as the best available information. It is precisely what happens when people approach a new market, such as the organic products market, where there is a marked lack of information. Such assumptions underlie the network contagion[2], where contagion ensures the transmission of beliefs and practices more readily between certain people (Burt, 2000). In this case, people with insufficient information about new organic products prefer to trust in the old beliefs transmitted and confirmed by social contagion and imitation within the social network.

Consumption of organic products is not only limited by the generalised distrust of their quality, there are other reasons too. To sum up, focus group members consume very few organic products for three main reasons:

- they do not trust the declarations of quality made regarding such products given that pollution is so widespread;
- such products are far too expensive for them to use every day;
- the distribution network of organic foods is poorly organised and there is little readily available information about them.

6.3 Means of transport and shopping

The policy of creating large shopping centres is highly developed in Padova, to the point where, nationally, Padova is one the cities with the highest concentration of big shopping centres. One direct consequence of these large centres is an increase in traffic and, consequently, in pollution. The proliferation of such centres is creating a new type of consumer, who probably has a lot of free time, with a new hobby: when the weekend arrives, he or she takes the car and takes a trip round all the big shopping centres in the area. This represents a real change in the way of life and, also, increases traffic and pollution. This type of consumer either does not realise or ignores the fact that, among other things, lower prices are cancelled out the cost of travelling and petrol. The other more serious consequence that local shops are being forced to close for lack of customers. This is obviously causing

huge problems for the elderly, or for those without cars or other means of transport to get to and from the big shopping centres.

Our witnesses do their shopping in a different way from that described above. Indeed they confirm the results obtained from a general survey carried out in Padova. Families tend to take their car and do a big bulk shopping in a supermarket once a week, buying the basics which they then top up on a daily basis in the food shops in their local area. In neighbourhoods where there are small shops, consumers often enjoy going there, because they build up a trust relationship with traders as regards the products they buy. Some still prefer to do their shopping in the old city centre where there is a far wider choice and often better quality than elsewhere and where shopping becomes an enjoyable and social task.

Thus, most people use the car once a week to do the shopping for basic goods (detergents, coffee, pasta etc.) in large supermarkets/discounts because it is cheaper, while they seem to prefer buying foodstuffs in the small local shops, None of the participants seemed to be particularly enthusiastic about the large shopping centres which they tend to see as being places where there are so many special offers that shoppers just get confused and end up spending more than they would have done shopping elsewhere because they fall into the trap of buying things that are useless, superfluous, to their real requirements.

7 Conclusions

The main results of this study concern the fact that social actors have a complex perception of the quality of life. This derives from three social dimensions which, manifested in an unpredictable, yet typical, way in each local situation, greatly influence the lives of individuals.

- The first dimension is that of the physical urban environment which surrounds the local community and is part of the larger ecological system within which society reproduces itself day after day. It is concerned with the physical objects that populate the social space of social subjects. The quality and the functionality of these physical objects and, more broadly, of the constructed environment that surrounds them will, naturally, influence the quality of life of people in a local area. The nearness of shops and primary services, the efficiency and adequacy of means of transport, schools and hospitals, the quality of the environment - for example, the air we breathe, the food we eat - are all crucial indicators when defining a person's quality of life. The nature and the extension of the environmental risks that surround us and which we must face every day also affect the quality of the environment in which we live.
- A second, fundamental dimension is related to the broader system of social relations the actors are involved in. A large part of people's daily activities depend on the institutional system, activities that are taken for granted because they are guaranteed and regulated by what is often an impersonal set of decisions and actions supported and promoted by institutional actors. This dimension includes economic organisations, the system of laws and norms, the cultural context and public and state administrations. Here, the focus is on the "external" cultural, political and economic influences that affect nature, structure and dynamics of social ties within a network.

- A third dimension that emerged from this research is the structure of the existing relationships, especially local, within which individuals are embedded. At this level, we have considered the presence and the structure of a specific local network, the patterns of ties between the *egos* in that network, and the ways that resources flow through the network as a consequence of its unique, specific structure. In this perspective we have considered the individual *ego's* ability and potential to mobilize resources through the network in order to achieve certain goals, to obtain some help, to shape his/her own lifestyle and consumption patterns. Here, our focus has been on whether the perception of the quality of life perception did or did not depend on the nature of the social network in which the *ego* is embedded.

Trust is the fundamental resource that influences each individual's level of satisfaction in relation to these three dimensions. This study has shown that trust between subjects and institutional trust are crucial for the actors involved, both as regards their perception of the quality of their lives (including the physical objects that are part of that quality) and in relation to the decisions that they will take as regards consumption, or as regards to how to act in order to improve or protect both the natural and the urban environment. This study has shown that there are diverse levels of trust within these two types of trust.

The first type of trust studied was internal type trust which is based on reciprocity and the presence of others. This type of trust is well established in the two neighbourhoods where this research was carried out. Even though there had been episodes when the implicit rules of social exchange were not entirely respected, in general, there is well established interpersonal trust where reciprocity is the rule. In Via Pinelli, the existing tensions could be blamed on the different cultures and social origins of the inhabitants but this does not mean that the rules of reciprocity are not respected at the level of everyday exchanges.

When considering institutional trust the question becomes more complicated. The very nature of modern institutions is closely linked to the trust in mechanisms of abstract systems. A lack of systemic trust weakens those elements of our daily lives that we "take for granted", creating confusion and anomie. Our witnesses said that they had little very trust in either the political and institutional system or in the representatives of the system. This is important for our study. All our interviewees were well aware both of the power institutions have in regulating social transactions and of the fact that institutions are also responsible for the strategies for developing urban sustainability.

Lack of systemic trust directly influences the consumption and action models of actors. The results of our study have shown that trust in institutions is indispensable if some attitudes are to exist. For example, the householders' act of separating rubbish depends directly on the level of trust they have both in the organisation that manages separate rubbish collections. Whether or not to consume organic eco-labelled products also depends on trust in the institutions of the market. When there is little trust in the ability to regulate and control the market, consumers find little reason to embark upon new consumption patterns. In this case the inertia that comes from habit and, also, social imitation prevails. Institutions also play a decisive role

in the provision of the means of transport required by individuals in order to do their shopping. Whether or not small shops will survive as well as reducing the impact of large shopping centres, depends directly on local administrations' political choices. On the other hand, the intermediary networks of actors do have some impact on consumption models. Separate rubbish collection for recycling also depends on the moral pressure that the members of the network in which actors are embedded are able to exert, Indeed, the fact of buying organic eco-labelled products also depends on the social "contagion" exercised by the individual's network of reference, if these networks tend, for some reason or another, towards encouraging sustainable consumption then they are able to "contaminate" members in a radical, convincing way.

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Chapter 8 Linking Sustainable Consumption to Everyday Life

A social-ecological approach to consumption research

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1 Introduction

The way people consume is shaped by attitudes, routines and the organisation of everyday life. Thus, strategies to sustainable consumption must start from a consumer perspective and have to take different everyday life practices and situations into account. In recent years, the Institute for social-ecological Research (ISOE) in Frankfurt/Main has developed a social-ecological approach to sustainable consumption, linking social-ecological life style analysis to the study of everyday behaviour and environmental impact assessment. Within this framework, different fields of consumption (nutrition, mobility, tourism) have been investigated. In some surveys the environmental impact has been calculated. Identifying behavioural patterns, motivational backgrounds and environmental impacts of different social groups, these studies bear large potential to promote sustainable consumption behaviour as well as the design of innovative products and services.

In our contribution, we will first introduce the conceptual and methodological framework of the social-ecological research approach to sustainable consumption (chapter 2). We will then demonstrate the approach more deeply, drawing on the example of nutrition styles (chapter 3). The last chapter sums up some conclusions resulting from these insights by bringing in a differentiated understanding of consumers.

2 A social-ecological approach to sustainable consumption

2.1 The organisation of everyday life

Since UN Conference on Ecology and Development in Rio de Janeiro 1992 there has been a widely range of research and policy efforts to promote

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sustainable consumption patterns. Somehow, these efforts do not seem to reach consumers or affect them enough to lead to fundamental changes in consumer behaviour.

Against this background more research is needed to understand consumption behaviour with regard to sustainable consumption patterns. Having this in mind the social-ecological approach to sustainable consumption focuses on the role of orientations and motivational backgrounds for consumption behaviour. Within these approaches it stresses the logic of everyday life organisation in a multidimensional meaning.

The way people eat or move is a result of both individual and collective habits that can be described as social practices. Everyday life action is rather governed by habits and routines than by deliberate and rational choice. Routines are characterised by a low degree of reflexivity. At the same time, they allow for immediate action and quick and easy decision-making.

On the other hand, everyday life embraces a broad variety of activities, such as cooking, shopping, caring work etc. In everyday life, these activities do not happen in isolation. They have to be connected to form a coherent whole. Different and sometimes conflicting demands of work life, household organisation, family management and the own needs are to be balanced, taking the own preferences as well as the wishes of other family or household members into account. Thus, everyday life turns out to be a complex of practices that hast to be actively constructed, maintained and modified (Voss, 1995). Organisation of everyday life is a complex task requesting planning, organisational skills and time.

Finally, it has to be acknowledged that the organisation of everyday life is still shaped pre-dominantly by a gendered division of labour.

2.2 Life Style Research and Sustainable Consumption [1]

Approaches that stress “subjective factors” and motivational backgrounds are developed in sociology and market research. They became prominent part of sociology in the eighties. Due to the societal change that took place in Western European countries, the erosion of traditional institutions, individualisation and differentiation of society implied that traditional sociological categories like professional position or education were not sufficient to analyse new social differences. The segmentation of society in different life styles, as suggested by the newly emerging life style research, represented a means to take these developments into account. On the one hand, life style concepts emphasize the importance of socio-cultural criteria and attitudes for the classification of social segments (cf. Schultz and Weller, 1997). By sub-dividing societies not only vertically (i.e. in upper, middle and lower classes), but also horizontally, according to socio-cultural criteria, a picture of different milieus in the social sphere is created, each of the milieus can be distinguished by its own life style. Elements of life styles characterise the self-identity of a group, but they also distinguish the group vis-à-vis other groups (cf. Götz, 2001). Thus, life style research is able to map the pluralization of societies. But on the other hand, life style concepts represented an explanation why societies were not bound to disintegrate by the growing tendency of individualization. Life styles can be understood as a mode of social integration that gives individuals the opportunity to be

socially integrated while living in disparate and particularised surroundings (cf. Götz, 2001).

The most important impulses for the development of the life style concept in sociology came from Pierre Bourdieu (Bourdieu, 1979). He was the first to present a multi-dimensional model of social space, with demographic variables (income, professional position, education, number of children etc.) in the vertical dimension, and preferences and tastes (on media, art, literature, products, leisure, politics etc.) on the horizontal dimension. He, however, still called attention to the importance of the vertical dimensions for the development of differences in taste and he did not name concrete groups or life styles. Today, sociological life style concepts are considered to be an extension and fulfillment of social structure analysis (Müller, 1992:369).

Although market research does not focus on the analysis of society, the development of life style concepts in market research was motivated by similar reasons as in sociology: Due to societal change, demographic variables and other classical segmentation variables had become less useful for predicting and explaining consumer behaviour. Moreover, in order to improve advertisement and marketing, there was an increasing need to know the consumer better.

With regard to sustainable consumption life styles seem to be commonly understood as a multi-dimensional concept in which the subjective dimension, such as values, orientations, attitudes etc. play a decisive role for actual behaviour. Therefore, in life style concepts behaviour is not described by social position (upper, middle and lower class behaviour), nor is it conceived as the behaviour of a homo oeconomicus; rather behaviour is understood as guided by motivation (Stieß and Götz, 2001).

However, it is the multi-dimensionality of the life style concept that makes it promising for formulating a sustainable consumption policy. A group-specific analysis is useful if social segments are identified in such a way that group-specific information campaigns or product marketing can be developed. This is only possible by drawing a holistic picture of the respective target group.

In Germany, the advantages of life style approaches for the sustainability discourse have been widely recognised. By analysing different life styles within their different dimensions, innovative approaches to different target groups can become visible, single groups can be understood in their specific rationality and potentials for changing behaviour can be identified and activated (Stieß and Götz, 2001).

Moreover, with life style based typologies it is possible to operationalize those influential factors that are generally considered ‘incalculable’: attitudes, orientations, emotions and motivational backgrounds. The influence of these soft factors can even be measured in terms of actual behaviour. Since these so-called ‘soft factors’ have proven to be, in fact, the truly ‘hard factors’ when it comes to changing behaviour, typologies of different target groups contain valuable knowledge as a basis for changing consumption patterns.

2.3 The social-ecological life style approach

General objectives of life style research in sociology and market research have been to describe societal change and to promote selling of products and services. This focus, however, appears hardly suitable for research into sustainable consumption. Conventional life style approaches fail crucial environmental and social aspects of consumption patterns, because they neglect the complex entanglement of consumption practices in everyday life and do not account for environmental impacts.

To adapt the life style concept to research into sustainable consumption patterns, the Institute for Social-Ecological Research (ISOE) has developed a social-ecological approach to life styles. This approach analyses the three dimensions and their relationships:

1. Social background of households (social situation and household context)
2. Orientations
    - related to life styles: general values, orientations with regard to work, leisure, consumption, the environment, health etc.
    - related to specific fields of consumption: attitudes, emotions, preferences, dislikes etc.
3. Indicators of actual consumption behaviour as practised daily.

The social-ecological typology evolves from group-specific patterns of orientations, behaviour and social situation and can be used as a target group model. According to the specific research interest or the field of need in question, we call this typology consumption, mobility, leisure or nutrition styles etc. The identified life styles can be analysed with regard to the three dimensions and can be used as target groups for the development of socially differentiated information, marketing and consumer advice offers (cf. Empacher et al. 2002).

This model implies some important advantages for the use in the field of sustainability. First, it takes into account the household context and thereby acknowledges the embeddedness of individuals in a concrete social context, a family or household. Conventional life style research sees individuals as embedded only in a life style group and abstracts from the immediate social surroundings of the individual. But these surroundings can have considerable influence on individual decisions, because compromises and bargaining among the different household members are implied, meaning that a change of behaviour towards a more sustainable behaviour pattern also depends on other household members.

Secondly, an important advantage of this approach is the inclusion of the behavioural dimension. This allows for the testing of hypotheses concerning the extent to which orientation and motivational factors influence actual behaviour (1). Moreover, it enables a consideration of the material dimension of consumption and thus allows this approach to link up with natural scientific studies of metabolic processes (2). Therefore, it is possible to analyse environmental impacts of different life styles and estimate reduction potentials within life styles. Finally, strategies can be targeted more effectively if environmental impacts of consumption habits and the amount of equipment of goods of the different target groups are known.

3 Social-ecological consumption research

In recent years, the Institute for social-ecological Research (ISOE) in Frankfurt/Main has developed a social-ecological approach to sustainable consumption, linking social-ecological life style analysis to the study of everyday behaviour and environmental impact assessment. Within this framework, several studies were carried out, focussing on sustainable consumption patterns from the perspective of everyday life.

Seminal work was undertaken in a study on behalf of the German Federal Environmental Agency (UBA), entitled 'Household Exploration of the Conditions, Opportunities and Limitations Pertaining to Sustainable Consumption Behaviour'. The study was based on a qualitative empirical survey of one hundred German households. The households were carefully pre-selected from a demographic, geographical and life style-related standpoint to establish typical consumption styles within German households. Life style and orientations of respondents were ascertained using open interviews. In addition, a standardised questionnaire was used to record selected indicators related both to the equippement with consumer goods and to consumer behaviour in key areas of household consumption (nutrition, clothing, mobility etc.) (Empacher and Götz, 2004).

Other research focused on in-depth examination of consumption practices in different fields of consumption, such as nutrition, mobility or tourism (Götz et al., 2002, Schubert, 2004). Among these investigations, the typology of nutrition styles will be presented in the following section.

3.1 Nutrition in Everyday Life

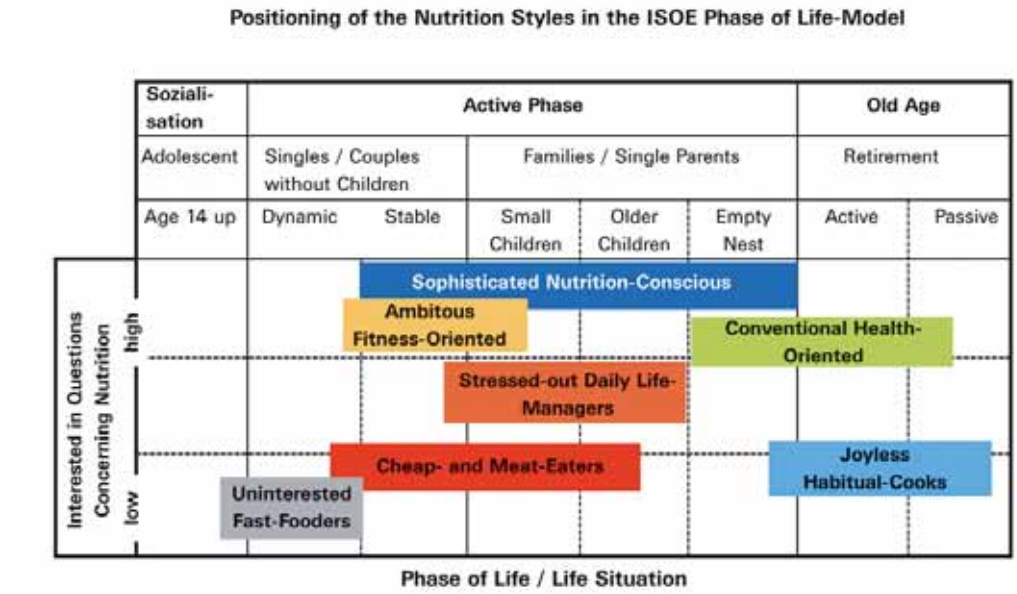
In the context of a joint research project »Food Change: Strategies for Social-Ecological Transformations in the Field Environment-Food-Health« the social-ecological lifestyle approach has been applied to the field of nutrition [2]. The main objective of the research project was to foster a more healthy and sustainable way of nutrition.

Within this research project, the Institute for Social-Ecological Research examined the way nutrition is embedded in consumer's everyday life. The established typology of nutrition styles gives advice for the development of strategies towards a food change from a consumer perspective. The typology links the study of consumer's motivations to the investigation of nutrition related behaviour and an environmental impact assessment by the analysis of material flows.

The nutrition style approach studies the interplay between food-related orientations and the way people manage their diet in everyday life. Based on this approach, an empirical survey with a dual-level, qualitative and quantitative methodology was carried out. The quantitative survey investigated the attitudes of a representative group of 2.039 adults towards nutrition and health as well as their behaviour. Furthermore, data on social situation, life context as well as detailed information on their occupation were collected. The attitudes on nutrition and health as well as some of the socio-structural characteristics were clustered and seven distinct nutritional styles were identified.

3.2 A Typology of Nutrition Styles

Based on the empirical survey, a typology of nutrition styles has been developed. The results illustrate the diversity of current nutrition styles in Germany: ranging from uninterested fast-fooders to highly health-oriented nutrition styles. Thus, they provide a better understanding of cognitive, motivational and structural barriers that prevent a more sustainable diet in the context of everyday life. Moreover the typology helps to identify



potentials and starting points that could support a »food change«.

Figure 1 gives a synopsis of the seven nutrition styles. The nutrition styles are arranged according to life situation (horizontal axis) and interest in issues related to food and nutrition (vertical axis). The different nutrition styles are sketched in the following sections.

Figure 1: Nutrition styles and life situation

3.2.1 Uninterested Fast-Fooder

The »Uninterested Fast-Fooders« are indifferent to nutrition- and health-related issues. Regular eating habits as well as cooking are not part of their daily routine. The Uninterested Fast-Fooders like to eat out, especially in their leisure time in the company of their peer-group. This nutrition style is wide spread among younger singles and couples; men are over represented.

3.2.2 Cheap- and Meat-Eaters

For the »Cheap- and Meat-Eaters« food has to be inexpensive and its preparation simple and not time consuming. Convenience products are therefore highly appreciated. Meat is considered an ideal meal, as its preparation offers a wide range of easy and creative ways. The Cheap- and Meat-Eaters break with rigid nutrition routines and shared meals have lost their importance. This nutrition style can be found primarily among young and middle aged singles, couples and families.

3.2.3 Joyless Habitual-Cooks

The »Joyless Habitual-Cooks« have very little awareness of nutrition issues. Deeply rooted nutrition routines structure their day and provide guide lines. Eating has the character of a duty, it is rarely connected with enjoyment and pleasure. This nutrition style is mostly found among retired singles and couples.

3.2.4 Ambitious Fitness-Oriented

The »Ambitious Fitness-Oriented« prefer high-quality food and follow a very disciplined diet, in order to increase their achievement potential and physical fitness. They balance job-related and private demands with a healthy diet. Therefore, high value and »healthy« products like organic food, but also functional food, play an important role. This nutrition style can primarily be found among couples and families in their child rearing phase, frequently among freelancers and self-employed and among households where both partners work.

3.2.5 Stressed-out Daily Life-Managers

The »Stressed-out Daily Life-Managers« have a strong interest in questions of nutrition, especially in order to provide a balanced diet to their children. The double burden of career and family and the lack of support through other family members make it difficult to realize this demand: getting groceries and preparing them becomes a tedious task. This nutrition style is widely spread among women in the child-rearing phase.

3.2.6 Sophisticated Nutrition-Conscious

The »Sophisticated Nutrition-Conscious« have a strong interest in nutrition issues and show great sensibility for the integral meaning of nutrition in connection with health. They pay great attention to quality, freshness, and the origin of the products. Organic food is considered a benefit to body and soul, synthetic additives are strictly rejected. This nutrition style is neither bound to a specific phase of life nor to a specific age.

3.2.7 Conventional Health-Oriented

The »Conventional Health-Oriented« highly value good food and have a strong interest in nutrition. Cooking, shopping and eating in a communicative atmosphere are highly appreciated. They prefer regional and seasonal products. Their desire to enjoy food collides with the wish to battle weight and health problems. This nutrition style is found among households in their after family phase.

3.2.8 Conclusions

The typology of nutrition styles demonstrates that the way nutrition is organized in the context of everyday life varies broadly. At the same time, it makes clear that nutrition related behaviour is shaped to a large extent by attitudes and orientations towards food and nutrition. Moreover the typology shows that nutrition styles are not distributed equally among the population. Most of them, like the »Uninterested Fast Fooder« or the »Conventional

Health-Oriented« have a distinct correlation to specific life phases or life situations (cf. Figure 1).

3.3 Environmental impact of nutrition styles

Assessment of environmental impacts usually is calculated on the basis of highly aggregated data. Measurements refer either to the level the entire population of a country or region or to the inhabitants of smaller territorial unit, e.g. a city. Environmental impacts of individual behaviour can only be calculated on a per capita basis. This approach, however, does not allow for distinguishing the environmental impacts of different social groups.

In order to obtain a more realistic picture, the analysis of nutrition styles was linked to environmental indicators, using the GEMIS methodology. GEMIS is a life-cycle analysis program and database for energy, material, and transport systems which been developed by the German Öko-Institut. In GEMIS, environmental impacts are accounted in terms of CO2 and SO2 equivalents.

Drawing on the GEMIS methodology, the Öko-Institut calculated the environmental impacts related to the production, processing, distribution, transport, storage and preparation of food (Wiegmann et al., 2005). Linking life cycle assessment to key indicators taken from the empirical survey, like the composition of meals (esp. meat, organic, chilled food), the way of their preparation, the place of eating (at home or out of home) etc., the environmental impacts of the different nutrition styles can be calculated, as it is shown in Figure 2.

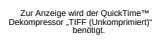


Figure 2: Nutrition Styles and environmental impact (Eberle et al., 2006: 81)

The results show that the nutrition styles vary with respect to their environmental impacts. In particular, the place of consumption as well as the frequency of meat consumption account for differing environmental impacts.

4 Overall conclusion

The social-ecological approach to sustainable consumption provides a fruitful and multidimensional framework for the study of sustainable consumption, linking consumption and environmental research. On an analytical level, the approach offers a better understanding of the complex interplay between motivational backgrounds, consumption patterns and their embeddedness in the routines and demands of everyday life. Moreover, it allows for a more appropriate assessment of the environmental impacts of consumption behaviour.

At the same time, the approach provides valuable insights for strategies to change consumption patterns in a more sustainable way. It has the potential to identify barriers and obstacles that prevent a shift to more sustainable consumption patterns, but also points to promising starting points from which a shift to more sustainable consumption patterns may depart. The focus on consumers' orientations and attitudes as well as on the needs and demands of everyday life provides a knowledge base for the design of socially differentiated information services and consumer advices as well as the development of sustainable products and services that meet consumer wishes and needs and "fit" into everyday life.

Thus, the social-ecological approach to sustainable consumption helps overcoming the shortcomings of merely production related approaches. It allows in particular for a shift in sustainable consumption research towards a consumer perspective bearing a large potential to inform consumer information and communication, product design, innovation strategies as well as sustainability policies.

Endnotes

[1] The section on life style research draws on the contribution of Empacher and Götz 2004.

[2] The research project »Food Change: Strategies for Social-Ecological Transformations in the Field Environment-Food-Health« was carried out by a consortium of several institutions: Oeko-Institute e.V. - Institute for Applied Ecology (ÖI) (coordinator), the Institute for Social-Ecological Research (ISOE), the Institute for Ecological Economy Research (IÖW), the KATALYSE-Institute for Applied Environmental Research and the Austrian Institute for Applied Ecology (ÖÖI). The project was funded by the German Federal Ministry of Education and Research (BMBF) within the Social-Ecological Research-Programme.

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Chapter 9 Consuming technologies – developing routines

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Abstract

Routines in daily life are crucial for understanding the environmental costs of household energy and water consumption. Routines emerge, develop and change in close relation with different kinds of everyday life technologies and in the consumption phases of buying, reshaping and using these technologies. The article focuses on conceptual and theoretical differences within four consumption areas each of which highlights different relations between consumer and technology. 1) Comfort, which relates to the house and how the owners reshape and redesign it. 2) Hygiene, which is strongly influenced by cultural norms. 3) Cooking, which is closely related to organisation of family life. 4) Communication and entertainment, which is strongly technology driven. The article includes a literature review of studies on these areas as well as theory development on how routines emerge, develop and change in modern everyday life.

1 Introduction

Routines are an important aspect of energy and water consumption in households. Therefore we have also had numerous campaigns over the years with the purpose of getting people to switch off the light when leaving a room, keeping a lower indoor temperature and turn off the running water while brushing our teeth. However, it is also commonly agreed that it is difficult to get people to change their routines. Nevertheless the idea presented in this chapter is that history shows that we change our routines all the time. However, this is not a result of concern for the environment or the result of campaigns to save energy; it is rather due to changes in the social organisation of everyday life combined with the introduction of new technologies.

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In this chapter I will first introduce shortly to social theories of consumption and how the question of routines is treated here. Next I will take a historical approach to how technologies in the last century entered households, and in what ways this has influenced the routines of everyday life. The main part of the paper discusses consumption and routines in contemporary everyday life. First with a focus on the planning and buying phases, where we see that different types of appliances are bought in very different ways. Secondly, focus is on how routines develop and change during the use and reinterpretation of the different types of appliances. The chapter concludes with a discussion of to what extent routines are influenced by norms and ethics learned in our childhood, by conscious reflections of economic or ecologic reasoning, by the design of new technologies or by changes in the social relations.

2 Consumption theory and routines

During the 1990s there was a growing body of research on consumptions from different social sciences (for introductions see Miller, 1995; Corrigan, 1997). Not that consumption was a new thing, but the importance that it was assigned changed, from being primarily viewed as an appendage of production to be seen as an important societal factor in itself (Featherstone, 1991). It is interesting to note that as a parallel, but independent process, consumption also became a main issue in the environmental debate, a debate that had previously focused on the production process (Haunstrup Christensen et all, 2005). The new focus in consumption theories was on the communicative and cultural aspects of consumption and one of the main discussions was to what extent consumption should be interpreted in light of modern or late-modern understandings of identity formation (Gronow and Warde, 2001). Work from Bourdieu has been used to interpret consumption in a class-based perspective, where norms and values are learned and internalised in childhood and unconsciously reproduced in adulthood, for instance in our consumption practises (Bourdieu, 1984). Late-modern theories from Giddens and others however question the strength of the class-based structures in recent society and emphasise the individual ability and need to reflect and construct ones own identity (Giddens, 1990). Most of these consumption theories have in common that they focus strongly on the communicative aspects of conspicuous consumption, and a recent body of research has opposed this, stating that a major part of our consumption is mundane, ordinary and based on routine (Gronow and Warde, 2001; Shove, 2003). The work in this chapter follows this line, focusing on how routines in everyday consumption emerge, develop and change, and focusing on the role that routines have in establishing a secure and liveable everyday life, where we are not forced to the overwhelming task of reflecting on everything we have to do every day (Ilmonen, 2001). The theoretical inspiration for this is however not very distant from discussions of the more conspicuous consumption, as both Giddens and Bourdieu are some of the main input to an understanding of the role and function of routines (Warde, 2005; Reckwitz, 2002). The common element in theories from Bourdieu and Giddens are their attempts to exceed the structure-actor dualism, though Giddens obviously has a stronger focus on the actor whereas Bourdieu are more structure-oriented. The most interesting elements in recent practice theory on routines are how to combine body, mind, things, knowledge, discourse and structure in the understanding of routines and Reckwitz

proposes to see agents as carriers of routines rather than as individuals with each their own routines (Reckwitz, 2002).

3 Historic development, household technology and everyday life

Routines have changed dramatically in the last century with the introduction of new technologies in all aspects of everyday life. In the following I will describe the headlines of this historic development focussing on when and how the technologies entered (Danish) homes, and how households reacted to this.

Already in 1878 Edison proclaimed his invention of the ***electric light*** system and his ambition that it should be available for everybody. Less than 20 years later the first households in Copenhagen also had electric light installed in their home. This was however only for the very few. The price for 1 kWh was 1 DKK, which was more than double the ordinary hourly wage, and remarkably close to today's price of 1.5 DKK. So besides the advantages of clean and safe light (compared with the dangers of open fire) it was not until after World War I that electric light became more common in Danish homes than gas light. The price however was not the only obstacle; also the competition with the gas distributors was part of an explanation (Danske Elværkers Forening, 1991). In the first decades of the history of electric light, people thus primarily met it (and got used to it) in public places and in the production, where it was effective in allowing production to continue after dark (Garnert, 1993).

Electricity for lighting could only become common in Danish households with a synchronous infrastructure development of grids and power stations, and soon the new established electricity companies were interested in expanding the market for electricity by introducing ***household appliances***. Vacuum cleaners, refrigerators and irons were available in stores in 1920s but not in common use, so the companies launched campaigns to promote the new technologies. Display rooms, renting possibilities and demonstrations of electric household appliances in local housewife organisations became common and popular; however the iron was the only real sales success until World War II. Scepticism from the housewives on the advantages of the new technologies, together with the price, were obstacles. In this period also new authorities were established to promote and help the households to use the new household appliances. For instance Statens Husholdsningsråd (Danish household authorities) was established with the purpose of promoting nutrition, hygiene, economy and the technical aspect of housework (Olesen and Thorndahl, 2004). The first decades after World War II were a period for collective solutions in household appliances. Freezing houses, where households had individual rooms in a common freezer, became widespread in Denmark and in the 1950s 70 % of the households in the countryside had accesses to a common freezer, and also common laundries with semi-automatic washing machines were quite normal (Olesen and Thorndahl, 2004). In these ways the housewives slowly became convinced that for instance meat from a freezer was not unhealthy and that a washing machine was able to clean the clothes in a hygienic way and they became convinced of the conveniences of the appliances. This prepared the way for the last phase of the arrival of appliances in the homes. In the 1960s and 1970s, following the economic growth and the women's

entry on the labour market, refrigerators, freezers and washing machines became widespread and normal in Danish households, and in the last 20 years also tumble dryers, dishwashers and microwave ovens have been seen by many families as necessary to survive in a stressful everyday life. The appliances undoubtedly lightened the burden of household work; however it also made it possible to increase the norms for instance for how often to launder and for specialised dishes for individual family members, as feminist researchers have shown (Cockburn and Ormrod, 1993; Cowan, 1983)

The latest development in energy consumption in households is seen within ***information and communication technology (ICT).*** The radio was established in Denmark in the 1920s and already before World War II about 80 % of Danish households had a radio. Television followed with official opening in 1951 and ten years later a majority of Danish households had television (www.dr.dk). In the 1980s the first personal computers were on the market and ten years later they started to become normal in Danish households. Thus it seems like the ICTs arrival in Danish homes went much smoother than that of the household appliances, the reason being either that they arrived later in the history when people were more ready for new technology in both an economic and a cultural sense, or that the services they offered were new and interesting and not just more convenient. Like the household appliances, also the ICTs arrival in the homes were both strongly marketed and supported by the authorities. We see this with the computers, which were pushed forward by tax incentives for companies who gave their employees home computers, and with politics of digitalising the communication between authorities and citizens. Even more than with the other technologies the ICTs have brought social and cultural changes with them. It not only made communication easier, it also fundamentally changed it (Silverstone and Hirch, 1992).

All of the technologies in our homes have gone through phases when they were new and fascinating and when they could be used to show status and wealth. All of the mentioned technologies are however now in a phase when they have become normal and necessary, and something which is difficult to choose not to have. The history shows that commercial interest from production and infrastructure companies has played an important role in the introduction of the technologies, but it also shows that the authorities promoted the development. In some cases the households resisted the new technologies and were not convinced of their advantages, in other cases they were much more interested.

The positive general story of new technologies entering the homes is about how daily life is freed from the ties of our natural surroundings and about increased convenience and comfort. The electric light freed people from the ties of the circadian rhythm; the refrigerator from the rhythm of the seasons, and the new ICTs have overcome limitations of time and space. Furthermore heating and lighting systems and many of the appliances made life more easy, convenient and comfortable. At the same time as these technologies eased and extended everyday life, however, they also changed the norms of it. Thus standards of hygiene, proper food and communication have changed dramatically in each generation during the last century, and any idea that we carry our routines with us from childhood thus has to be abandoned, though some of the norms that influence new routines might be established in childhood.

Before going into the discussion of how routines in contemporary everyday life are established, however, we shall have a look at how different technologies, including the house itself, are purchased.

4 Making a home and buying appliances

The most important, in an emotional and economic sense, durable we consume is our home and this holds true even if it is a rented or an owner-occupied residence or if it is an apartment or a detached house. However the acquisition of a home is in many ways not a buying process in line with buying other consumer goods. To mention just a few things which make it special, the houses are seldom new and together with the home you also get neighbours and a neighbourhood, the house has a location which you cannot change. However the acquisition of a home may still be analysed within theories of consumption. For instance it can be shown how social class in the understanding of Bourdieu is very appropriate in understanding who lives where and in what type of house (Gram-Hanssen & Bech-Danielsen, 2004). Here it is also shown how the house is something to work on, change, decorate and furnish and that this process is an important aspect of transforming the house into a home. In this process of putting your own stamp on the residence, sometimes the house may be fundamentally rebuilt, at other times just slightly changed. In both cases it may influence energy consumption. Furthermore it is also relevant to mention that choosing a residence normally also means that a specific type of heating system follows this residence, depending on whether it is a district heated area or there i.e. is natural gas infrastructure. In this way people in Denmark seldom really decide which type of heating they want, it just follows from their choice of residence and district.

An analysis of how house owners use energy labels and the mandatory advice they get when purchasing their house show that people do not renovate their home to make it more energy efficient, but if they want to change their house for other reasons than energy, they may include energy consideration in that work (Gram-Hanssen et all, 2005). Very often the first thing to do when buying a house in Denmark is to rebuild kitchen and bathroom and this process typically also include purchasing of new white goods. In this way buying refrigerator, dish washer and cooker are part of a consumption process where status and identity in different ways influence the rebuilding of the kitchen. In other cases buying an appliance is primarily driven by an immediate need, for instance if the washing machine breaks down, the family often feels an urgent need to replace it before the laundry overflows the basket. In both cases most consumers reflect on energy consumption by using the mandatory energy labels, but in the case of urgent need the price may be considered more important (Gram-Hanssen et all, 2005). However it seams that for Danish consumers buying white goods always include some kind of reflection on energy efficiency due to massive campaigns in favour of A-labels over the last decade.

Also choice of type and amount of light is normally a part of the redesigning of the house and thus fashion, style and aesthetic are most important for what to buy. For most people the question of energy consumption is not a part of this process, and only later on they may realise that they have chosen solutions that are not appropriate for using energy saving bulbs, which means that the question of using energy bulbs was never really considered in spite of massive campaigns also on this subject.

Buying information and communication technology however is not closely associated with the question of furnishing and designing the home. Thus buying ICTs may – more than buying other appliances – be like what is normally understood as the process of buying things. Research on this subject describes how questions of newness, fun and status are important for the frontrunners whereas the motivation of others for buying may be more a question of not falling behind development (Røpke, 2001; Gram-Hanssen, 2005b). Living without a computer and internet in Denmark is about to become both difficult and unusual. Another interesting driving force especially related to ICTs relates to the individualisation processes. In the historic background we saw how many of the appliances first were introduced on the market in a common solution: Freezing houses and common laundries. For ICTs we also had internet cafés and in the beginning they also might substitute the private computers, though soon we saw that it was normal to have computers in the home, and later to have individual computers for all the members of the family as well as individual televisions.

One of the reasons for the growing amount of appliances in the homes also has to do with the question of removal of the old things. When buying a new refrigerator or freezer quite often the old one isn't thrown out but placed in a secondary room, in the basement for instance. Even more we see this tendency with the ICTs. When the family buys a new television for the living room, because they want a bigger or fancier one, often the old television is placed in another room of the house, instead of being removed. Thus it in not unusual to find households with more televisions than household members, and the amount of appliances is thus not just a question of individualisation, but also a result of it being easier to get appliances into the home than to get them out.

5 Using technologies – developing routines

In the previous sections we have looked at the historical background for the use of technology in our homes and we have looked at how and why appliances in contemporary everyday life normally enter the homes. In this section I will elaborate on how people use their different types of technology and how they develop routines while doing this. My input for this is 40-50 qualitative interviews with people concerning their energy consumption and everyday life. These interviews were conducted in 4-5 different research projects over the last 6 years and published in different ways though none of them with a specific focus on routines (Gram-Hanssen, 2004, 2005a, 2005b; Gram-Hanssen, Petersen and Kofod, 2004; Gram-Hanssen et all, 2005). The main question to answer in the following is to what extent routines are influenced by the social structures of society, by technology itself or by individual reflection, which may develop into questions like:

- Do norms from childhood unconsciously influence the use of new technologies?
- Do other people influence it?
- To what extent and in which situations do people reflect on their routines, and is this reflection based on input from campaigns and public policy, from economic reasoning or other things?
- To what extent do the technology and the infrastructure determine the routines in the daily use?
- What are the dilemmas and paradoxes realised concerning everyday life routines of energy consumption?

5.1 Comfort - heating and lighting the home

In a study of 1000 identical houses with very different energy consumption it was found that one of the main explanations for the difference in heating consumption is related to the indoor temperature (Gram-Hanssen, 2003). Thus a relevant question is why some people maintain a much higher temperature than others.

From the interviews we learned that people associate high, respectively low, temperatures with very different things. Some people, liking low indoor temperature, for instance explained that they think it is much healthier to keep temperatures low and they associate it with their active outdoor life; when you come back from a long walk you don't need a high temperature in the room, it only makes you feel lazy. On the other hand some, who liked high temperatures, explained that it is much nicer and cosier with higher temperature, and they talk about some of their acquaintance who is not very good at relaxing and enjoying life: 'If he would just turn on the heat it would be much nicer'. Interpretations of these and other families show that the difference primarily relates to wider norms of what a good life is, and it is not a very reflective approach they have to the temperature in their home, it is only in the interview situation that they start reflecting. Furthermore it is obvious that the technology in this case does not influence their temperature level, as they live in the same type of house with the same heating system. However, in a historic perspective it is important that the technology influenced the level of comfort temperature. The question whether campaigns to keep low indoor temperatures have influenced the temperature level can be answered with that those who prefer to have a lower temperature also use energy consumption as an argument, and quite a lot refer to experiences back in the energy crisis in the early 1970s. However those liking a higher temperature may feel in the interview situation that they have to defend that they go against the recommendations, though in their everyday life it does not seem to influence their behaviour.

Another aspect of energy consumption from heating relates to the routines of how to regulate the valve of the radiator. Here technology plays a more important role, as the logic of district heating and thermostat valves prompt the households to a specific routine which is to leave the valves in the same position all the time only closing them when airing. In some families they tell that they do this because the caretaker tells them to do it, in other families it is the husband who is in charge of this and decides to do it this way. Other families, however, do not understand the logic of the technology or do not think it works well, so they often turn up or down and sometimes man and wife do not agree so one turns up and the other down. The thermostat valve is an example of how automatic technologies, that were supposed to replace the daily routines, can work for some people and not for others.

Lighting might be one of the cases where routines from childhood influence the routines of adulthood. Three generations ago electricity was very expensive and one had to be careful in turning off the light when not necessary. In most of the interviews I have made on energy consumption, people reflect very much about if they are good or bad at turning of the light, and they think that this is an important explanation of the size of their electricity consumption, in spite of the fact that lighting accounts for less than 15 % of the total electricity consumption in Danish households (Gram-Hanssen, Petersen and Kofod, 2004). A reason might be that lighting is the

most visible part of the electricity consumption together with the fact that it is a routine carried over from childhood. When using new types of lighting technology, these routines however become more ambivalent: Is it always a good idea to turn off a low energy bulb, and how to turn off halogen lamps, so that the transformer is also turned off? Old routines on new technology are sometimes not a good idea.

5.2 Hygiene - clothes washing and drying

Clothes washing is still primarily a female domain, not necessarily so that women do all the laundry but in the sense that their norms often rule the standards of how to launder (Rambøll, 2005). The women may be influenced by norms inherited from their mothers on the importance of cleanliness, but the routines of laundering will often have changed, because of new technologies in washing machines, in washing powder and in types of fabric (Shove, 2003). However the washing machine might also be reinterpreted and used for other purposes than cleaning dirty clothes. A mother of three teenagers explain how she washes three to four full loads every day, the reason being that it is the easiest way to handle clothes of her children and husband who all do a lot of sport and every day carry home sports bags of wet towels and track suits used only once and not really dirty. However she finds it easier to put everything into the washing machine and the dryer afterwards than finding a place in the bathroom to dry the towels and remembering which belongs to whom. She even explained that they have thought of buying one more washing machine to increase the washing capacity. Also other families explained that once clothes are out of the wardrobe the only way back is through the washing machine, regardless of whether it is dirty or not. These are examples of how new routines emerge while reinterpreting technologies. As this frequent washing actually requires quite a lot of work, it is interesting that very few of the mothers question the amount and necessity of the washing, and contrary to what might be expected it is actually the mothers who themselves promote this level of washing. Also it is noteworthy that very few consider the environmental cost of the washing, even if the family in other domains reflects on their environmental performance. If the family relates washing and the environment, they do it in line with the public campaigns which have focused on 'filling the machine' and 'keep a lower' temperature. Other studies show that people might think that they follow the advice though studies of their actual everyday life show that they often do not (Rambøll, 2005). However no public campaigns has ever focused on questioning how often clothes need to be washed.

Having a washing machine or not is seldom really a question. However, the tumble dryer is a much more debatable technology which some think is indispensable and others find unnecessary. Some has one and use it for all their clothes others explain that they only use it for beddings and towels because it softens them, and dries the rest on a line; others again do not use it for their nice clothes because it spoils them, but use it for the rest because they find it easier. Those without a tumbled dryer state that they don't find it a problem not to have one, and some of them find that it is a waste of energy. Also some explained that clothes dried outside in the open air smell much better. As we can hear the tumble dryer can be interpreted and used in many different ways, and the main explanation of how to interpret it seems to relate to norms of consumption and norms of what is easy and what is

necessary. In this case the norms may be reflective, come from childhood or more likely a mixture of both.

5.3 Cooking - storing food and preparing meals

On one hand cooking is ruled by norms from childhood concerning what and how to eat, including the norms of a 'proper' hot meal in the evening. On the other hand the supply of new exotic food and of so called convenience food together with changed everyday lives, following women's entry on the labour market, have entailed big changes in the food culture (Warde, 1997). This also means that only some of the norms and not the routines of contemporary everyday life come from the childhood of today's adult.

As an example of different routines related to food, the use of microwave ovens and freezers may be illustrative. Historically the freezer has been seen in rather different ways. First as a utility of preserving home produce, then as a link in the industry of the frozen food market, and lastly as a tool in the convenient food market (Shove and Southerton, 2000). In line with this we can in contemporary use of the freezer find rather different explanations of how it is used. An old couple told how they primarily use it to extend the season when they can use fruit from their garden. A couple, who has taken early retirement and have a very poor economy, told how they use the freezer to hunt for the cheapest offers. A young career woman alone with a small child explains that the freezer allows her to shop only once a week, and still get proper food. Families with older children told how their freezer was primarily used for ice-cream and pizzas, which the children can heat when they come home from school. Finally one family told how they just got rid of their old big freezer and now only had quite a small one. They told how they used to buy half a pig. At the time it was 'in' to do that in their circle, but nowadays, they explained, nobody does that anymore, as all now prefer fresh food. It seems that very different things like living circumstances including economy and time pressure, stages in life circle and peer group opinions affect how to use a freezer.

Feminist studies of the microwave oven have shown how it allowed the mother to prepare individual dishes for different family members (Cockburn and Ormrod, 1993), and other studies have shown how the freezer and the microwave oven together constitute the home technology link of convenient food (Warde, 1999; Shove and Southerton, 2000). My interviews can add to this that people may buy the microwave oven with one purpose, but having it in the house the routines develop differently. A woman told how her husband wanted the microwave oven as a popcorn machine, which she thought was rather useless, but after he bought it, she started to use it for heating leftovers if she was home at lunchtime and sometimes also for defrosting food, which she however had bad conscience about doing as she was rather concerned about the environment.

5.4 ICT - Communication and entertainment

Routines with regard to computers are certainly not something people carry with them from their childhood. Adults have often learned it at their job, and bring it to their everyday life, whereas children normally have learned it through playing with it. Studies among teenagers show that there are greater variations in the ways, and the amount, that teenagers use their

ICT, than there is in their other possessions. Thus being a 'normal' teenager in Denmark implies having a mobile phone, television, hi-fi, and often also a personal computer. Though interviews show that there is great variation in the use of these ICT, from having everything on almost all the time to not really finding it interesting (Gram-Hanssen, 2005). In the same study families explained how they use and place their computers. Some have an office-like place for one or two computers where those using the computers can be separated from other activities in the house. Other families have computers in the living room or in the kitchen because they want the use of computers to be an integrated part of family life whether it is used for entertainment or for information seeking. Furthermore some have personal computers, some have only one or two to be shared by the family, but there are also families where they have as many computers as family members but do not have them or place them as personal computers, one reason being that the computers have different ages, and consequently different capacities, the logic being that the best computer should not be reserved for one person but for the activities that require the most capacity.

Studying ICTs we see that routines change very fast. Families tell that for instance videos and consols (Playstation etc.) were used often when they were new and interesting some years ago, but now the interest and fashion has faded, and often the sets just stand and are used very seldom, if at all. Thus many of the ICTs consume more than 90 % of their energy consumption while in standby mode and only a minor share of their electricity consumption derive from actual use (Gram-Hanssen and Gudbjerg, forthcomming). A study of how families react to information on standby consumption, and to technical devices that automatically close of standby, show that for some families and for some types of standby consumption it is very easy for people to change their daily routines on how to turn appliances on and off. This is typically the case if reflections on the new information merge with previous norms of consuming and saving, and if the technological design of the appliances makes it easy to do.

Even though many of the ICTs are new, the use of them might be regulated partly on norms relating to the parents' childhood. The ways to discuss and regulate children's use of computers may resemble discussions on the use of televisions in their parents' childhood, and also the regulation of children's use of mobile phones may resemble earlier use of the traditional telephone. And this holds true even though studies show how the mobile phone has been reinterpreted by the users and today has to be viewed as something very different from the ordinary telephone (Røpke, 2001; Mäenpää, 2001).

6 Conclusion

Routines are important in the understanding of environmental consequences resulting from consumption in households, and in this chapter I have shown that these routines develop in close relation to everyday life in the residence and to technology and infrastructure. However there are different trends within each field of consumption in the household.

It has been shown that norms from childhood concerning cleanliness, saving or consumption attitudes, the right indoor temperature, cooking and eating and the use of telephones and televisions may influence today's behaviour. These norms are part of an explanation of how today's routines are constructed, though it is important to emphasize that it is not the routines

themselves that are carried over from childhood as there has been pronounced technological and social changes which also have had a vast impact on today's routines.

An independent question in this chapter was to what extent conscious reflections play a role in the construction of routines and to what extent the routines thus can be influenced by campaigns. The conclusion is here that campaigns to some extent can influence routines, though the campaigns are normally focusing on very specific and minor aspects of the consumption. Furthermore people sometimes think that they are following the advice of the campaigns though closer studies show that they are not. Especially if the technological design and broader cultural norms draw in the same direction as the purpose of the campaigns there is a better chance for the reflections to work.

Technologies are often the cause of the change of the routines. Not as a technological determinism, as development of technology in it self is a social construction, but for most of the consumptions field as the direct reason that the inertia of the routines is overcome. New technologies always demand a change of the routines, as routines are the daily practical handling of the material things that surround us, and if the material things change the routines also have to change. Therefore it is also obvious to think of the users routines already in the design of the technologies. However we also see that the users often rethink and reshape the technologies in ways that was not predicted by the designers.

The social relations in which the routines develop also have significance for the development of the routines. In example vi see that it primarily is the norms of women concerning cleanliness and food which are important for that part of the routines, whereas it is more often the norms of men or caretakers that have influence on the routines of regulating the heat. Finally the whole organisation of the everyday life is most important in the construction of the routines as the routines exactly are the smallest parts of the social organisation of everyday life.

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Chapter 10 Wavering between radical and realistic sustainable consumption policies – in search for the best feasible trajectories.

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1 Introduction

Sustainable development is to a large extent about the management of change of production and consumption. Given the challenges resulting from climate change mitigation and adaptation radical changes are indeed called for. Yet, the spatial and temporal extent of these radical changes is not a priori clear, nor necessarily equally sweeping for everybody anywhere anytime.

In this article radical change is seen as a long term process in which steady progress in the right direction is regarded as more essential that quick success. 1 will argue that pressing for swift radical changes bears a serious risk of becoming counter productive, because:

- pressing for rapid change is often wasteful and may prevent the best possible ways of exploitation of innovations, the consequent economic setbacks may eventually result in a slower pace of sustainable development than a slower but steadier change strategy;
- rapid change over a wide front of applications and sectors is usually impossible, consequently rushing for piecemeal successes may later on turn out to inhibit more structural progress over a wider front;
- pressing for rapid changes usually encounters strong opposition from various interest groups, thereby risking either to get bogged

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> down in acceptability discourses, tactics and compromises or to compromise democratic principles of public decision making by placing perceived environmental emergencies above the opinions of the electorate.

The typical concern about the choice for a non-radical strategy is that the world ends up with business as usual (e.g. the recent Climate Target 2050 initiative of Finnish environmental NGOs, Ilmastotavoite 2050). In other words there is a distrust that a strategy of systematic steady changes can be kept up over a longer time frame. However, if that's a valid concern why not worry that more radical changes are followed by at least equally radical ones in the opposite or at least quite different direction. For example, when considering the energy policy mixes in various EU members states, one can observe that economic efficiency (of the sector or system), security of supply, environmental issues and the fiscal balance of the public sector have been alternating in terms of priority position. As a consequence energy saving efforts, for example, have been varying greatly over time (ODYSSEE; Boonekamp 2005). Even though each of these changes were – at least to some extent – understandable under the circumstances of their time, it seems that in retrospect more steady pathways would have been possible.

On the other hand traffic safety is an example of steady improvement thanks to steadily building up policies. Even though in the aftermath of major accidents public opinion may temporarily press for swift and radical changes, the history of traffic safety improvement is typically built from

sequence of smaller steps guided by long(er) term (but non- binding) targets. Social learning appears to be an important process in this respect (Himanen et al 2006).

In this paper 1 will try to argue that determined policies aiming for consistent steady change are preferable over those stressing radical changes, even though in the end steady change over a wider range of sectors and behavioural realms still implies radical change after all. This seemingly less thrilling viewpoint is nevertheless quite demanding with respect to design and implementation of sustainable consumption policies. There are three challenges:

1. First there is the, so far, dominant policy design philosophy, which is still largely based on a technical-economic assessment. Would it help, if the assessment base would be fundamentally widened, i.e. accounting for the social dimension on an equal footing?
2. Second, even if the assessment base would be widened, it matters what attributes are considered. Would it help, if utility would get more attributes than material wealth, e.g. by adding 'quality of life' or happiness-indicators?
3. As a third issue, the governance of sustainable consumption policies deserves attention. Up to now policy design tends to hinge on the initiative of (central) public authorities, even if the policy preparation has been otherwise of a participatory nature. In the current globalised complex market economy, this approach may as such be problematic. Would it be possible to start up processes and structures that are capable of generating the right signals and measures, without repeated recourse to top-down approval or start-up?

These challenges to policy design, assessment and implementation will be discussed in section 2. Section 3 will present some examples from studies and policy experiments in which the notions of section 2 are tested. Section 4 will provide a concluding reflection on how the promotion of sustainable consumption could proceed.

2 Policy design and its appraisal

2.1 Widening the economic scope

In most OECD countries sustainabi1ity po1icy portfolios are increasingly dominated by economic policy instruments. Since broadly spoken neo-classical views prevail regarding the socio-economic management of countries, the alternatives for intervention are reduced, whereas intervention is anyhow seen as a sometimes unavoidable second best solution[18]. Yet, even within the so-to-say 'neo-classical world' there are still significant differences in viewpoints, not the least with respect to market imperfections (Perrels 2005a). The more a country's prevailing economic views acknowledge the existence of substantial market imperfections, the more room will there be for instruments designed for so-called second best situations. As such this will already allow more space for explicit sustainable consumption policies.

One of the key problems in economic appraisal is the way consumer utility is defined in mainstream economic analysis, For short run and/or smaller changes the usual representation of utility suffices in many cases, but for larger changes and or long term changes risks of misinterpretation increase (Perrels 2005a). Furthermore, even when alternative approaches are used there is often an exogenously imposed change in the trade-offs between consumption attributes (e.g. more public and less private consumption). In that sense both neo-classical and ecological economic evaluations tend to be of a purely technical-economic nature. Shove and Wilhite (1999) have been pointing at this bias as an important source for continued misguidance or at least disappointments.

2.2 Extending utility beyond material wealth

2.2.1 An economic approach

The inclusion of the social dimension in policy appraisal on an equal footing is not easy. It means that somehow people's assessment of the change in their social well being or 'quality of life' has to be appraised. For more specific matters and not too long time scales more detailed measures of well being and its various attributes can be used. However, if it comes to more comprehensive policies it will become very hard to obtain reliable assessments of representative agents. Furthermore, apart from the measurement problems, there are fairly strong indications that people's happiness is more steered by subjective well being (i.e. an individual's position compared to those of peers) than by objective well being (i.e. an

[18] . The term 'second best' refers here to a conditional (local) optimum, instead of the first best optimum (optimum optimorum) which is not attainable due to market imperfections.

individual's current position compared to the one in a previous period) (Diwan 2000; Kahneman 2003; Kaun 2005). This is rather problematic in the case of sustainable consumption, since the motivation starts from the inter-temporal improvement (or prevention of deterioration) of a broadly defined quality of life, even though sustainability entails also cross-sectional distribution effects. Behavioural economics has however also demonstrated that the commonly applied operationalisation of the utility concept in mainstream (neo-classical) economics, which is based on material wealth only, increasingly risks to misrepresent well being when GDP per capita continues to grow beyond some level of comfort Diener et al (2002).

On the basis of the above considerations we may conclude that the core indicator (utility) in social-economic assessments merits a revision in order to enable the inclusion of more attributes. Unfortunately there are only interesting proposals, but — as yet — no satisfactory solutions for such a revision. For example, Hofstetter and Madjar (2003) review various so called happiness and quality-of-life indicators. They suggest a more comprehensive approach to assess sustainable consumption and identify the principal elements, but admit that in particular the links with happiness are as yet not operationalised. They do stress that next to monetary and physical measures of inputs and outputs (material wealth) time use is an indispensable element when assessing well being. This has been shown earlier by e.g. Becker (1965) and Winston (1982) by applying micro-economic theory to hitherto non-explored areas.

2.2.2 A sociological approach

The relevance of the inclusion of time in welfare assessments can also be illustrated by means of the 'Hirsch hypothesis' about social limits to growth (Hirsch 1976). The hypothesis is a mixture of economic and sociological notions. A first social limit has to do with the fact that the appropriation of goods contributes both to direct needs (food, clothing, entertainment) *and* to derived or generic needs, in particular *status*. The problem is that various commodities' income elasticities of demand and supply respectively not necessarily have similar values and not necessarily develop in the same way over time. The more the attributes of a good depend on features that cannot be manipulated or manufactured, the less affluence will help to make it more accessible to larger groups of consumers. For example, TV-sets can be reproduced in large quantities and at the same time new features can be added, thereby allowing simultaneously that the number of owners increases while others can distinguish themselves by buying the latest model with all possible gadgets. On the other hand there are only limited possibilities to increase for example the number of summerhouses in beautiful landscapes. Increase beyond a certain a level would destroy the very feature that makes the good so desirable. Consequently, the prices of such goods continue to rise faster than the average price index and – depending on the circumstances – possibly at an ever increasing pace. Hence such goods are only attainable for those that manage to raise their real wage rates much faster than the average rises in purchasing power and/or those that – at least temporarily – are prepared to swap free time for extra labour time. In fact a similar line of reasoning about this social limit can also he found back in the theory on social distinction of Bourdieu (1977).

Another social limit identified by Hirsch has to do with his hypothesis that increasing affluence leads to increasing selfishness. He postulated that affluence implies ever larger time claims for consumption. Increasing real purchasing power implies more purchases, whereas there is often also an expanding choice – at least seemingly – to ponder about. Furthermore, the larger wealth requires also time to be actually enjoyed. As a consequence there is less time for socialising and hence in the end consumers would not experience being better off than before. Hirsch also referred to advertising practices that – allegedly – increasingly encouraged consumers to prioritise individual self-interest[19].

The pitfall for the Hirsch hypothesis and also for the scheme of Hofstetter and Majdar (op.cit.) may be residing in technical change, probably in conjunction with cultural changes. Ritzer (2001) points at the increasing significance of the *means of consumption*[20] for the achievement of commercial success. The efficiency of consumption or rather the capability of raising the throughput of consumption transaction per unit of time is a key challenge due to the rising affluence to which Hirsch was also referring. Yet, just as with the misjudgement of classical economists regarding the capabilities to raise factor productivity and thereby escape from the 19e century industrialisation miseries, the critics of the currently prevailing unsustainable consumption patterns may have too limited a grasp of the possible interplay between technical development and cultural innovations, e.g. with respect to 'virtual reality'

2.3 How to integrate policies and practices in daily life?

Even though there is an initiating role for public authorities, sustainable consumption is typically an issue which should be embedded in the day-today decision making of consumers and producers. The policy aim should be a transition towards sustainable consumption, which becomes ever more an integral part of social-economic dynamics, thanks to the fact that sustainable consumption offers the best growth in value added for both producers and consumers. This would mean that a public strategy for the advancement of sustainable consumption should become redundant over time.

The integration of sustainable consumption principles into day-to-day decision making of producers and consumers requires a firm belief of the involved actors in these principles and their beneficial effects. In turn such a belief can only become established if the actors have reasons to believe that the public authorities are really committed and that the policy will continue without radical changes.

[19] . 2 I mention it for reasons of completeness, but do not regard this as the most convincing part of the hypothesis on social limits to growth.

[20] . The parallel with the 'means of production' is obvious. In fact it is about the production-consumption interface, which can be distinguished from the means of production proper.

3 Some examples of change and their manageability

3.1 Mobility and urban sprawl

It is well known that urban sprawl and car dependency are mutually reinforcing phenomena, which have significant negative impacts on the eco-efficiency of societies. It appears nevertheless difficult to curb the trends. An important reason for this is that at the level of individual decision making the anticipated benefits of living in a detached house in a suburb are insufficiently corrected for the aggregate impact of many similar decisions on the attainable utility of potentially moving households. The continuation of the suburbanisation will cause more congestion and a worse urban air quality than anticipated by the individual families. Furthermore, even if the family would try to ponder about this effect, it may just as well arrive at the conclusion that a more central location would not help (apart from the likely trade-off between living space and proximity) if most other potential movers would stick to their original decision.

As was pointed out in section 2.3 steadiness in policy strategies can breed confidence. So, in this case one could assume that a consistent urban development policy focusing on optimising proximity, e.g. by exploiting multi-functionality in spatial design in conjunction with a quest for higher densities, could contain the trends of suburbanisation and motorisation. However van Wee et al (2002) indicate that there are limits to the guidance that spatial lay-out can provide to household's mobility behaviour. The point is namely that residential areas of a particular design (i.e. discouraging car use and promoting non-motorised modes) tend to attract households that have commensurate mobility preferences. The self-selectivity causes the car-oriented households to drop out. In turn planners may wish to resort to very strict regulations on residential choice, but with such a policy the entire urban area may face a decline in the population and economic activity.

Another snag is that urbanisation seems to correlate positively with the intensity of consumption (or consumerism). In several countries independent studies point in the same direction, e.g. Perrels (2005b) for Finland and Holden and Norland (2006) for Norway. This connects well to the theory of Ritzer (2001) about the means of consumption (see also section 2.2.). Apparently cities in its entirety seem to facilitate consumption in comparison to non-urban locations. The impact on consumption belongs to a larger class of effects which imply that in many respects urban citizens are more exposed to interaction with economic and cultural forces both within and beyond the city perimeter. As a consequence urban dwellers are not travelling less than others, even though they can enjoy more proximity of services (Perrels 2005b). A larger modal share of public transport and non-motorised modes helps to reduce the transport emission per capita of urban citizens, but this is offset by more intercity and long distance (air) travel (figure 1 and table 1).

When both business and international travel are excluded the eco-efficiency of the urban citizen with respect to passenger transport seems on the whole to be worse than the sub/semi-urban citizen and often also the countryside resident. Inclusion of all forms of business travel tilts the picture in favour of cities. However, if the indicators were to include also international ferry and airline travel the environmental performance distinguished by place of residence would converge. Residents of (larger) cities report more international ferry and airline trips, probably both for push

and pull reasons. That means both the easy accessibility and the inclination of urban residents cause this larger amount of trips. Furthermore, especially larger cities count more business activities with international relations, causing their employees to engage in more international travel, whereas these employees live either in the same city or in adjacent urban fringe.

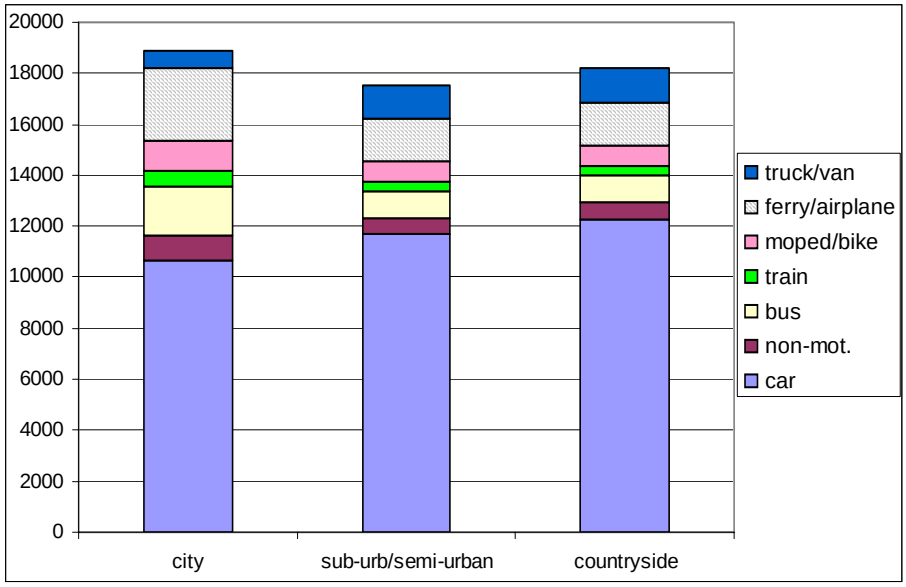

Figure 1: Transport performance in person kilometres per year by area type and mode

Table 1: Emissions per traveller by place of residence (origin) excluding/including business trips (trips by ferry and aeroplane not included)

	City (=100)	Sub/semi urban	Countryside
CO_2 emissions/car traveller	100	95/102	96/103
NO_x emissions/traveller	100	85/92	92/99
N_2O emissions/traveller	100	98/106	103/111
Particles emissions/traveller	100	94/101	100/108
NO_x emissions/pkm	100	87/92	90/96
N_2O emissions/pkm	100	99/107	100/108
Particles emissions/pkm	100	95/102	98/104

In addition to interaction effects between urban lifestyles and augmented mobility patterns, cities can also be considered in terms of their spatial-economic functioning. The larger a city is, the larger will be the surrounding area with which it interacts. This results in a tendency that a larger share of the employees in larger cities is engaged in activities that involve more long distance travelling. In other words the observed differences in people's travel performance are to some extent also the product of the spatial-economic organisation of a country . Finland shows a tendency of continued reduction of the countryside population and a steady increase of the population of a small number of cities (or city regions), whereas other areas with medium densities and stand-alone medium-sized towns have by and large stable populations. The question arises to what extent centralisation is beneficial for the national economy and for sustainability and what is the leeway

regarding these objectives when trying to manipulate the balance between the Helsinki metropolitan area and the other (principal) centres.

Apparently, in terms of eco-efficiency of travelling, city life in practice does not result in an evidently better environmental performance, even though the potential for higher eco-efficiency may be technically present (thanks to public transport and proximity of services). Nevertheless, given an existing sizeable urban structure sprawl, represented in the analysis in Perrels (2005b) by urban fringe residence, has significantly more boosting impact on travel than more inner city residences. So, even though we should be careful with being overly optimistic about the travel reduction potential of cities (as compared to other settlements), urban sprawl obviously makes things still worse. In this respect it would be worthwhile to carry out the kind of studies referred to above in a dynamic setting. In significantly expanding cities such as the Helsinki metropolitan area, it is important to know to what extent people, who move from the central city to a suburb or semi-urban area, are imposing their urban mobility patterns on those new areas or conversely are adapting to less mobile lifestyles. The KulMaKunta study (Perrels et al 2006) provided some interview based information which hints at effects from both sides.

The lessons of these various studies is that pressing for radical changes in the form strongly guiding spatial planning may produce all-in-all rather disappointing results. This is not say that planning wouldn't be needed, but the complexity of the underlying processes calls for caution, proper preparations, some degree of flexibility and commitment to strategic objectives.

3.2 Exploring the pre-conditions for sustainable consumption

In the just completed KulMaKunta study, which explores the potential of eco-efficiency improvement through the facilitation of sustainable consumption (Perrels et al 2006), the *maximally realistic* change from a baseline development from 2000 to 2030 was tested for various scenarios that pursue eco-efficiency improvements.

The study first investigates the baseline developments from the year 2000 up to 2030 with respect to demographics, the dwelling stock, purchasing power, the private car stock, and the emissions resulting from these trends. A basic degree of technological development regarding energy efficiency and specific emissions has been taken into account, but otherwise the scenarios focus on socio-economic and spatial dynamics, and not in particular on technological solutions for emission reductions (even though a higher penetration of heat pumps has been explored in one of the scenarios).

The study recognises that there are four basic forces that determine to a large extent the attainable changes in eco-efficiency. These forces are:

- technological development
- the size and composition of the population
- the spatial organisation of settlements and settlement hierarchies
- economic growth

Technological development on the one hand enables large reductions through cleaner technologies, but it just as well can result in products or

product modifications that entail a substantial increase of energy and material consumption. For example, advancements in screen display technologies enabled reductions in the electricity consumption per screen. However, subsequent attempts to enhance picture quality implied a boost of energy consumption per screen. The flatness and the decreasing production cost allow for quick spreading of displays in hitherto unused places/functions. So, all in all the final result is an overall increase of electricity consumption for this kind of applications.

In the Finnish case technology is the only factor that contributes to an improvement of eco-efficiency both in relation to monetary terms (e.g. emissions per euro production value) and in relation to physical terms (e.g. emission per capita). Economic growth, as it entails a gradual transition from manufacturing to a service based economy, improves the eco-efficiency in monetary terms, but it does not stop the growth of emissions per capita. Obviously more wealth means still also more a larger consumption of energy and materials. The increase of households in Finland, with an overall almost stationary populations, as well as the spatial organisation in Finland contribute to a deterioration of the eco-efficiency, both in monetary and in physical terms. The overall effect is for the period 2000-2030 that the emissions per euro production value decrease, whereas they continue to increase per capita (figures 2 and 3).

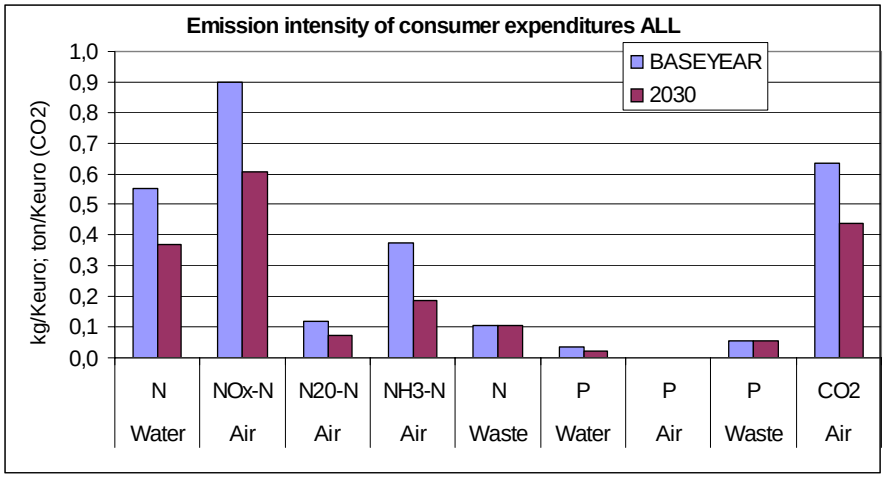

Figure 2: Emission intensity per euro in the baseline scenario in 2005 (base year) and 2030

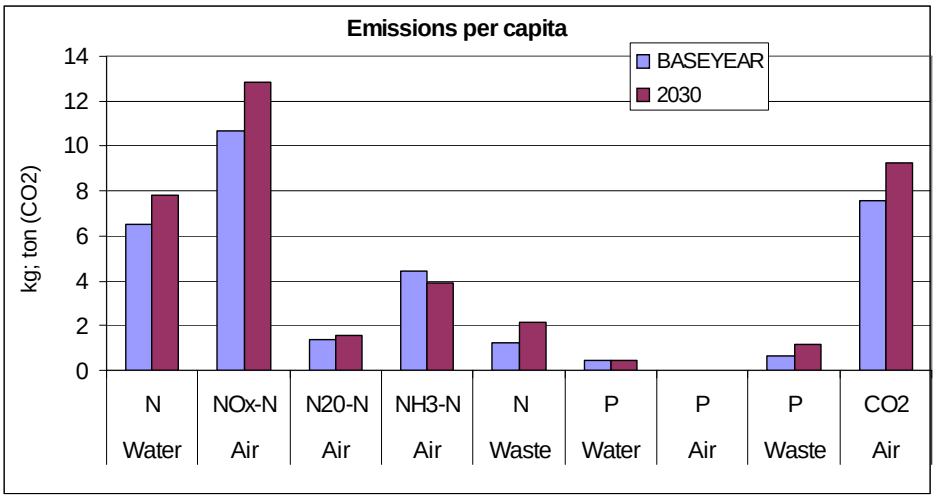

Figure 3: Emission intensity per capita in the baseline scenario in 2005 (base year) and 2030

In the baseline the CO_2-emissions per capita grow by 14%. When the alternative scenarios are combined this is reduced to a growth of 10%. In absolute terms it still means that the CO_2 emissions are almost 2 Megaton less than in the baseline (approx. 4% of the emissions attributable to consumption). The baseline scenario does include the realisation of the currently constructed 5th nuclear power station, but on the other hand assumes that the ACEA objectives will not be achieved as the current trends in average new cars sold in Finland makes the achievement less likely.

In the alternative scenarios is assumed that (in comparison to the baseline):

- new (semi)detached homes are more built in the already built-up areas of suburbs and partly even more in the central cities, this affects the construction of approx. 110.000 homes in the next 25 years; this scenario also assists to prevent a retreat in public transport;
- service oriented senior-homes are built predominantly in regional centres, the senior moving there are often giving up a more spacious home in exchange for good services in or nearby the senior-home and tuned to this age group; it concerns newly built apartments and it partly prevents production of detached homes for other households, as more are now vacated by seniors;
- for those that choose to live outside urban areas tele-work and other (tele)services are promoted, among others by means of fiscal facilities; this results in energy saving for travelling and in due course creates some employment in villages as demand for various kind services is going up.
- the installation of heat pumps is promoted.

The scenario measures are often quite large scale and have not so much scope for even wider application, save the option of extreme exertion. So, eco-efficiency improvements, beyond what seems achievable in this scenario study, need to come from technological changes proper as well as a mix of technological and behavioural innovations. When these would be added probably a reduction in emissions per capita becomes feasible, but one should not expect spectacular reductions. To realise such a technically

induced improvement of eco-efficiency, the real prices of (fossil) energy and raw materials should increase steadily, but preferably not in major shocks as this may only reduce funds for R&D or stall spreading of innovations due to tightening budgets. Instead there should be a widely agreed long term prospect of rising energy and raw material prices.

The results of the KulMaKunta exercises can also be compared with various studies regarding the environmental Kuznets curve (e.g. Rothman, 1998; Unruh et al, 1998) which to date have not produced unequivocal results regarding the actual existence of an environmental Kuznets curve, let alone that the downward sloping part can be reached quickly or accelerated.

4 A way forward?

I have been arguing in favour of radical changes in a long term setting, while trying to prevent swift changes that merely upset economies and social fabrics. So steadiness and long term commitments are much more important than spectacular short term scores in limited areas. The stress should be on the design of long term transition policy environments, thereby facilitating decision making in the medium and short term, as uncertainty is reduced in this way (not removed of course).

Social-economic policy assessments need improvements regarding the use of the key-indicators, i.e. from a traditional utility concept mainly based on material wealth to utility concept that encompasses ‘quality of life’ without getting stuck in the pitfalls of a dominance of subjective well being.

Even though many indicators have already been suggested a robust and widely applicable form has not been found so far. The emergence of satisfactory versions has to be reconciled with utility theory (or rather vice versa the utility theory would need to be revised). Subsequently, widely agreed satisfactory quality of life based utility concepts can be introduced in socio-economic assessment models.

At the same time experimentation could be intensified both with regard to product development and with regard to integrated spatial and energy system planning to seek for maximum attainable realistic transition pathways.

Last but not least policy design itself should try to build directly from the three pillars of sustainability, instead of environment and economy only, while the social pillar is only treated through side conditions with reference to acceptability issues.

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Chapter 11 Towards a concrete sustainable consumption policy: What can we learn from examples?

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We present five examples of sustainable consumption measures or campaigns: organic food, changing washing machine use, renting efficient white-goods, a sustainable lifestyles campaign, and a car-free housing development. The environmental and social impacts of consumption are largely determined through infrastructure, the goods and services available, and habits. Our examples affect habitual use behaviour, the availability of and access to sustainable solutions, or the overall organisation of life. We judge that any of these three targets is important. Sustainable consumption research should focus more on how to shape habits and how to improve the availability and acceptance of sustainable solutions.

1 Introduction

Current patterns of consumption and production are unsustainable in both developed and developing countries. In developed countries, the levels of pollution, especially those causing global change, are far too high and trends go in the wrong direction. In developing countries, there is too much strain on the local resource base, and this strain is increasing due to population growth, increases in wealth and urbanisation.

The need to "chang[e] unsustainable patterns of consumption and production" has been firmly acknowledged by the World Summit for Sustainable Development (WSSD) in Johannesburg. The Johannesburg Plan for Implementation contains a description of a "10-year framework of programmes in support of regional and national initiatives to accelerate the shift towards sustainable consumption and production […]," which world leaders resolve to implement (United Nations General Assembly 2002, §13). While the Johannesburg Plan for Implementation (JPI) calls on all countries

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to take action, with developed countries taking the lead, it does not contain any specific commitments, timetables, or review procedures. The JPI nonetheless presents a general commitment by all nations, especially those who promoted the adoption of this passage, to take specific policy measures to promote sustainable consumption and production.

Policy declarations in support of sustainable consumption are easy, but how does one go about implementing sustainable consumption? What would a regional or national program "to accelerate the shift towards sustainable consumption" look like? There is a fuzziness that surrounds the term "sustainable consumption" in the international policy and scientific meetings that I have attended bearing this very name. Such a fuzziness is absent in debates about, say, renewable energy or clean drinking water, other WSSD commitments. There is no lack of definitions and experts seem to have an idea of the end goal, but there is a paucity of ideas about specific steps to take to get to the goal of sustainable consumption. Sustainable production is better defined, and UNEP already operates "Cleaner production centers" around the world that will continue their activity in this area. The development of a program to promote sustainable consumption and production, however, requires ideas of what actions should be taken on sustainable consumption, by whom and how.

In this paper, I introduce a general sustainable consumption policy framework that requires as one element the development of specific actions, initiatives and policy measures for sustainable consumption. I then review five selected existing initiatives to investigate how these examples can serve as the seeds for a sustainable consumption policy and what general lessons can be drawn from them. The examples are drawn from a set of 34 examples of sustainable consumption that were identified and reviewed for Japan's research program on "lifecycle approaches to sustainable consumption" (Hertwich and Katzmayr 2003).

2 A framework for sustainable consumption policy

The Johannesburg Plan for Implementation specifies a number of elements that a program for sustainable consumption and production should contain. These elements are

- policies promoting sustainable *patterns* of consumption and production, including the polluter pays principle,
- policies to improve products and services while reducing impacts on the environment and health (eco-efficiency),
- awareness raising measures,
- consumer information tools, and
- public procurement.

Even if the JPI uses more words to describe these policies, it is not any more specific. The provisions are, rather, qualifying the applicability of the elements. For example, JPI suggest to "develop and adopt, where appropriate, on a voluntary basis, effective, transparent, verifiable, non-misleading and non-discriminatory consumer information tools." No concrete measures or approaches are mentioned to change consumption patterns, other than the "polluter pays principle", and it questionable that it is

politically feasible to make polluters pay and, if it was, that prices would sufficiently impact consumption patterns.

What is required is that sustainable consumption policy takes a more concrete gestalt. This requires an overall understanding of the type of actions are required to achieve a defined objective and a way to measure and verify the success of these actions. It requires furthermore ideas for specific measures to implement, and a general understanding of sustainable consumption actions that will foster the invention of new measures and initiatives. To develop and evaluate policy measures, we need to be able to relate individual household behaviour to larger systems variables.

I propose that three specific elements should be part of a coherent program on sustainable consumption:

1. An overall strategy. The strategy needs to lay out what the policy objective is and develop a broad-brush vision of how it can be reached. The strategy should be based on a careful empirical and theoretical analysis and should be able to relate consumption to the larger policy framework, which includes sustainable production, energy, employment, and population. The strategy should build on an understanding of how society's activities lead to environmental and social impacts are produced and on scenarios how these impacts might develop given possible developments in the underlying socio-economic and physical processes. Duchin (1996) has laid out a modeling framework on which such analysis should build.
2. Specific measures, actions and initiatives to be taken by different actors participating in the program, including public policy makers at the local, national and multinational levels, consumers, activists and businesses. The present paper aims to stimulate the development of such measures by investigating existing examples, which may be scaled up or otherwise provide stimulus, ideas, and understanding relevant to the development of further actions.
3. The capability to evaluate policy measures and other actions for sustainable consumption in a consistent manner. Such evaluation should be possible on different scales, as measures may vary from local initiatives to larger tax policies. How an evaluation of the environmental aspects consistent across scales is possible is laid out somewhere else (Hertwich 2003). The evaluation of acceptability of policy measures and social issues remain open research questions. This paper only gives some ideas of what is required of such an evaluation system.

In this paper I investigate examples of sustainable consumption that provide ideas for policy measures and demonstrate what these measures might look like and achieve. It should be clear, however, that they could also be examples for consumer action, indications of a business opportunity, or opportunities for NGO activists.

3 Opportunities of Sustainable Consumption

The need to address consumption follows from the global environment & development agenda, which emerged from the Rio Earth Summit. This agenda includes the right to develop for the global poor and aims for a convergence of affluence. The common perception, although hardly ever explicitly articulated, is that this convergence will be at the level of the middle class. What Keyfitz (1998) calls the "middle class package" includes various appliances, communication equipment, and - most clearly visible - a car. Being concerned about the environmental effects of such a policy, Keyfitz reviews four types of measures to reduce environmental impacts:

1. *end-of-pipe measures*, such as catalysts, sewage treatment plants and filters
2. *increases in mechanical efficiency*, such as increased car mileage, increase insulation of houses etc.
3. *raising use efficiency*: multiple-flat houses, public instead of private transportation, car sharing etc
4. *lifestyle change*

Two lines of argument can now be made for the role of sustainable consumption. The first line calls into mind the limited resource availability, the limited capacity of the environment to buffer emissions. Keyfitz (1998, p. 496) takes this line of reasoning. After reviewing the first three types of measure, he arrives at following conclusion: "*But even with these [ecoefficiency and use] changes, a population of 10 billion could not be accommodated in the style of life described as middle class without irreparable damage to the environment. That style would have to be more radically changed than indicated above*." This argument says that our consumption of material goods *has* to be limited for environmental reasons. If we want fairness – implying some degree of global economic equity – the consumption of materials and "environmental absorption capacity" per person is already too high in industrialized countries. Future technological progress is unlikely to do more than compensate for expected growth.

The second line of argument is that a shift in consumption patterns and life styles can bring about a reduction or increase in emissions and other pressures. Consumer behaviour is hence relevant for the future level of environmental and social impacts. It presents an opportunity to reduce pressures and, *inter alia*, a factor relevant for scenarios and predictions of future emissions. It should therefore be considered on bar with technology. Given the increasing number of single households and the increasing proportion of the population in retirement, one could imagine that the behaviour of these population segments becomes more important. Figure 1 displays the energy requirements for different households in the Netherlands. The graph shows a clear increase of energy requirements with household expenditure, but it also indicates that at a given expenditure level the energy consumption can vary significantly. This variation, produced by differences in the consumption patterns of different households, is at a level that is significant relative to, for example, the level of emissions reductions required by the Kyoto protocol.

Figure 1 nicely displays the factors of expenditure level and individual variation that are both part of the picture of sustainable consumption. Some analysts primarily focus on the difference in the composition of the

commodity basket; others point to the need to limit absolute levels of consumption. Increasingly, however, analysts are bypassing the issue of the level of consumption by focusing on the quality of life achieved. Investigating the quality of life achieved in relationship to the impacts of consumption appears to be a reasonable and promising approach (Norris and Segal 2002; Hofstetter and Madjar 2003; Norris 2003).

Figure 1 displays only energy consumption. The investigation of the "environmental impacts" of consumption has started with energy and now been extended to cover CO2 emissions and other fuel-related pollutants. Investigations for other environmental impacts, especially those related to biodiversity and toxic emissions, are limited or non-existent, and investigations of social impacts are limited and qualitative. The environmental and social impacts of consumption are at best known on the aggregate level. A more accurate understanding of how environmental and social impacts are produced in our society is required.

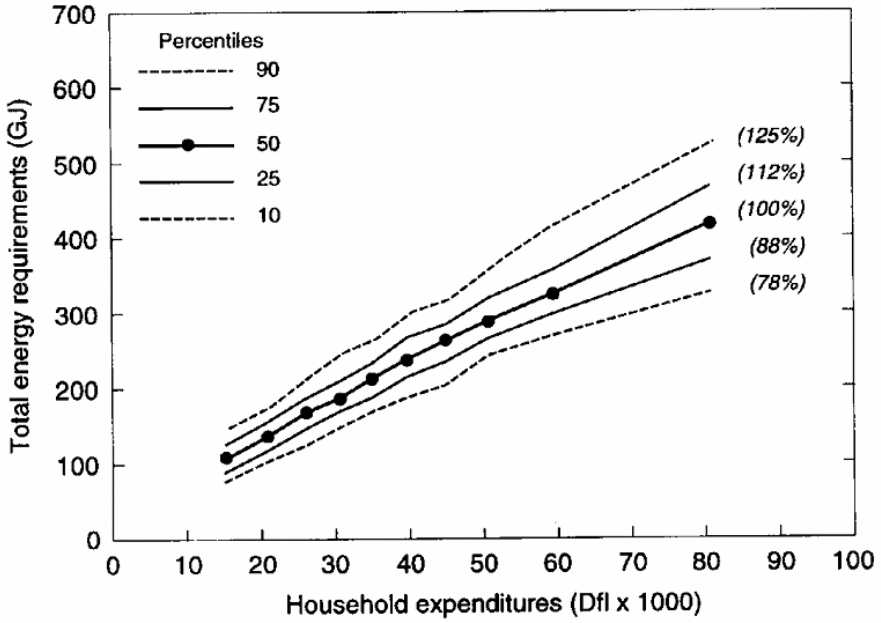

Figure 1: Total energy requirement per household versus household expenditure for the Netherlands. Source: (Vringer and Blok 1995).

The currently available data shows a strong connection between levels of wealth and energy use, but also interesting differences both among nations and among different households within a nation. These differences remain to be explained, but they point at the potential for less impacting consumption patterns at comparable levels of wealth. Other pollutants and impacts may show other patterns. Investigations of the environmental Kuznets curve hypothesis have shown that the relationship between pollution and wealth on the national level, across nations and time, depend on the pollutant investigated (De Bruyn 2000). It remains to be seen whether this dependence on the type of pollutant also exists within countries, i.e. on a disaggregated level, per individual household. Figure 1 indicates, however, that in the Netherlands there is only a weak flattening of energy requirement with expenditure, so that we cannot speak of a Kuznets-type effect.

There is an interesting and relevant pattern of national differences revealed by energy analysis. Investigations show persistent differences in per-capita energy consumption across nations (Figure 2). Grübler (1998) suggests the existence of development trajectories, or path-dependence of development, based on evidence displayed in Figure 2. Transportation research shows that individuals have certain mobility "careers," e.g. that their car usage is strongly shaped by past mobility behaviour. I believe that the path-dependence of environmental impacts is something that can be seen not only on the national level, where it has been documented, but also for regions, towns, settlements and individuals. If such a path-dependency indeed exists, it is very relevant for policy, because it indicates that policies today shape future emissions to long after the policies have been removed again.[21] This mechanism acts through behavioural inertia, through habit formation. In fact, behavioural factors interact with market dynamics, technology development and infrastructure. Infrastructure and behaviour are the prime candidates for explaining the existence of these national development trajectories. Technological learning may also play a role, but technological innovation usually spreads quite efficiently at least across developed nations.

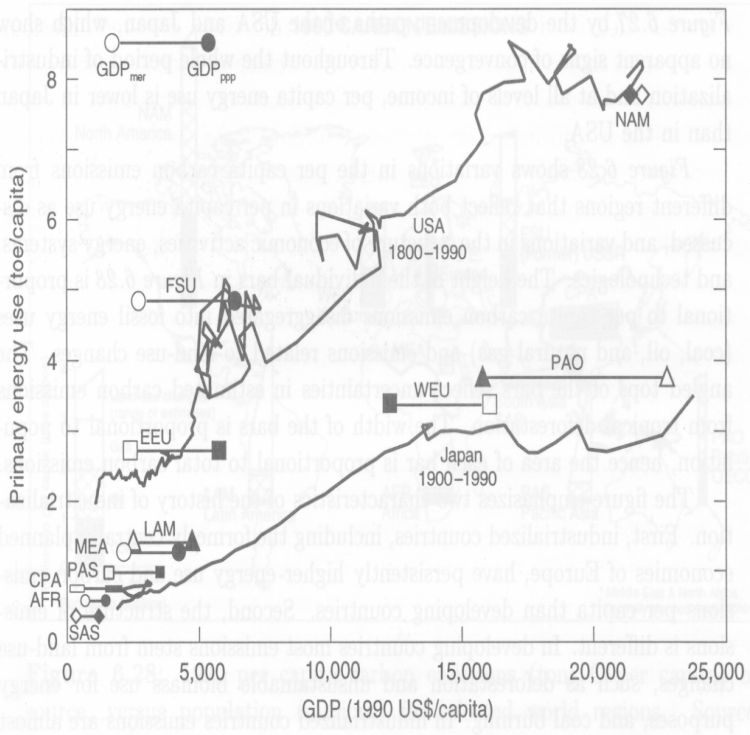

Figure 2: Primary energy use (toe/capita) versus GDP/capita for major world regions (1990 USD at market exchange rates and purchasing power parity) and two historical trajectories for the US and Japan. Source (Grübler 1998)

[21] I would like to thank Anders Biel for pointing out that consumer psychology does indeed provide empirical support for my notion of behavioral inertia and the importance of habit formation (Biel 2003).

4 Addressing Sustainable Consumption

UNEP has recently suggested using the life 'functions' nutrition, mobility, housing, clothing, health and education as a way to organize its work on sustainable consumption and production (UNEP 2002). Functions can be seen as components of lifestyles. Functions are fulfilled by different products and services. This is a useful manner of organizing the analysis of sustainable consumption issues. It is important, however, to also address the entire consumption pattern of a population, the lifestyle. Otherwise sustainable consumption would stop at what Keyfitz calls use efficiency. A total reduction of impacts could not be guaranteed, because the time and income rebound effects could lead to increases in e.category emissions related to other functions. Hertwich and Katzmayr (2003) have used functions to organise the analysis of sustainable consumption measures, but they have also used lifestyle as a separate, overarching (Figure 3). They have described 34 campaigns, policy measures, individual or corporate actions that could be described as examples of sustainable consumption. These were selected from a larger group of examples identified in the electronic appendix of the report. These measures address the functions of mobility (8), housing (6), clothing (8) and nutrition (4), as well as the cross-cutting areas of appliances (4) and lifestyles (4). In this paper, I describe only five examples and discuss their general features.

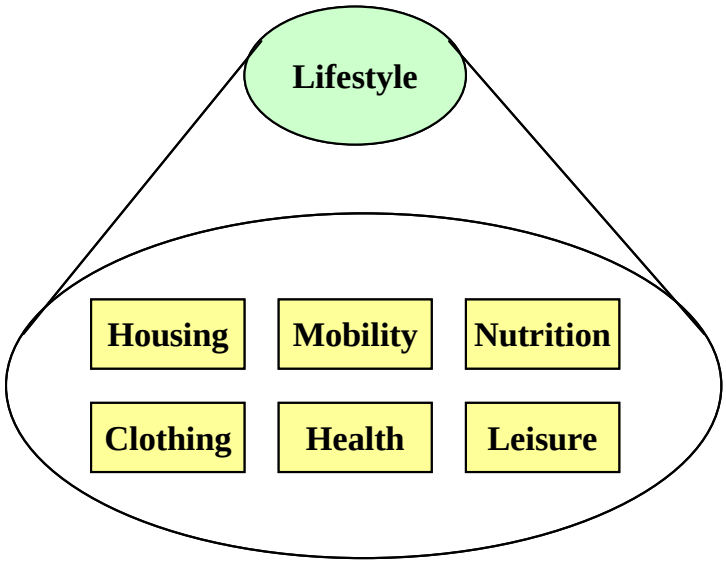

Figure 3: Functions as components of lifestyle.

5 Examples of sustainable consumption

5.1 The "WashRight" campaign

The International Association for Soaps, Detergents and Maintenance Products (AISE) conducts a campaign that attempts, among other things, to reduce the washing temperature (to 30 and 40 ^{o}C) and encourage a fully loaded laundry machine (www.washright.com). The campaign also attempts to reduce the detergent consumption and the packaging material. The campaign uses TV advertisements and leaflets. WashRight is a voluntary industry initiative based on a code of conduct. In some way, it only strengthens an ongoing trend. Average wash temperatures in Europe have dropped from 65 to 48 ^{o}C over the last decade (Uitdenbogerd 2001). This trend has been enabled by better detergents and by easy-care fabrics such as new synthetics. The lower temperature leads to substantial energy savings. For a 1996 reference washing machine, electricity use was 2.32 kWh/cycle for 90 ^{o}C, 1.45 for 60 ^{o}C, 0.76 for 40 ^{o}C and 0.44 for 30^{o}C. A continuation of the trend towards lower temperatures, together with an increase in laundry machine efficiency, can bring a substantial reduction of electricity used for washing.

5.2 FUNSERVE – Functional Service Contracts for White Goods

This project started in 1999 and has the aim to develop and field-test functional service contracts in the EU member states Austria, Germany, Sweden and the UK. This approach offers customers the services directly instead of the products that provide these services. Three electric utilities in Germany and Austria and the appliances manufacturer Electrolux cooperate in leasing highly efficient appliances to the customer. The leasing scheme includes free delivery and installation with instructions on the optimal use, free repairs and a service hotline, and the removal of the appliance after the agreed period. The targets of this project are, among others, to assess the benefits and the costs for the participants and the environment, to evaluate the market potential, and to test consumer acceptance. Consumer surveys have provided promising perspectives. Retailers have also shown an interest in participating. The project participants claim that a 10% market share of the appliances in the EU would reduce the energy consumption by at about 7TWh, which corresponds to a saving of CO2 emissions of at about 3 million tons per year. Moreover, 50 million m^3 water and 26.000 tons of detergents could be saved each year (Dudda et al. 2001). The field test on the Swedish island of Gotland has not been a commercial success, however, because the subscriber density achieved was too low to cover the cost of providing the service.

5.3 Organic food lines of supermarket chains

Organic labels transmit information about the conditions of production to the consumer and thus allow the consumer to make decisions that are in accordance with their values and preferences. Organic products are usually also more expensive. The British supermarket chain Iceland, however, converted its entire frozen vegetable line to organics without raising the

costs. Its initiative, which removed the cost barrier at a stroke, put the rest of Britain's supermarket chains, many of which sell organics at very high mark-ups, on the defensive and under pressure to follow suit. Nonetheless, 6 months later the company abandoned the plan to sell only organic "own-brand" frozen products, after an unexpected slump of 1.5 per cent in sales (McCarthy 2000). Another attempt to introduce organic food to a broader audience, the "Ja Natuerlich" line of Billa in Austria, initially focused on produce, bulk and dairy products. It was highly successful in giving the Billa high-quality image and attracting wealthy customers. The number of products, of product categories, and the market share have steadily increased and competitors have followed suit with establishing their own lines of organic products (Ja! Natürlich Naturprodukte G.m.b.H.).

5.4 Action at Home

"Action at Home" is a so-called social marketing campaign operated by the Global Action Plan in the United Kingdom.[22] Participants receive a questionnaire to establish a baseline of household environmental impact called Greenscore, which is measured again at the end of the programme. A monthly information pack provides step-by-step suggestions for making small changes to their practices. Packs cover waste, water, transport, shopping and energy, as well as 'next steps.' Over 30000 households have taken part in Action at Home. Unfortunately, the return of questionnaires has been low, so that the Global Action Plan cannot judge the impact of the campaign (Hobson 2002). For the "Sustainable Lifestyle Campaign" in the United States, the Global Action Plan claims savings of 9-17% of the household energy use, 16-20% of transportation fuel, and even larger amounts of water and garbage. This results in savings of USD 200-400 per year in utility costs. It is not clear, however, how representative and reproducible these number are. Hobson (2002) reports that only half of the UK participants that she interviewed have changed their behaviour, and that most changes were minor and could be done with no cost and little effort, such as turning off the tap when brushing teeth. She criticizes the focus of Action at Home on "rationalizing lifestyles" and instead suggests a focus on social action and fairness.

5.5 Car-free housing project Vienna-Floridsdorf

This apartment complex includes 244 flats of different sizes (50-130 m2) and was opened in the year 1999 as a demonstration project for car-free housing on the periphery of Vienna (GEWOG 2000). The apartment complex includes garages only for bikes and for car-sharing. The money saved from not providing one parking space per flat was invested in common areas, such as social rooms and a playground. The project includes an office for teleworkers and free-lancers, a fitness room, and a distribution/storage room for organic food. Solar energy is used for hot water heating. The apartment building is located near the old and the new Danube has therefore

[22] http://www.globalactionplan.org.uk/aboutus/athome.htm. The Global Action Plan and its "Sustainable Lifestyle Campaign" started in the United States (http://www.globalactionplan.org). Similar activities also exist in Canada (http://www.toolsofchange.com).

easy access to recreational areas. Access to the city is available through a nearby subway station. Only 5% of the trips of residents are with cars, 58% are with public transport and the remainder is walking and biking.

6 Classification of the Examples

We have classified the examples of sustainable consumption according to function, type of change (going back to Keyfitz' categorization) and mechanism of action. A classification of all 34 examples can be found in the electronic appendix. Looking at the type of change, most of the examples identified fall into the mechanical or use efficiency category (Table 1). We even put organic food there, because it works through changed production methods that reduce pollution; it is like purchasing any other clean product.

In terms of mechanisms of action, the WashRight campaign works through convincing people to change their habits and lower the wash temperatures. Funserve increases the access to high-efficiency white goods by removing the initial cost barrier and spreading the costs out over the use phase, where they are compensated by lower electricity costs. Organic food lines work like eco-labels, providing information about the production of a product, and they makes organic food available or more easily accessible to customers. The "Action at home" lifestyle campaign aims mainly at changing habits and routines which increase the use efficiency of various household functions. In some way, it may also be seen as affecting the lifestyle by introducing environmental considerations into day-to-day decision making. The car-free building in Vienna puts inhabitants into a more sustainable set-up. The building is a micro-infrastructure offering access to playgrounds, socializing opportunities, ready access to car sharing. There are also shared values among the inhabitants, so that inhabitants encourage each other by example and through social pressure to reduce car use, separate the garbage, and buy organic food.

Table 1: Classification of the examples of sustainable consumption

Example	**Function**	**Type of change**	**Mechanism of action**
WashRight Campaign	Clothing	Use η	Changing habits and routines
FUNSERVE white good rental	Nutrition, clothing	Mechanical η	Improved availability through changed incentives
Organic food line at supermarket	Nutrition	Mechanical η lifestyle?	Availability & information on sustainable product
Action at Home	various, lifestyle	Use & mechanical η	Changing habits and routines
Car-free housing Vienna	Mobility, housing, lifestyle	Use η lifestyle?	More sustainable set-up, opportunities and social pressure for car sharing etc.
Car-free housing Vienna	Mobility, housing, lifestyle	Use η lifestyle?	More sustainable set-up, opportunities and social pressure for car sharing etc.

7 Discussion

The proposed policy framework calls for sustainable consumption measures to be implemented. Only the WashRight campaign and the organic food line can be seen as full-scale examples of sustainable consumption. Our intention with identifying and reviewing sustainable consumption initiatives is to provide clues for policy measures. We now need to ask whether the examples can and should be replicated and scaled up to serve as specific policy measures. Or is it something else we can learn from them? A number of evaluations is necessary to develop successful policy measures.

1. Are the examples successful in reducing the environmental impact? This is, in fact, a complicated question to answer. Does the example work as intended? Do the changes to behavior, appliances, etc indeed reduce environmental effects, taking into account changes throughout the product or service life-cycle and rebound effects? Does the target audience indeed accept the proposed changes?
2. Can the examples be replicated and scaled up? What kind of adaptations are necessary to allow a replication and how do they affect impacts? Are the proposed changes acceptable and indeed attractive also for a wider target audience? For this purpose, it is necessary to understand how the examples work. This is why we have reviewed the mechanisms of action. Is there something more general to be learned about what policy should target?
3. Are there scale effects? Looking at the car-free housing, a wider adoption of a car-free lifestyle would obviously provide significant benefits by making cities more liveable and thus reducing urban sprawl. There would be a positive feedback as less cars lead to better non-automotive accessibility and make it easier for pedestrian, bikers, and extensions of the public transport system.

I am not aware of any study that has systematically gone through these questions and shown how such a scale-up works. In the field of energy efficiency, however, a number of initial examples have been implemented as large-scale policy measures. These, however, mostly target appliance efficiency and not behavioural changes. I will therefore just discuss how these questions can be addressed.

Hobson's (2002) study of "Action at Home" provides an example for how to evaluate whether an intended change has indeed been achieved. An evaluation of household environmental impact using, for example, the techniques used by Vringer and Blok (1995) can provide a comprehensive quantification of the changes in environmental stressors caused by specific changes in behaviour in a household. This even takes the rebound effect into account. In some cases, a more narrow analysis of the targeted change may be sufficient. The systematic evaluation the environmental effects of changes in household consumption is also required for the evaluation of policy measures called for in step 3 of the suggested framework.

The question regarding replication and scale-up requires an understanding of the mechanisms of action, and the elements that need to be in place for a successful adoption. When studying the mechanisms of action, I found that most measures, and especially the more effective ones, do not fit into the dominant conceptual frameworks for sustainable consumption. Four types of conceptual frameworks for consumer decision making were

identified and discussed in the final report of the OECD sustainable consumption program (Geyer-Allély et al. 2002). The frameworks, as much of sustainable consumption policy, focus often on day-to-day decision making. Through changing daily, consciously made choices, however, we are able to affect only small fraction of the direct and indirect impacts caused by households, because these decisions are relatively unimportant in our lives. Of the five examples reviewed in this paper, only the organic food line focuses on consumer decisions that can be seen as addressing day-to-day decision making. Even for organic food purchases, Thøgersen and Ölander (2002) have shown that habit formation is important. The WashRight Campaign and Action at Home focus on changing daily routines. The Funserve project aimed at providing households with more efficient durables, a very infrequent decision with a substantial commitment to future consumption. The car-free housing project, as indicated, works through multiple mechanisms that range from providing an opportunity to live without your own car, through social pressure, to shaping non-automotive mobility careers. In this case, infrastructure, social norms and habits are all important.

Based on this study of examples, I would like to propose a conceptual model for consumer behaviour which takes into account habit formation and inertia. This model is provided in Figure 4. This model takes habits as a basis for consumer behaviour. A substantial reason is required for consumers to even arrive at a state of decision making, i.e. to seriously consider to act differently than "normal". This can be a crisis (like the BSE crisis), a change in the external environment (like a move) or a shift from one life-cycle stage to another). According to this model, a piece of information such as an eco-label or an advertisement would be insufficient to substantially change consumer behavior.

Behavioural research provides substantial support for this type of model. Biel (2003) has suggested a similar model based on the lessons of a research program into habitual change required for the consumer adoption of green products, such as eco-labelled laundry and dish-washing detergents. While environmental values are important in determining whether such products are purchased, satisfaction with past purchases is more important. Biel also emphasizes to the importance of social context. He points to experimental research which indicates that social norms are strong motivators for unselfish behaviour and can act more effectively than individual rewards. The extensive, game-theoretic literature on the prisoner's dilemma and similar social dilemmas indicate that individual behavior is significantly shaped by expectations about the behaviour of others. Social norms, social expectations and reciprocity are hence important factors in shaping individual actions. They may prompt the consideration of new alternatives. They may also provide examples about what alternatives to adopt. The individualistic conceptual model displayed in Figure 4 should hence be seen as embedded in a larger, social model of decision making.

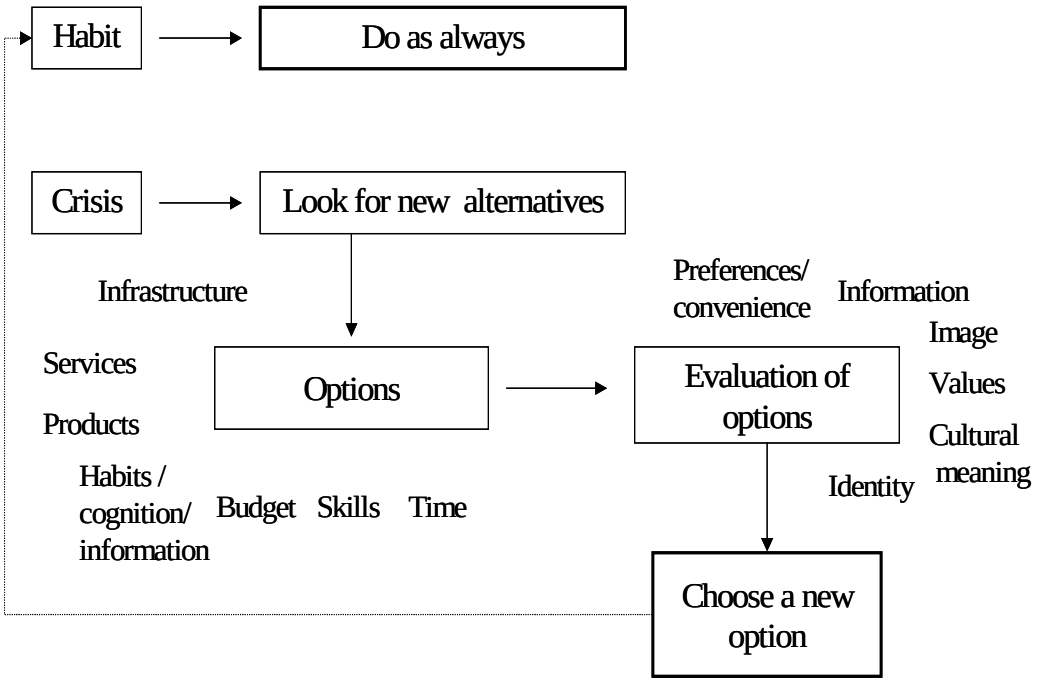

Figure 4: Conceptual model for consumer (in)action

8 Conclusions

The examples of sustainable consumption reviewed range from targeting specific, small changes in behaviour, such as reducing the clothes washing temperature (100s MJ/person/year) to fundamental changes of how individuals organise their life through car-sharing and more local activities (10,000s of MJ/person/year). They may target many million individuals (WashRight) or only a small, self-selected group (car-free housing). Further research on these examples is recommended, combining life-cycle assessment type studies with social research. This research should investigate the effectiveness and acceptance of different measures by different groups/in different cultures. It should help develop measures that target individuals when they are susceptive to changes, either when they make big decisions (where to live, whether to buy a car) or when they form habits and routines. Research should not only focus on individuals and their socialization, but also on regions, city planning, and infrastructure development.

The impact of consumer expenditure is largely predetermined either through factors the consumer has very little influence over, such as the available infrastructure, the nature of the energy system and the properties of products and services available, or through habits, social expectations, and long-term decisions e.g. about where to live and work. The level of consumer expenditure increases with economic growth. Segal (1998) that much of this increase is related to an increase in the level of expenditure required to satisfy a given need and thus does not lead to an increased quality of life. For these reasons, sustainable consumption policy should

focus more on following factors, which shape the long-term development of our society:

- Infrastructure: Change the infrastructure so sustainable lifestyles become more attractive, transport is reduced, and public transport, biking and walking are made easier and more popular.
- Habit formation: Investigate and influence the formation of habits and routines. A better understanding of the processes of culturalization and socialization (Wilk 2002) is required. As Faye Duchin pointed out at a IIASA workshop, we need to understand the human life-cycle and attempt to influence decision making at stages of change, e.g. when one person establishes her first own household.
- Availability and access to products and services that reduce the impact of household consumption. Sustainable solutions, even if they do not achieve universal market penetration, are important because they indicate a development alternative, influence the development of conventional products, and may be adopted in situations of crisis. For appliances, market transformation programs have already increased the efficiency of the entire product spectrum.

These factors are promising targets for a sustainable consumption policy. Measures targeting these factors can, in conjunction with the learning provided by the framework laid out in this paper, contribute to reducing the overall environmental impacts of our industrial society.

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Chapter 12 Environmental Consciousness of Consumers in Post-Socialist Society: the Case of Estonia.

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1 Introduction

In the development of modern society the nature of environmental consciousness has remarkably changed. Traditional nature-related practices have been replaced by environmental consciousness based on the creation, communication, reception and implementation of expert and scientific information. Because of this environmental consciousness is often (misleadingly) defined as environmental awareness, which signifies a narrower, technical kind of knowledge instead (for example, one of the main practices of environmentally aware individual is environmental consumption, which assumes that the individual is aware that there actually are expertise and technical solutions on all levels of production and consumption). In the course of the development of modern institutions the basis of the commitment to environmental behaviors has shifted from the bonds of traditions to the awareness and trust in technology and expertise.

The critics of the modern society claim that modern environmentalism is grounded on instrumental kind of awareness, i.e false „manufactured" presuppositions that prevent us from understanding the actual cause of environmental problems (for example Beck 2004/1986, Christopher 1999). Ecological thinkers believe that the cultivation of instrumental awareness in highly developed modern societies will keep us from understanding that environmental problems are the outcome of the inner logic of modern society. This approach undermines the modern concept of *environmentally aware individual*. According to this paradigm the collectivist constellation of environmental practices is in the process of modernization and expanding instrumental rationality gradually replaced by individually rationalized environmental acts. My presentation will take a closer look at the emergence of different paradigms of environmental consciousness and modernization in the case of Estonian society.

Although the actualization of environmental problems as well as the adjustment of environmental arguments to the production and consumption

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processes started in Western Europe already in the 1970ies, the need for environmentally sustainable politics came apparent to former Soviet states just in the end of the 1990ies, in the process of joining EU. Estonia was accepted as a member of the European Union in May 2004 after ten-year rapid and economically successful development. Still, relatively good economic indicators were achieved at the cost of several social, cultural and environmental problems. Estonia experienced difficulties in fulfilling European standards in many aspects, one of them was the correspondence of environmental legislation to EU directives. For example, until 2004 there had been practically no systematic development of environmental consumer behavior (waste separation, eco-labelling). Consumer behavior as well as overall environmental consciousness of Estonians is strongly influenced by their Soviet past and rapid transition during the 1990ies. Hereby this paper analyses the environmental behavior of Estonians after the joining of EU and its influential preconditions from the late history of Estonia.

The second, theoretical part of this paper introduces shortly the counteraction of the modernization of the society and the development of paradigms of environmental consciousness. The third part offers short overview of the periodization of the late history of Estonia and environmental consciousness in Soviet modernity. The fourth part of the presentation discusses on the social price of the rapid economic transition and its relations to the present environmental consciousness – lack of discussion and participation in environmental deciosionmaking, uncritical consumer culture, lack of institutional trust, appearance of critical individuals etc.

2 Modernization and environmental paradigms

Industrial society has remarkably changed human definitions of nature. Beck (2005/1986, 9): „The opposition of nature and society is a construction of the nineteenth century, which enabled to dominate tnature as well as ignore. In the end of the twentieth century nature has been conquered and exploited and transformed thereby from outer to inner, from given to manufactured phenomenon. In the course of technological-industrial transformation and global commodification of nature it was brought back to the industrial system. At the same time nature became the inevitable prerequisite of the lifestyle intrinsic to the industrial system. Dependance on consumption and market shows in its peculiar way also the dependance on nature; and the markets immanent dependance on nature becomes the fundamental law of the industrial civilization *inside* the market systems and *with* the aid of it.“.

The problems caused by the subordination of nature to the human needs were defined as the mere side-effects of the production of goods. Simple side-effects like pollution or drought could be localized and treated with „Western medicines“, all kind of sub-policies. But localized treatment and dispersion of modern problems were the cause for the systematic cumulation and boomerang response (term used by Beck 2004/1986) of risks, simple single problems formed into issues like ozone-layers, loss in biological diversity, overall contamination of nature, health risks from pesticides etc.

Ulrich Beck uses the notion of risk in describing major changes in modern society (2004/1986, 13): „Unlike the factory-related or occupational hazard

of the nineteenth and the first half of the twentieth centuries, these can no longer be limited to certain localities or groups, but rather exhibit a tendency to globalization which spans production and reproduction as much as national borders, and in this sense brings into being supra-national and non-class-specific global hazards with a new type of social and political dynamism."

The end of the 20th century was the time when the need for the definition of the meaning and worth of modernization started to spread widely. This period of modernization is known under many names, all referring to subsequent stage of modern society (post-, late, second modernity), in this paper the *post* is defined through the concepts of Ulrich Beck (2004/1986), i.e reflexive modernity and risk society.

According to Beck (1996, 28) „[…] „reflexive modernization" means self-confrontation with the consequences of risk society which cannot (adequately) be addressed and overcome in the system of industrial society (that is, measured by industrial society's own institutionalised standards)." I. e in his vision reflexive modernity operates technically in the same way as simple modernity. According to that reflexive modernity is not a second phase of the modernity, but an in-between stage of modernity and something else. The need to overcome the institutionalised standards of industrial society means that according to this paradigm present instrumentally rationalised environmentalism will not be able to succeed in solving environmental problems.

This in-between stage brings about relevant societal transformations in three areas (ibid, 29): „First of all, the relationship of modern industrial society to the resources of nature and culture, on whose existence it depends, but whose reserves are being used up in the course of an assertive modernization. […] Second, the relationship of society to the hazards and problems produced by it, which in turn exceed the basis of societal conceptions of security. […] Third, the exhaustion, dissolution and disenchantment of collective and group-specific sources of meaning (such as belief in progress, class-consciousness) of the culture of industrial society […] leads to all the work of definition henceforth being expected of or imposed on individuals themselves."

This means that individuals are supposed to cope with expanding environmental problems in an environment of decreasing security and increasing ambivalence. Beck, Bonss and Lau define it (2003, 2): „In first modern society social change is conceived of as occurring within a stable system of coordinates. But the challenge of theorizing reflexive modernization is that the system of coordinates is changing."

According to this simple modern societies suffer firsthand functional crises while reflexive modernities suffer crisis of legitimation. While simple modernity raises the need for environmentally responsible consumption (which is unmistakeably in the name of a good cause), reflexive modernity has to cope with issues, where the good cause has to compete with other, contradictory causes (for example avoiding extra-packaging for the sake of the environment, but giving up health security; bying bananas in the name of the development of the South, but at the same time binding it to the unfair Western monetary and trade system). As the collective narratives and meaning creating processes pluralize, individuals are forced to rationalize their environmental behavior at one's own risk. Beck, Bonss and Lau (2003,

7) find, that in risk society risks and expectations of catastrophe dominate public debate even before actual decisions are made.

To differentiate environmental worldviews/paradigms in the development of modernity, the concepts of social, environmental and ecological paradigms need to be introduced. As the concept of social or anthropocentric paradigm is quite widely understood, the differentiation of environmental and ecological concepts is still quite ambiguous. While many researchers have claimed that the term *environmental* should be replaced with the term *ecological* in the sake of avoidance of out-moded definitions (for example Dunlap et al 2000, 1), the distinction between those two terms has not found enough explanation.

As I find it necessary to differentiate three different paradigms of environmental consciousness, I borrow the terms used in Dunlap and Van Liere's (Dunlap et al 2000) widely exploited quantitative measure of proenvironmental attitudes (New Environmental [later Ecological] Paradigm Scale): Dominant Social Paradigm, New Environmental Paradigm and New Ecological Paradigm. In Table 1 these three concepts have found closer examination.

Table 1: Paradigmatic formation of environmental consciousness

indicators	dominant social paradigm	new environmental paradigm	new ecological paradigm
evaluation of nature	nature is reified as culturally external phenomenon	nature is a resource, but also a threat to human being	humans form a problematic part of nature
roots of problem awareness	direct contact with nature, feeling of disorder or uncleanliness	direct contact with nature, reception of environmental expert information	environmental expert information is problematized in the light of personal system criticism
meaning of the environmental problems	existance of environmental problems, *too many* problematic or annoying aspects	problems are of linear nature, insufficient adjustment of technology and control in solving problems	environmental problems are of complex nature, issue of environment is the central problem of modernity
reason to/ or not to behave environmentally aware	denial of problems and keeping away from problem sources	attempt to consciously fix problems, reduce risks	questions modern awareness and expertise, prerational cognition
environmental behavior in practice	not to behave, not to harm, following of the norms	aware behavior in the limits of *possibilities*, consumer practices	aware behavior is mixed with confused attitudes, possible return to traditions and nature

Dominant social paradigm corresponds to the general worldview of early industrial society, which defines nature as a resource – culturally external. Perception of environmental problems is situational, depending on direct experience of nature or information emphasized by mass media. The system interpretes actualized environmental problems as a simple and transitory threats, individuals perceive environmental problems as they contradict their overall affinity for purity and order. Individuals have not defined

environmental behavior as an aware practice, the environment-related behavior is foremost based on (negative) social norms (thou shall not… - litter, make fire etc) and traditions.

New environmental paradigm is peculiar to simple modernity, developed industrial society. In the light of this paradigm nature is still treated as resource, but also as a culture theme – coping with everyday environmental problems have made nature a normal part of everyday life, brought back to culturally internal. According to that environmentalism is a social norm and trust towards environmental expert information is legitimized. This worldview represents trust in science, technology and expert information, which will aid man in solving environmental problems as well as threats from nature. According to new environmental paradigm environmental endangerment originates from the insufficient adjustment of environmental technologies (for example low awareness of the people) and excessive exploitation of natural resources - new environmental paradigm emphasises the importance of sustainable development and *positive* (i.e individual does not have to give up anything) environmental practices like environmental consumption. Economic-technological development and its instrumental rationality is taken as the guaranty of social and environmental wellbeing.

New ecological paradigm is intrinsic to reflexive modernity, risk society. This type of environmental consciousness originates from the individualized suspicion and cognition of ambivalence. The ambiguity of interpretation of environmental problems and contradictory solutions offered by modern expertsystems endanger common modern rationality and the fundamentals of new environmental paradigm. Michael Cristopher (1999: 358): „[…] environmental consciousness means concern about environmental problems that is instrumentally justified and can largely be explained by the spread of knowledge and experience of the degradation of nature. Ecological consciousness, on the other hand, involves a concern for the environment that is coupled with the claim that modern thought, including traditional environmentalism, is grounded in erroneous ontological and epistemological presuppositions that prevent it from adequately understanding, or responding to, our environmental problems.“ Ecological thinkers realize that risks are inherent to highly developed societies and that awareness is not enough. They challenge modern rationality, but the lack of new rationality feeds them with anxiety. The actual behavior of the representatives of new ecological paradigm can not be defined one-to-one. Although the ecological behavior is often used as a synonym for environmental behavior (f.e waste behavior, certain consumption patterns), there can be defined no actual distinction between the practices of environmentally and ecologically conscious individuals. The difference might be found only in the rationalization of the behavior. As the representatives of new environmental paradigm justify their behavior with trust in expert systems and sub-politics, the representatives of ecological behavior adjust their individualized risk strategies to given circumstances. This might find an outcome in constant aim to be aware of the risk situation (f.e which kind of fishes contain less dioxines this year), in return to traditional lifestyle or in giving up any kind of environmental practices.

3 Historical backround of environmental consciousness

Modernization processes described by Anthony Giddens, Bruno Latour, Scott Lash etc do not apply one-to-one to every society, Beck et al (2003, 7): „First modernity is posited as a prerequisite for second modern society, but there are groups of countries it doesn't apply to […]. [The distinction between first and second modernity] is completely Eurocentric. It takes for granted that the institutions that second modern society dissolves or transforms are there in the first place […]. This European constellation must be enlarged and reassessed by studing the effects of second modernity on non-European constellation."

The modernization processes do not follow the book even within the limits of Europe, the difference may not lie only in the lack of the simple modernity institutions, but also in the type of the simple modernity – this paper takes a closer look at Soviet type of modernity and its impacts on the environmental practices in Estonia.

The development of environmental consciousness of Estonians has been influenced by three distinct periods in the course of last two decades: Soviet period (1944-1987), the breakthrough (1988-1991) and transition period (1992-2000).

3.1 Soviet modernity (1980ies)

In 1944, after the German occupation Estonia was united with Soviet Union according to Molotov-Ribbentrop treaty between Germany and Soviet Union (signed in 1939). In the course of the first decade of the Soviet regime the structures of the previous civil society were disrupted, private property was nationalized, communication with foreign states was forbidden, media censorship was established, freedom of speech as well as mobility of the individuals were restricted. Externally democratic looking elections were achieved at the price of repressions and forbidded dissent.

Soviet modernity followed the principles of planning economy – while western modernity was rationalized on the basis of cost-benefit analysis and wellbeing of individuals, Soviet modernity rationalized itself by five-year production plans and loyalty to the communist party. The ultimate goal for the Soviet economic rationality was to outperform West in economic competition.

Planning economy (*to produce at least as much as planned and more*) subordinated nature to the Soviet system, expressing culturally external meaning of nature. Soviet society lived in an illusion of the endless natural resources. Unreasonable extensive production and the experiments on nature changed the traditional (or intrinsic) meanings of nature. In the name of the productivity natural environments were recultivated according to Soviet ideology – the bogs were drained and lakes were run dry, foreign species were introduced in the local environment. Although the norms to protect the nature existed, there was no control over the implementation of them, because the norm rates were basically classified (f. e amount of pesticides).

The decisionmaking processes on the environmental issues (like on any other) took place without public discussion, by politizised science and state apparatus. The information about environmental problems and risks was classified, media texts were censored – in this way the public

communication denied the existence of environmental problems. Although in 1980ies the readership of the journal „Estonian Nature“ was remarkably high (about 25% of the inhabitants) (Lauristin & Vihalemm 1988), this was partly the result of the overall deficit of information (Vihalemm & Kõuts 2004). Media turned relatively much attention to the environmental issues, but the content analysis showed, that the main attention was paid to less important issues like ecological education, natural resources and parks; the causes of the environmental problems found rare identification. The environmental problems were argued to be intrinsic foremost to the Western society.

The nationalization of private land property in the beginning of the Soviet period did not interrupt traditions of nature-related practices (such as berrypicking in the woods), and despite of the urbanization, relatively big proportion of inhabitants were occupied in the sector of (intensive) agriculture. The natural economy was also quite common, f. e sewing, gardening and other environmentally less exploitive practices, although these acts were not defined as environmentally aware practices. As the economic system kept people from extensive consumerism (narrow variety of products, practically no packaging, circulation system of glass-tare), there was lack of elementary information about the health and environmental impacts of goods, not to mention risk information. On the level of the individuals the environmental behavior was associated with negative norms – thou shall not walk on the grass, litter or smoke… Still, in a way the absense of private property exaggerated the carelessness towards surrounding environment despite of the prohibitions.

Lack of information and absence of inner reflexivity of the society exaggerated environmental problems of the Soviet modernity. Denial of the environmental problems and being silent about these issues prevented from the formation of modern environmental awareness (from the formation of new environmental paradigm) (Kiisel 2005).

3.2 The breakthrough (1988-1991)

During the Soviet period many potentially environment endangering processes were kept classified from the public. In the end of the 1980ies one of these processes – planning of phosphorite mines in Estonia – became a motive for national movement to take public action. The Soviet Union planned to establish large phosphorite mines to an ecologically sensitive region of Estonia (important watershed). Despite of the long classification of the future mines the information about them became public still and caused acute reactions among the public. Consequent „phosphorite war“ was foremost the question of national self-consciousness, the right to decide on the issues bounded in Estonia (Aare 1999). In 1989 in the light of the societal reaction to the phosphorite issue the Supreme Council of Estonia signed the conception of environmental production and rational exploitation of natural resources (Raukas 1997).

The concern about national natural resources and watersupply united environmentally concerned people, this was the start of public national-political movement. Those movements served as the first political parties in newly independent Estonia. In August 1991 the final act of the fight for Estonian independence took place, the Supreme Council voted for the

„Resolution on Independence of Estonia“ (Lauristin & Vihalemm 1997). Soon after that, in the circumstances of deficit, economic degeneration and rapid growth of inflation the environmental issues lost their importance, the enemy in the form of the Soviet Union was not so apparent anymore. By the year 1992 the environmental organizations had lost their popularity, which shows, that the environmental movement did not act on the environmental, but on national concern instead.

Media was freed from censorship and promoted highly critical discussions on national values as well as environmental issues (Lauristin & Vihalemm 1997). Risks that had been in latent state till then (such as pesticides, issues of underground water, phosphorite pollution), were found in media and public debates. Such a high reflexivity was not caused only by the environmental concern of the individuals, but also because of the national and utilitarian aspects – concern over personal wellbeing. As the Soviet period did not support the formation of active environmental consciousness, the phosphorite and other environmental issues could not unite public for long, environmental issues were replaced with problems of crime and economic transformation. Under the conditions of overall deficit there were certainly no possibilities for the development of environmental consumption.

3.3 Transition period (1990ies)

The beginning of the 1990ies the restoration of Estonian statehood took place, constitutional reform and the multi-party system were institutionalized. The green party diminished by the second democratic elections. At the same time economic „shock therapy“ took place: currency reform (1992), privatization and restitution of ownership rights, rebirth of banking system and collapse of the intensive production. In social differentiation poor-rich opposition became significant, in the light of the growing social problems individuals were differentiated on the basis of their income (Lauristin and Vihalemm 1997), at the same time consumption acquired ever-expanding symbolic value. During the transition period the economic elite was brought to the front, societal rationality was redefined – economic arguments were given much priority in front of social, cultural and environmental issues. In September 1994, when the Russian troops left Estonia, new pollution areas were discovered on the territories of former Soviet army, this pollution issue was the main environmental agenda through transition period (Kiisel 2005).

From the mid 1990ies Estonia was clearly oriented to the European Union. Following the European example Estonia enacted the law of sustainable development (1995); the first environmental strategy (quite social paradigm centered) of Estonia was established only in 1997. In the mid 1990ies the living standard started to rise, but issues like the increasing poverty, growing criminality and corruption, decline of birth rate reduced the overall positive image of economic development (Lauristin and Vihalemm 1997). Trust in the rationality of the economic system was for the first time undermined only by the end of the transition period as the financial crisis (1997) influenced the wellbeing of individuals and reduced the faith in the flawless functioning of the capitalist world (Kiisel 2005).

In 1998 the first law of waste was enacted (issue of simple modernity), in 1999 the law of genetically modified organisms (the first formal contact with the problematic of risk society). In environmental areas the main financial input was made in the implementation of environmentally pure technologies in order to correspond to modern environmental acquirements.

The changeover to market economy brought on forced individualization of the individuals – in the unstable environment of transition society individuals were responsible for the risks taken. Individuals wer forced to abandon their collective meaning frames and choose between individual risk strategies. In this sence similar features in risk and transition societies can be found. The fragile stability of the transition society was hold up by the illusion of the flawlessness of the economic rationality. This allowed to redefine the perceived environmental problems as the „old" problems inherited from the Soviet Union. The contacts of the individuals with environmental information decreased, the auditory of media publications segmented and the print-run of environmental journalism diminished ten times, readership to less than 5% of the population (Vihalemm & Kõuts 2004). In mass media the issue of environment was reduced to non-important and culturally external (environment did not „sell"), but compared to the Soviet media representation issues of environment had replaced the issues of nature and system was replaced by the individual (Kiisel 2005). The lack of economic capital hold back the development of environmental media as well as environmental movements till the end of 1990ies. The concern about the environment was not caused by the rise in the income or wellbeing of the individuals (as in western societies), but more on the personal fealing of frustration from direct contacts of environmental pollution (trash by the streets). Changes in the patterns of economy (foremost the decline of intensive agriculture) and value systems as well as urbanization diminished the nature-related practices of the individuals. This shift in environmental practices happened in the aid of import of Western lifestyle (media, travelling, networking…). Although environmental consumption patterns were not institutionalized, environmental practices became part of the symbolic self-expression of individuals.

4 Present environmental practices

For Estonia the 21st century can be defined as the economically stabilized period. The non-instrumental arguments (the social, cultural and environmental) that were repressed during the transition period have found their way back to the public agenda. The formation of the civic society (strengthening of NGOs and interest groups, voluntary work) rises the criticism towards instrumental rationality, the reflexivity of the society is gradually growing. Estonian environmental NGOs develop and pluralize (from nature protection to environmentalism), they have more strength to have one's say in decisionmaking processes. Although Estonia ratified Århus convention in 2001, the practice of the environmental decisionmaking shows that the obligations to provide public with environmental information are still formally defined (Kiisel 2005).

Joining of the European Union promoted the development of environmental legislation, f.e laws of nature protection, forestry, waste (2nd version) and packaging (2nd version) were enacted. The implementation of

the new laws has been quite problematic as the new norms do not originate from the natural reflexion of Estonian environmental problems, but from EU documents, i.e Estonian public institutions do not reflect (in the sence of reflexive modernity) as much as they translate. This kind of societal learning might lead to different kind of risks than in Western societies.

Although the readership of the environmental journals and other publications is relatively small (aroud 5% of population), issues of environment and nature are now popular in mass media, which might be partly caused by the growing number of environmental problems. The media representation of environmental issues lacks of criticism, the orientation of the interpretation is social and environmental paradigm centered (Kiisel 2005). It is also peculiar to the environmental argumentation that the intrinsic values of environmental acts are rationalized through EU, f. e Estonians have to adjust to recycling behavior in the sake of EU (not of environmental sustainability). First environmental media campaigns have taken place, compared to the institutionalized negative (don't!) environmental practices in the Soviet period now positive practices of behavior are introduced (i.e consumption practices).

The concern about the environment has become social, but passive norm – according to different social inquiries around 90% of the individuals express their anxiety about environment, at the same time the concern is not realized in environmental practices (Kiisel 2002, Raudsepp 2002). It can be explained by the weak institutionalization of environmental behavior – the actual possibilities to behave in an environmentally acknowledged manner are quite difficult to access (for example lack of environmental products, equalised tax systems, lack of recycling conditions). There is also lack of clear institutional guidelines how to behave in an environmentally aware way.

The present environmental awareness of the Estonians is consumption oriented, careless attitudes towards environment are tied to the memories of the Soviet past. The perception of environment is segmented due to the overall segmentation of living conditions and lifestyles, regional differences and economic success. Although common attitudes toward environment are mainly pragmatic and instrumentally rationalized, the pluralization of the transition experience („winners" and „losers") seems to have cultivated also system-critical, ecologically conscious individuals. Rapid economy-oriented transition has provided individualization mechanisms that are characteristic of risk society.

4.1 Environmental consumer behavior

Compared to the Soviet period environmental practices (or the meanings related to those practices) have changed remarkably. In the Soviet modernity individual responsibility was tied to nature-related practices and defined as denial (do not pollute). Nowadays the individual responsibility is related to alternatives in consumption process, and defined through affirmation (do recycle). This distinction is naturally foremost like process not actual situation. Traditional nature-related (like berrypicking, home-made jam), pragmatic (returning bottles to the shop, weather-stripping of windows for the winter) and normative behaviors (switching the lights off) - all familiar from the Soviet time were basically forgotten during the transition period

because of the reorganization of lifestyles and institutions. Ten years later these practices have returned to the lifeworld of Estonians, but often defined as (trendy) consumption practices. Some pilot analysis (Sööt 2004) have indicated that the emhasizing of environmental awareness on the level of individuals is imported to Estonia by the flows of the developing consumer society. In this section I will give short overview of the problematics related to main environmental consumption practices in Estonia.

Environmental consumption is foremost influenced by functional capability of the system – environmental products are not easy to find, except from separate ecologically oriented shops (introduced in the course of previous years). Pilot analysis of Estonian Green Movement has showed that the total number of different ecolabelled products at Estonian supermarkets does not exceed count of 200, total number of the found ecolabels was 10. According to the information of the „natureshops" their customers are mainly young women ecpecting a child or with little children. This means that natural products and environmentally sustainable consumption is important firsthand to individuals hwo cope with the issues of risk. The lack of ecolabelled products at stores is caused by low awareness of the producers as well as consumers (demand and supply). Business representatives claim that the ecolabelling needs extra attention (f. e communication campaigns), but the willingness to contribute in this process is relatively low (Samel 2003, Tafel & Viia 2003). At the same time several pilot analysis have shown that many enterprises use communication to express their products in order to be distinctive on the bases of some nature- or environment-related argument. F. e 28% of the webpages of Estonian business enterprises have emphasized environment- or nature-related aspects, but only few of those pages referred to actual politics in the name of less exploitive production, the rest of the webpages were referring to the natural features of their products, self-defined environmental aspects or just declarations of different environmental values (Karo 2003). The analysis of the advertisements of Estonian journals showed that 30% of the advertisements referred to nature or environment, and half of those referred to the natural features of the product. Only one advertisement out of 762 referred to the actual appropriation of environmentally sustainable production (Kübar 2006). It can be concluded that environmentally loaded product promotion is practically missing in Estonia, at the same time business enterprises prefer to play with natural and environmental arguments in the process of marketing communication. It is interesting that business enterprises do not want to refer to environmental expertise as we could expect. This sets a challenge to individual consumer behavior, as there is no expertise to trust. Pilot analysis shows also that Estonians generally trust business enterprises to behave in an environmentally responsible manner (Karo 2004), but this might be related to general trust in modern economic rationality. On the other hand inquiries have shown that Estonian consumers are quite suspicious towards environmentally „packaged" goods (Normak 2005). Although individuals considered environmental arguments very important, only 21% of them believed that environmentally advertised enterprises also correspond to these values in actual life. 38% of the respondents did not believe in environmental production and 40% did not know what to think. In western modernity the suspicion about environmentally loaded communication appeared with a ten-year-shift after the appearance of the first „green hype"

cases (Wagner 2003), in Estonia the suspicion is there even before the actual intervention of environmental production.

How do consumers evaluate their environmental awareness? According to the representative cross-national media and communication inquiry (MEEMA 2005) 68% of Estonians claim themselves to be environmentally aware or highly aware consumers, 6% of respondents always examine ecolabels (52% - sometimes), around ten per cent of respondents did not know ecolabels. 14% of respondents do not know how to evaluate environmental aspects of packages. 64% of Estonians are willing to pay more for an environmentally loaded product (yes, much more – 5%, yes, a little – 59%). The most popular environmental technical solutions are energysaving bulbs (I use this - 68%), energysaving domestic technics (58%) and recycled paper (38%).

Waste behavior was not strictly determined during the Soviet period. In country regions where the traditional lifestyle was quite common, household waste was disposed somewhere on the private territory (and still is), part of it was composted. In bigger places the waste was disposed in local dumping grounds. Although in the course of the transition period all small and illegal dumping grounds were officially closed, the disposal of waste is still quite uncontrollable. During the Soviet period the quantities and qualities of household waste were not remarkable to implement recycling programs (waste was an issue of hygene, not of natural resource) – the goods were merchandized basically without packaging, all refreshment drinks, milk etc were packaged in high-deposit glass-tare and the scrap paper was collected in the course of public campaigns (mainly by the schoolchildren). The biggest issues of waste behavior were dangerous waste (problem was denied) and littering. During the transition period the tare and scrap paper recovery systems fell apart, ironically, at the same time the rate of consumption went up. The re-establishment of waste recovery systems started in the end of 1990ies. As these conditions were not easy to promote (too few public collecting cans, constantly changing recovery systems, no systematic communication…), the reinvention of recovery of packages and scrap paper developed slowly. As in 2002 recycling was a habit to every fifth city inhabitant (Kiisel 2002), then according to last inquiries the situation in recycling behavior has remarkably changed only in the area of deposited packages (interviews with representatives of Estonian recovery organizations). Packaging recovery organizations such as der Grüne Punkt started in Estonia a year ago. Due to this the amount of reusable materials has grown twice compared to previous year, but the change in recycling behavior has not reached masses. As the actual conditions for recycling behavior are regionally very different, it has been difficult to to carry through opinion surveys on the comparable basis. Crossnational inquiry from the end of previous year (MEEMA 2005) shows that 14% of Estonians use all possible conditions to deliver the recyclable materials to the recovery system.

According to my in-depth interviews in Tartu, Estonia (Kiisel 2005) the present enviromental practices are constellations of traditional and imported behaviors, for example, in one's childhood a person was told to switch off the light after leaving the room (as the electricity did not cost practically anything during the Soviet period, this practice was more like a remnant of protestant ethics. Nowadays this behavior is argumented by economic (it

costs) and environmental (like the whole world) aspects. The environmental arguments have formed on the basis of imitation, forehand because of travelling in Western countries, media... This kind of imitated solutions like paper bags or avoidance of „E"-s are taken for granted. In some cases it might turn into a problem – for example people expect „responsible persons" to introduce this kind of waste separation systems as they have seen abroad. Although the density of population in Estonia does not support this idea, sometimes this was the only solution my interviewees trusted. The index of environmental consumption (MEEMA 2005) shows that the environmental consumption practices are positively correlated to higher income and elite groups. This supports the idea, that environmental consumption practices belong in Estonia above all to the narrative of technological progress and economic development.

The interviewees whose worldviews comported with the social and environmental paradigm argued that the activation of environmental practices is above all a matter of time and development. This represents the general trust towards modern economic rationality. Examples of situations where the individual may be incapable of understanding of the actual outcomes of one's behavior, focused their thoughts to finding new stable rationalization grounds. It seemed that the representatives of social paradigm would keep to the irrational activities more easily than the interviewees whose worldviews matched environmental paradigm. I suggest that the environmental practices of the representatives of social paradigm were more norm (I'm told to…) than trust (why?) based. Individuals responding to both paradigms expressed their faith in simple correct answers and linear solutions, during the interviews the respondents did not express their concern about complex environmental issues.

The interviewees whose worldviews comported with the ecological paradigm reflected risk issues more thoroughly. Their personal risk strategies were not so much awareness as cognition based - they did not reflect on any certain expert information, firsthand the cognition of impoverment (disturbance, criticism, doubts, stress, words *fear* and *catastrophe*) was expressed. These interviewees did not observe the development of society as linear process. The ecological worldview seems to have its roots in Estonian rapid economic transition, which has thrown social insitutions, human relations and collective meaning sources to a new and unstable system. As Estonians have maintained quite strong ties of traditional lifestyle (f. e grandma in the country), it can be postulated, that the individuals of Estonian risk society will find their risk strategies and sources of trust in traditional nature-related lifestyle.

5 Overall conclusion

This paper postulates that the features of Soviet modernity exaggerated the extent of its environmental problems and that the Soviet past has remarkably influenced present environmental consciousness (awareness, practices) in Estonia. The absence of reflexivity in the society prevented it from adequately responding to the environmental problems.

Present environmental practices are partly influenced by traditional lifestyle, the modernization of the society has added three paradigms of rationalization of environmental practices. Soviet period with its irrational rationality fed the development of social paradigm, uncritical following of

the normative behavior. Transition years were the period of simple reflection of instrumental (economic) rationality, environmental paradigm developed on the basis of imported environmental half-truths. Stabilization period has revealed the appeareance of suspicious development critics, who contextualize environmental problems in the inner logic of modernity (ecological paradigm). The formation of environmental practices are contextualized in Table 2.

Table 2: Development of environmental practices in Estonia

Periodization of the late history	Environmental practices
21st century – flows of reflexive modernity in parallel with rational economy-oriented system	Paradigmatic pluralism of environmental practicies: environmental consumption (ENV), normative (SOC) and traditional behavior, not-to-exploit-too-much behavior (SOC), risk calculation (ECO)
1990ies – years of rapid transition, formation of rational, economy-oriented modernity	Import of environmentally aware consumption practices – growth of environmental consumer behavior as part of environmental identity (ENV), translation of traditional environmental practices into environmental consumption practices (ENV), avoidance of extra ecological footprint (not to behave in an exploitive manner) (SOC)
1988-1991 – contradictory opposition of Soviet and kapitalist rationality	Normative (SOC) and traditional practices, active collective environmental behavior in environmentalist organizations in the name of the national determination and protection of local environment against the economic interests of Soviet Union (ECO+nationalism)
Soviet industrialism and planning economy	Traditional practices in parallel with Soviet normative and economic practices, non of them actualized as environmentally aware behavior (SOC)
(Preindustrial period)	Prerational-traditional relations with nature, natural economy

As the joining of the technological-economic culture of EU was rationalized for Estonia mostly through translation (top-down strategy) not through inner reflextion, it can be postulated the union process favored on the institutional level the development of social paradigm (blind following of the norms, difficulties in reflecting down-top arguments) most. At the individual level certainly environmental paradigm was most influenced – due to the joining of EU the possibilities for different environmental consumption practices have broadened remarkably. Environmental paradigm originates from trust in economic-technological institutions, ecological paradigm emanates from the criticism of the environmental paradigm.

Global risk society originates from western democracies, as a result of long-term economy-oriented linear development. Estonia has been coping with risk society issues (bird-flu, war of terrorism) without being traditionally modernized (f.e knowledge-based decisionmaking, trust in expert information, industrial development). The formation of modern environmental practices has to cope with raising doubt in modern solutions, doubt precedes the environmental practices that have not been introduced yet. The question is how the symbiosis of doubt and trust will achieve institutional cohesion to cope with ambiguity and individualization of rationalities?

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Chapter 13 Emerging sustainable consumption patterns in Central Eastern Europe, with specific focus on Hungary

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1 Introduction

Sustainable consumption is defined here "as the use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardize the needs of future generations" (Norwegian Ministry of Environment, 1995). Accordingly, it encompasses economic, environmental and social dimensions, all of which need to be changed or adjusted in order to achieve consumption patterns and levels that are indeed sustainable.

The direction of change towards more sustainable consumption may be both top-down and bottom-up, but so far most of the attention seems to have been focused on top-down processes, achieving rather good results in creating more sustainable production patterns. In Central Eastern European countries, far less consideration has been given to achieving more sustainable patterns and level of consumption, either top-down or bottom-up. There are several reasons for this; however, by far the most important one is that increasing the levels of consumption is strongly believed to facilitate the development of the region, just as well as the development of any region in the world (Durning, 1992; Jacobs, 1997).

Another very important reason is that consumption was constrained in the not so distant socialist past of the region, and as a result of this, consuming more and achieving levels of material consumption similar to those in the western part of Europe is a very important motivation for most of the population.

Nevertheless, one can find a variety of bottom-up, voluntary, consumer-citizen driven initiatives in the region that aim creating a more equitable

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society with less environmental impact. In other words, they promote more sustainable patterns and levels of consumption.

The aim of the EMUDE research project[23] was exactly to find and describe such initiatives in countries of the European Union focusing mostly on Western Europe but also collecting cases in the new member states, as well as consider the wider-scale applicability of these more sustainable everyday-life patterns. The way such consumer-driven sustainable consumption initiatives were termed in the project was "creative communities". Creative communities are defined as groups of innovative citizens who organise themselves to solve a problem or to invent new ways of carrying out everyday activities, and in doing so they move towards social and environmental sustainability. Thus, creative communities are what Seyfang (2005) terms “grassroots initiatives for sustainable development”, Georg (1999) calls “citizen initiatives”, and Jackson (2004) “community-based initiatives”. Since this paper is based on the EMUDE research project, I am adopting the term “creative communities”.

In what follows below I introduce creative communities from Central Eastern Europe. However, in order to contribute to their better understanding, I will first provide some background on the region, both in terms of the relatively recent transition to market economy and democracy, and its impact on welfare and consumption trends.

2 Some background on transition and consumption

Central Eastern Europe (CEE) is a region that can be defined in different ways. In this paper this term refers to the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia, eight of the ten countries that joined the European Union in 2004. It is important to note here that these countries represent diverse cultural traditions. The objective of this paper; however, is not to attempt a comprehensive analysis taking into consideration all the diversity, but to point out general trends characteristic of the region.

2.1 The transition to market economy

The countries of the CEE region all belonged to the so-called socialist block, which means that they all had centrally planned economic, political as well as welfare systems. Out of the three actors usually considered in the provision of welfare - the market, the family and the state - in the socialist countries most of the responsibility rested on the state (Esping-Andersen, 1990). The state, rather exceptionally,

- assured complete employment (which was achieved through over-staffed state companies),
- provided for free education for all including nursery and kindergarten care and education to allow for the employment of women,
- provided for a social as well as health care system that was freely available for everyone, and tried its best to assure that everyone

[23] EMUDE stands for “ Emerging User Demands for Sustainable Solutions” and was supported by the EU’s 6th framework programme. More information on the project can be found at http://www.sustainable-everyday.net/EMUDE/.

was included in society and had access to the provisions of the welfare system, and
- through subsidies kept the prices of products and services low, making them available for the majority of the population.

In this system, of course, one could find examples of exclusion, there were differences between the rich and the poor, but compared to the differences existing in capitalist societies today, they were much less pronounced.

In the background, however, there was mounting pressure on the environment as it was viewed as a resource freely available for exploitation, and neither the material nor the energy efficiency of production were priority issues (Tellegen, 1996). Additionally, full employment, free education for all, well planned and cheap public transport systems as well as a good quality social and health care system were very expensive to maintain. These, together with the increasing number of people demanding more political freedom, the freedom of speech and the freedom to self-organise, necessitated a change that took place in the late 1980s and early 1990s. (Ferge, 2001; Firgyesi and Kapolyi, 2005)

2.2 Consumption and consumption trends in CEE

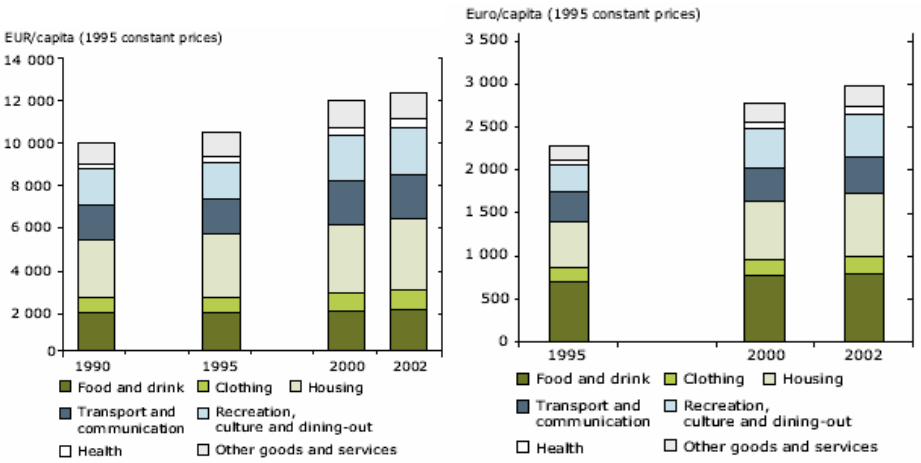
Household consumption was constrained in the past regime so much that some authors label this period as the "economy of permanent shortage" (Buchowski, 1996:85). At the same time, the efficiency of production was not an issue for reasons mentioned above and also because there was no real competition on the market. All of this changed during transition. Inefficient companies needed to be closed down, competition picked up, and household consumption, though first stagnated or even decreased in some of the countries, quickly started rising again. Increased levels of consumption are expected to result in increased pressure on the environment. In CEE countries, at least for the initial period after the change, pressure on the environment as measured in emissions decreased due mostly to the closing down of the most polluting companies (Archibald et al., 2004).

Overall consumption trends; however, have been quickly counteracting this initial positive environmental impact. Household spending has been increasing as data from the GEO data portal[24] and the EEA (2005) in Figures 1, 2 and 3 illustrate. In spite of this, spending is still well below Western European levels, although the average per capita ecological footprint of Central Eastern European citizens is about three quarters of that of the average Western European (WWF et al., 2005).

In summary, it can be said that although levels of consumption in the new member states are currently about one fifth of those in old member states, consumption, and together with it its environmental impact are rapidly rising. Furthermore, as growth in consumption is considered to be beneficial for economic development, and increasing it is the most important goal of new member states, it is likely to grow further unless a rather drastic change in thinking about the quality of life is effected.

[24] UNEP's online database at http://geodata.grid.unep.ch/

Figure 1: Household expenditure per capita in EU-15 countries and in 5 new member states (EEA, 2005:17-18)



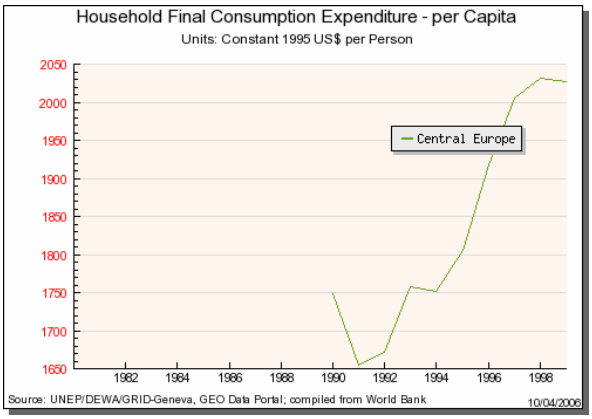
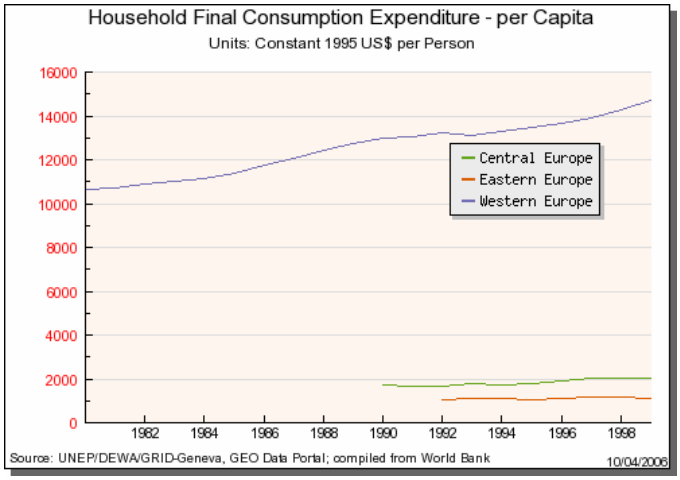


Figure 2: Change in household final consumption expenditure in Central Europe (GEO data portal)

Figure 3: Household final consumption expenditure in the different regions of Europe (GEO data portal)



3 Creative communities in CEE

Creative communities have existed and more are emerging in the Central Eastern European region just as well as in Western Europe. The reasons for people to join their forces and search for novel and more sustainable ways of performing everyday activities are just as diverse in CEE countries as they are in Western Europe. The most important motivations in CEE are the following:

- finding local and customized solutions to problems and needs that are not fulfilled by mainstream society,
- strengthening the social fabric and enhancing social inclusion,
- solving social problems such as unemployment and the depopulation of villages,
- ensuring better protection of the environment and a more efficient and environmentally friendly use of resources,
- finding alternatives to capitalism and market economy, the only solutions presented after the change of regime at the end of the 1980s – beginning of 1990s.

It would be difficult to say which motivation is the most important one in the region, but it is important to emphasize that in the majority of cases creative communities, although they may be focusing on the solution of a particular problem, often provide answers to a variety of issues. Thus, in a great proportion of the cases both social and environmental sustainability are positively affected. Below, I examine some of the motivations that I consider important, and then describe specific characteristics of CEE countries that could be taken advantage of in promoting creative communities, and through them more sustainable consumption patterns.

3.1 "Filling the gap": providing services no longer granted by the state

Although it was greatly needed and anticipated, the transition to market economy, capitalism and democracy, bringing with it the move to decentralisation, came as a great shock to a large part of the population in CEE countries. The most important reason for this is that the state had to discontinue its paternalistic role of providing for everyone. Thus, CEE societies had to face the

- closing down of factories that resulted in unemployment as well as the closing of factory-supported nurseries and kindergartens,
- enlarged the gap between the rich and the poor,
- steep decrease in the purchasing power of salaries, and
- the privatisation of welfare services.

(EC, 2003; Ferge, 2001; Frigyesi and Kapolyi, 2005; Haney, 1999)

These changes in the society and economy of CEE countries explain why there was a sudden need for creative, civil society solutions to attempt to close the gap in the provision of social services and the satisfaction of people's needs.

Thus, in responding to a shortage in **nurseries and kindergartens** that resulted in much larger groups in remaining institutes, overburdened staff and a situation not so conducive to the development of children, in CEE countries we now have small, often family-run nurseries, kindergartens and day-care services such as those exemplified by the "mini kindergarten"

cases[25] found in the region. These kindergartens contribute to local social sustainability by hiring teachers and staff who were previously unemployed, establishing links and cooperation between the stakeholders in nursery education such as the parents, the local government and the teachers. Environmental sustainability is enhanced by the location of the nursery close to where the children live thus reducing transportation needs, using toys made locally, often by the parents and of natural materials, and food for the children is also purchased locally, often from local growers. Furthermore, children in these schools learn more sustainable everyday life patterns through being part of them, and it is hoped that this will have an impact on their adult life.

The **care of the elderly** was also shaken during the transition years. Due to the state no longer being able to provide for their care, old-people's homes had to be closed down. This, end the decrease in the purchasing power of pensions, necessitated that people get together and find solutions to help those who do not have caring families, still an important dimension of taking care of the elderly. Thus, there has been a new interest in starting senior clubs, which provide space for the elderly to get together, engage in creative crafts and performance as well as sell the products they made in their own shop, and also dine together cheaply. Such clubs thus help the elderly to actively engage in society, keep local traditions, arts and crafts alive as well as teach them for the younger generation. The fact that this also promotes the use of locally available resources and materials is an important contribution to environmental sustainability.

An additional very important problem in the region is the combined effect of **unemployment**, **urbanisation** resulting in the **depopulation of villages**, and the lack of employment in rural areas. These factors motivated a number of very devoted people to initiate so-called eco-village projects. Although this is closely linked to this section, it also highlights another important motivation to form creative communities, and is described below.

3.2 Finding alternative ways of development

Eco-villages in the region create an alternative development model for settlements. They can be viewed as project providing complex solutions to a number of problems existing in contemporary CEE society. The EMUDE research project identified several cases in the region; however, numerous other projects could be related, alone in Hungary there are more than a dozen eco-village initiatives. What is common to them is that they promote an environmentally friendly lifestyle including housing, work and food while attempting to overcome social problems. They offer complex solutions to various challenges present in the countryside: environmental degradation (organic agriculture and utilisation of alternative energy sources), depopulation of villages (creating local jobs and attracting people from the cities), and lack of local jobs (reviving local crafts and traditions). Thus, as well as promoting more sustainable consumption patterns, they may also serve as models for more sustainable local development.

The *Model Eco-friendly Hamlet* in Poland (Meroni, 2006), for example, strengthens the local social fabric by involving people in various projects to save the local school from closing. Projects are also developed to improve

[25] A more comprehensive discussion of the cases can be found in Meroni, 2006.

the image of the village, which at the same time acts against its depopulation. Eco-tourism, the revival local crafts, and alternative energy generation are all part of the new development. As more local people get involved, more projects are conceived of and implemented with the coordination of a local not-for-profit organisation.

An example from Hungary is the *Gömörszőlős Sustainable Village Project* in North of the country. Its aim is the revitalisation of a small village inhabited by a couple of hundred people, mostly elderly, and the solution of social and (un)employment problems based on the principles of sustainable development. The project is managed by The Ecological Institute for Sustainable Development, a not-for-profit organisation that drew up a comprehensive development plan for the village (see Figure 4 for the outline of the plan), which is piloted there and can later be used in the other villages of the region. It includes local institutional capacity building and training for the people in the demonstration and training centre of the village that was renovated using traditional and environmentally friendly technologies.

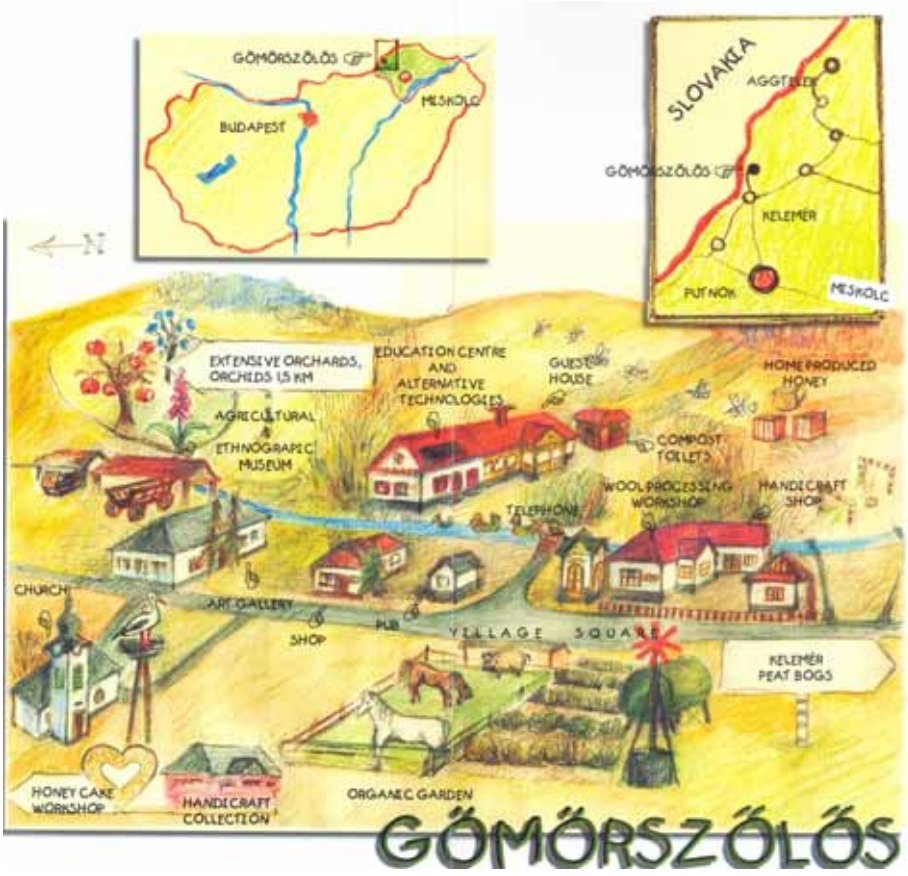


Figure 4: The development plan for the Gömörszőlős Sustainable Village Project[26]

[26] Source: leaflet of the Gömörszőlős Sustainable Village Project produced by The Ecological Institute for Sustainable Development in Miskolc, Hungary

An important feature of the project is that, similarly to the Polish Model Eco-Friendly Hamlet, it does not create a completely new village but instead sets out to develop an already existing one.

A different case from Hungary is the *Open Garden Foundation*[27] that is a not-for-profit organisation in central Hungary. It runs a community-supported agriculture project through operating a demonstration organic market garden and a vegetable box scheme, both of which employ local people and people with disabilities. Its objective is to promote the consumption of locally grown seasonal food, to connect producers and consumers directly and by doing so contribute to the creation of healthy communities.

It needs to be mentioned here that in the majority of cases the present economic and infrastructural setting is not conducive and supportive to creative community initiatives. Alternative solutions to energy generation or wastewater treatment are often not accepted by authorities issuing the permits. Unlike in some Western European countries, for example in the Netherlands (Spaargaren, 2003), people do not have a choice of what kind of energy generation they support. Furthermore, for people living in the country more flexible forms of employment would be needed so that they can engage in creative communities work as well as look after their households and smallholdings. As a result of these challenges, the initiatives are fairly often struggling to "stay alive" or in other words, to achieve economic sustainability, and rely heavily on devoted "heroes", national and European Union funding, and also on volunteer work.

4 CEE characteristics that can be built upon in promoting creative communities and sustainable consumption

4.1 Experience in being parts of groups

In the past regime, ruling communist parties in CEE countries organised all kinds of group activities, and, in fact, greatly encouraged participation in various communal events *within* the realms of the party. As a result, people were involved in youth groups, belonged to the local housekeepers' association, took part in local clean-ups, tree-plantings, party festivals, helped their children to collect waste separately, attended clubs for seniors and participated in neighbourhood watch schemes and in numerous other collective activities. Thus, it can be said that the communist party tried its best to include everyone in some kind of a group, each of which had quite a full and varied schedule of activities. (Buchowski, 1996)

This has both a negative and a positive impact on the formation of creative communities. To begin with the former, it needs to be mentioned that after the transition groups and communities began to be associated with the old regime, thus getting rid of them was considered to be the sign of development.

At the same time, a large number of people had very positive experience of belonging to and being active in groups, which they started missing after the transition. This experience and positive memories could be taken

[27] More information on the project can be found at http://www.nyitottkert.hu/.

advantage of in presenting newly emerging creative communities to central eastern societies.

Furthermore, it needs to be born in mind that although independent and politically active civil society was largely missing from life under the communist rule, people were active in extended kin groups and informal interest groups. These were a necessary part of survival in the "economy of permanent shortage" (Buchowski, 1996). In these groups, people often shared cars, tools, and assisted one another in house building, gardening or animal husbandry; practices that still form a natural part of life for a great number of people.

4.2 Consuming local products

Consuming local or at least regional products was encouraged in the past regime to reduce dependence on imports from outside the socialist block. This movement was kept in the region but gained a new momentum in the globalizing world. Its aim now is the protection of local jobs and local products through buying them instead of imported ones. This can even be said to be a mainstream movement with a specific logo in Hungary, for example, for products made in the country.

Another characteristic is the tradition to buy local fruits and vegetables at the local market. This, of course, is weakening with the increasing popularity of hypermarkets. But in the fairly recent past, for example, in Hungary, each village and town held a market at least once a week on Saturday where local people came to sell their produce and thus supplement their income. Village as well as town people purchased their weekly supply of fresh local vegetables and fruits at these local markets.

However, with the change of economic system, the increasing popularity of supermarket shopping and more stringent EU legislation for markets (regarding food safety, hygiene and market operation), a great number of the markets needed to be closed down. This way, small growers were forced out of the market or now need to travel long distances to be able to sell their produce.

As this tradition is still fairly strong in the CEE region, there is great potential for strengthening and improving already existing initiatives with ideas from Western European cases such as the ones collected and studied in the EMUDE research project (Meroni, 2006):

- the *Local Food Link Van Group* that organizes growers into a common marketing and delivery group, or
- the *Cream o'Galloway Dairy Farm*, which turns an organic dairy farm into a local tourist and educational attraction by opening it to customers and other interested people; this way creating an alternative source of income for the farmers.

4.3 Culture of reuse and recycling

Recycling and reuse on the household scale has a long and strong tradition in CEE, partly due to the "economy of permanent shortage" before the transition, which was already mentioned and discussed above. People are reluctant to throw their things away; they can always find a new use for old objects, give them to their neighbours and relatives, or get rid of them at the annual junk-clearance organized by municipal governments. On the junk-clearance days, people put their unwanted objects, furniture, clothes, bicycles, etc. on the street and before the municipal government collects

them anyone can come and take them away for free. This practice and the strong tradition of reuse can explain why initiatives teaching people new ways of reuse and recycling were found to be widespread and popular in the region in the EMUDE project.

4.4 Existing infrastructure

The most significant type of infrastructure that needs to be mentioned is the good public transport networks in CEE countries that were designed to reach even the remotest villages. However, with most of the attention, including financial resources, now drawn to road and motorway building, they are quickly deteriorating. Whereas their maintenance and upgrading could greatly contribute to social inclusion through making it possible for people in remote villages to travel to schools and jobs to their local town since they cannot afford to own cars. This may not reduce the need for bicycle associations, mobile bicycle repairmen, car sharing or "walking bus" initiatives found overwhelmingly in urban areas in Western European countries, but especially from the point of view of reducing pressure on the environment, public transport networks should be kept in the focus of mobility oriented solutions.

5 Overall conclusion

In summary, the most important conclusion to draw is that in the new Central Eastern member states of the European Union there is a lot of experience and skills to build on in a move to promote creative communities, a participatory welfare society and sustainable local development. At the same time, as this region is moving rapidly towards the mainstream Western European way of living and consuming, as well as becoming globalised; these experience and skills are becoming lost and forgotten. Thus, there is a rather urgent need to strengthen what still exists and to provide people with positive examples from the west that could be easily adapted to Central Eastern circumstances and local needs. The fact that CEE countries still have, or at least remember, the patterns of life that Western societies are re-learning and re-discovering is something that should be valued and protected.

Meanwhile, new patterns of consumption such as car sharing, solidarity purchasing and shared housing could be introduced and presented as alternatives to consumer society. In doing so, it needs to be born in mind that both parts of the European Union have valuable experiences, production and consumption patterns as well as skills to offer one another, and these could be taken advantage of in better ways.

On the other hand, it is important to remember that creative communities, although numerous examples do exist, represent only a rather minor section of society and the people working in and for them have to overcome a variety of difficulties to succeed in creating not only socially and environmentally, but also economically sustainable solutions. Consumers are often locked into inflexible systems in their everyday activities such as eating, moving, housing that not only limit the choices available to them, but often make it impossible to implement more sustainable options. To cite an

example for this, to have a permit issued for a household wastewater treatment system other than joining the local sewage network is very difficult in Hungary. Additionally, choices are limited further by funding and investment priorities, as well as loan and mortgage policies not taking sustainable consumption options and alternative solutions into consideration. For example, mortgages for newly built houses in new development areas are more favourable than those for buying and renovating old houses.

Finally, when formulating sustainable consumption policies for the European Union, it is important to consider the different past of people living in the new member states as well as the positive and negative effect it might have on the implementation of policies. People in the CEE region, for instance, have experience of shared use but they associate it with the economy of shortage and otherwise unsatisfied needs. Therefore, a policy designed to popularise and encourage it should frame it very carefully to avoid evoking negative associations while taking advantage of the experience and skills people have.

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Chapter 14 Design for Sustainable Consumption

New roles designing system innovations

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1 Abstract

Transition towards sustainability requires **radical changes** in the way we produce and consume and, more in general, in the way we live. The prospect of sustainability necessarily places the very model of development under discussion. In future decades we must be able to move from a society in which well-being and affluence are measured by the production and consumption of goods, to one in which people live better consuming (much) less. In fact, we need to learn how to *live better* (the entire population of the planet: *equity principle*) and, at the same time, *reduce our ecological footprint*. In this framework the link between the environmental and social dimensions of this problem clearly appears, showing that **radical social innovation** will be needed, in order to move from current unsustainable consumption models to new sustainable ones.

Given the nature and the dimension of this change, we have to see transition towards sustainability (and, in particular, towards sustainable ways of living) as a *wide-reaching social learning process* in which a *system discontinuity* is needed. Therefore a, system approach is important in order to seriously tackle the transition towards sustainability, i.e. so called **system innovations** should take place.

It is also important to frame this approach within a profoundly modified conception of the surrounding world; within the increasingly **interconnected** and **multicultural** context of globalisation (or *transnationalisation*). Nowadays it is very clear that contemporary social reality is no longer

[28] The paper is the results of a collaboration between the two authors; nevertheless Vezzoli wrote chapters 2, 3, 4, 7, 8, 9, 10 ,11; Manzini wrote chapters 5, 6.

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conceivable in terms of isolated, rooted and independent worlds, nations or communities. Within this context, a promising emerging economic model is that of **distributed economies** (e.g. distributed energy generation, distributed computing (peer-to-peer), and creative communities, cooperative networks), that could reduce the environmental impact, while facilitating a resources access democratization. So forth, in terms of sustainable consumption and system innovation, a key role could be played by **local-based and network-structured enterprises, initiatives and activities** (e.g. *Creative communities* and *cooperative networks*).

In this framework the paper reviews how the discipline of *design for sustainability* has enlarged its scope and field of action. From *material and energy low impact selection*, to *Life Cycle Design* or *Ecodesign* of product, to **design for eco-efficient Product-Service System**, to **design for socio-ethical sustainability** (where the equity principle of sustainability is directly addressed, and not indirectly as a potential result of a radical resources reduction in industrialized contexts). An emerging hypothesis is that a design approach that seeks to tackle radical innovation and sustainable consumption effectively should operate (and define the way to do so) on a **system innovation** level. A design with a strategic approach towards the **promotion/development of local-based and network-structured initiatives.** A design for sustainable system innovation starting with the local, but at the same time (to avoid being limited to localism) developing a **transcultural - "migrant" creativity - attitude,** so as to be endowed with an effective social creativity, able to become part of the wider transition towards sustainability.

Finally, new roles to be played by design **Higher Education Institutions** (HEIs) as fundamental to this transition process are emerging: HEIs not only as places for (advanced) education, but even as **diffusers of sustainable ideas** and **incubators of sustainable** (locally based and "networked") **enterprises**".

2 Sustainable consumption and system innovations

In the second half of the '90s a series of studies and analyses led to a clearer understanding of the dimension of change necessary to achieve a society that is effectively and globally sustainable. It was then realised that conditions for sustainability can only be achieved by *drastically* reducing the consumption of environmental resources compared to the average consumption by mature industrialised societies.

The debate about more sustainable consumption patterns has been included in the agenda of the major international governmental institutions over recent years starting with the United Nations. Particularly significant was the setting up of the *Sustainable Consumption* Unit of the UNEP (*United Nation Environmental Programme*) in May 2000. The initial assumption was that "in spite of the progress made by the industrial world and enterprise during the last decade […]the extent to which consumption exceeds the Earth's capacity to supply resources and absorb waste and emissions is still dramatically evident" (Geyer-Allely E., 2002).

Some studies (taking into account demographic growth forecasts and hypothesising, rightly, an increase in the demand for well-being in currently disadvantaged countries/contexts) have brought out a staggering result:

conditions for sustainability are achievable only by increasing the eco-efficiency of the production-consumption system by at least ten times. In other words we can only consider sustainable those socio-technical systems whose use of environmental resources per *unit of satisfaction/service rendered* is at least 90% below what is currently to be seen in mature industrial societies[29].

These estimates are approximate and currently under scientific discussion. However, they are still valid to indicate the proportions of the change that should take place. A profound, **radical transformation** in our development model is necessary and the production and consumption system in this sustainable society will be profoundly different from what we have seen up to now. This scientific evidence leads political, scientific, philosophical and social debate to question not only production processes and artefacts (products and services, infrastructure and all the various forms of anthropological settlement), but also patterns of consumption and access to goods and services. In other words the prospects are of **radical social innovation and system innovation in general** (UNEP , 1993; ERL, 1994; ERL, 1993).

Discussion about consumption patterns in the framework of a transition towards sustainability has been included in the agenda of the major international governmental institutions over recent years starting with the United Nations[30].

Over the next few decades we must enable ourselves to move from a society where well-being and economic health are measured in terms of growth in production and material consumption, to a society where we are able to live better consuming far less, and to develop the economy reducing the production of material products.

A context where economic growth can not be seen as the ultimate goal, and where, as Sen upholds (Sen, 2000), freedom is the initial means by which to achieve a development that must be orientated towards improving life; freedom as a guarantee that people are the protagonists of their own destiny and not the passive beneficiaries of a development programme[31]

How this may happen is at present difficult to foresee. It is, however, certain that there will have to be a **discontinuity** that will effect all facets of **the system.**

[29] On this question see works by Wuppertal Institut fur Klima, Umwelt, Energy; by the Advisory Council for Research on Nature and Environment (in particular: *The Ecocapacity as a challenge to technological development*,a study funded by a group of Dutch ministeries); by the *Working group on eco-efficiency* sponsored by the World Business Council for Sustainable Development (see particularly the final report *Eco-efficient Leadership*, WBCSD, 1996).

[30] The setting up of the *Sustainable Consumption* Unit in UNEP (United Nation Environmental Programme) in May 2000 was significant, but already in 1993 the same organisation published *Achieving Sustainable Consumption Patterns: the Role of the Industry*, UNEP IE/IAC, Paris.

[31] Sen proposes five types of freedom (correlated and linked to development policies): political (freedom of choice of government, freedom of the press, etc), economic (access to consumption and credit), social (access to education and health in function of access to economic activity), transparency (against corruption) and protection and security (from poverty and destitution, guaranteed by social security networks) (Sen A., 2000).

Given the nature and the dimension of this change, we have to see transition towards sustainability (and, in particular, towards sustainable ways of living) as a *wide-reaching social learning process* in which a *system discontinuity* is needed. Therefore a, system approach is important in order to seriously tackle the transition towards sustainability, i.e. so called **system innovations** should take place.

This complex issue can be summarised in the following question: how can we foster new quality criteria so as to separate the social demand for well-being from a relationship that is directly proportional to the increase in consumption of resources, characteristic of mature industrialised societies? And how can this process fit into and orientate transitions that are already in progress in mature industrialised societies, and those that are desirable for developing and newly industrialised countries?

In particular, what answers can the design world give to these questions?

Before looking at the answers that design research has given to these questions, we must take another step: we must place them in the context we are living in, a rapidly changing context of which we shall now recall some key factors.

3 A multicultural, interconnected, networked context

We must think of the transition towards a sustainable society in a profoundly modified framework, both in our conception of, and the reality of, the world around us: transformation in the nature of work, revolution in communication and information, emergence of genetics and biotechnology. In our modernity, individuals, ideas, images, products and money are in movement as never before possible and the fundamental characteristic of our modern subjectivity, where individuals and groups seek to include the global in their (modern) activities, is the effect that the interconnected elements of mass electronic communication and mass migration have, as Appadurai claims (Appadurai, 2001), on the workings of our collective, social imagination. It is an age in which the crisis of the nation state is evident, in which it cannot be taken for granted that effective public spheres are typically, exclusively or necessarily national; in which it seems hardly probable that nation states, in a complex interactive system, can in the long term govern relations between the global and the modern (Appadurai, 2001); a *liquid modernity*, to use Bauman's phrase, where everything is transitory, modifiable and experimentable (Bauman, 2005).

We live in a global context, (or rather *postglobal*, i.e. the crisis of globalisation (Deaglio, 2004)), that is becoming more and more **interconnected** and **multicultural.** It is by now evident that contemporary social reality is no longer thinkable in terms of worlds, nations or deep-rooted, independent, isolated communities. Although individuals continue to act in specific places, what has now become apparent to all is how the various geographical areas are linked together in different ways by a continual circulation of objects, people and information. This has changed and will continue to change relationship patterns, concepts and our perceptions of near/far, pertinent/afferent possible/impossible, belonging/extraneous.

We have entered a truly multicultural, interdependent world, which can be understood and changed only in a plural perspective that is able to converge cultural identity, global networking and multidimensional policy.

The new economy is organised, as Castelles says (Castelles, 2002), on global networks of capital, management and information, whose access to technological know-how lies at the root of productivity and competitivity. Interactive computer systems operate in wide-ranging, open networks and the information technology paradigm has jumped from mere connection between computers to *co-operative computing*, which reaches beyond the position of the subjects involved in the interaction.

Out of *networking* as a fundamental form of competition in the new global economy (and from its accompanying new information technology) has emerged a new organisation model: the **networked enterprise** (Castelles, 2002)**.** These are enterprises (and a growing number of organisations and institutions) that are organised in networks of variable geometry, the webs of which make the traditional distinction between large and small companies less important, and that provide services through their connectivity (their structural capacity to facilitate communication without interference between their component parts) and consistency (the degree of interest sharing between the goals of the network and those of its components). This is a new division of work based on the attributes and capabilities of each worker, rather than on the organisation of their working roles. Work is increasingly based on teamwork, *networking*, *outsourcing* and subcontracting.

Continuing along Castelles' line of thought (Castelles, 2002), our contemporary societies are increasingly built around a bipolar opposition between the network (globalisation) and the ego (identity). The networked society looks increasingly like a *meta-social* mess to the eyes of most people, where setting up a *meta-network* leads to the disconnection of non-essential functions, of subordinate social groups and of devalued geographical areas.

Interconnection and multiculture are key context factors that some people very explicitly interpret as aggravating circumstances (to defend oneself against), others as a necessary field of confrontation (the starting point), and others as an opportunity and driving force for sustainable innovation (to be exploited).

4 Sustainable consumption: between environmental and social ethical sustainability

Before going into more directly design-linked implications, let's reflect on another basic question: the environmental and socio-ethical dimensions of sustainability are in reality closely linked when we consider the fundamental issue of extraction, transformation and distribution methods used for the (primary) resources needed to produce energy and materials (for the maintenance of our production and consumption systems); and the related issue of the socio-economic stakeholders that hold and manage property rights and power over these processes. In particular, let's consider an underlying question, raised by all those studying the environment, namely

the transition from non-renewable resources (especially fossil fuels: oil, coal etc.), to renewable resources (sun, hydrogen etc.).

As we know, from a strictly environmental point of view, using oil (and other fossil resources) determines most of the carbon dioxide emissions that have, in their turn, caused global warming (due to the greenhouse effect); this in turn determines various environmental problems: increasingly violent climate phenomena, the desertification of some areas and rising water level in others, but also the migration of pathogens (both for man and animals). There are also many widely-known problems and environmental risks associated with the various extraction and transformation processes, and the transport of these resources.

Let's now look at the issue from an economic and socio-ethical point of view. Resources from fossil fuels – due to their localisation and the complexity of extraction and transformation processes – have lead to a series of highly centralised production and distribution infrastructures. The consequence has been a widespread centralisation of the economic infrastructure which, in the opinion of Rifkin (Rifkin, 2002) and others, has resulted in reduced opportunities for access to resources (above all to energy, and particularly electricity). This is the key factor in perpetuating poverty in the world[15]. It is therefore said (Rifkin, 2002) that the enlarging rift between rich and poor can to a large extent be attributed to the very nature of the fossil fuel energy regime. Without access to resources and to energy in particular, individuals have little control over their own destiny. Only by freeing themselves from oil, coal and natural gas imports, can developing and newly industrialised countries emerge, improving the economic conditions and quality of life of their populations.

As an alternative to fossil fuel, the use of renewable, local resources, starting with sun and hydrogen, presents indubitable environmental advantages, due to their reduced greenhouse effect (and its impact), inexhaustibility and lower environmental cost compared to the various processes of extraction, transformation and distribution.

What we are interested in underlining here is that these (renewable) resources by their very nature could lead to an extensive redistribution of power, towards single individuals, and this is a necessary step towards establishing the conditions that would enable the earth's riches to be shared more fairly. Coming back to what Rifkin and others said (Rifkin, 2002), this is the essence of a policy for bottom-up re-globalisation. Briefly, let's see why.

Sun and hydrogen can be used locally through relatively simple processes. The sun is inexhaustible and present everywhere, though in varying intensity (curiously, there is more sun in the so-called "Global South"). Hydrogen is the lightest, most elementary and widespread chemical element present in nature and is also practically inexhaustible. It does not naturally exist in a free form, but it can be extracted from natural sources.

[15] For example, many have observed (Stiglitz, 2002) that the rise in oil prices during the seventies and eighties was the main cause of debt increase in the third world. These nations were forced into debt, for billions of Euro, with international monetary institutions and with banks, to guarantee oil imports. In many of the world's poorest countries, the cost of paying interest and settling debts is today greater than the amount needed to provide essential services for their own populations

Technology for these renewable resources have still not been developed in a significant way, but already today the installation and management of photovoltaic (sun) and hydrogen combustion cells are infinitely less complex than plant for oil wells and refineries. They are therefore also installable and manageable by small scale economic entities, even by a single residential complex or single individuals.

If adequately exploited, sun and hydrogen (ubiquitous and inexhaustible) would enable every human being to have more power and move towards a democratic regime of resource management. These sources would allow micro-plants to be set up close to the end-user, who would no longer be only a consumer but also producer of the energy he uses. Autonomous photovoltaic panels and combustion cells could supply electricity rapidly and at a favourable cost. When a sufficient number of such micro-plants have been installed (whether purchased or managed), they could be connected together into micro energy-grids, and therefore into a constantly expanding (potentially global) energy grid. Individuals, residential complexes and local communities could in this way share and exchange energy, achieving self-sufficiency and consequently increased power, in a framework of greater interdependence. Ultimately, they could challenge the traditional centralised energy generating plants (born and developed during the age of fossil fuels), and escape the grip of the huge, powerful, energy and electricity companies, causing a radical change in important flows of power: no longer from top downwards, but from bottom upwards.

In short, such a decentralised infrastructure "fed" by renewable sources, on the one hand would reduce environmental impact, and on the other could facilitate a democratisation of resources and energy, enabling individuals, communities and nations to reclaim their independence while accepting the responsibility that derives from their reciprocal interdependence (self-sufficiency and interdependence).

Assuming these hypotheses of *distributed generation* (Rifkin, 2002), a new worldwide energy network could be grafted onto the developing global information networks and stimulate the birth of a new culture of participation. Giving access and power to local communities also contributes to enhancing the positive aspects of humanity's cultural plurality, where local cultural forms should aspire less and less to being possessions to defend, and more and more to being opportunities for positive cross-fertilisation towards a general improvement in the conditions of life on earth[18].

Renewable energy sources have the characteristics that lead to low environmental impact, decentralised and democratic production systems, but all this may not necessarily happen.

Whether in industrialised, emerging or developing contexts it will be essential to develop the capacity to gather large masses of producer-users into networks and associations with an adequate, decentralised, bottom-up, institutional approach, in order to guarantee more control to community members and power over their own destiny: for example, in developing countries, village co-operatives in collaboration with micro-credit banks[19].

[18] On this theme, see later the hypothesis of "migrant" creative thought for design.

[19] On a worldwide level, co-operatives are the best organised vehicles to set up and diffuse such economies, able to acquire local resources and make them operative, without the aid of huge transnational companies. Co-operatives are organised on a geographical basis,

More in general (i.e. not only in relation to solar and hydrogen derived energy) we can observe that in an interconnected context (in communications, but potentially also in resource management) a principle that double ties the environmental question to social ethics can be summarised as follows: **use primary local, conservative, regenerative (i.e. locally sustainable) resources and introduce decentralised system networks for the extraction, production and use of resources.**

It has also been observed (Sachs, 2002) that when they are local, social-economic stakeholders involved in the extraction, transformation and sale of resources, pay far more attention to preserving (resource) renewability. The obvious underlying reason is that their economic subsistence depends in the short, but also in the long term on these resources. Therefore they are not in favour of using them up.

At this point we can make a further observation.

There exists a potential for convergence between key environmental and socio-ethical strategies that is inherent in re-globalisation models characterised by diffused participation, where locally based networked communities and "network enterprises" (consisting not only of entrepreneurs, but also of users, NGOs, associations, institutions etc.) **assume particular value.**

This theme intertwines with other points of interest in research on so-called forms of alternative economy or alternative enterprises, founded on the concepts of co-operation, collectivity and collaboration (the so-called C factor (Razeto, 2004). In particular, it merges with research on "co-operative networks" and "creative communities" (Florida 2002; Manzini ; Manzini, Jegou, 2003), characterised by the self-organised activities of aware, critical, motivated citizens who are organized to a greater or lesser extent into networks and solidarity economy districts. In other words, it is linked to work on those forms of sustainable social innovation, i.e. solutions of high social quality and low environmental impact, that spring from active, bottom-up, social participation.

Because of their importance in a process of transition towards sustainability, we shall explore these phenomena in the following paragraph.

5 Promising cases: creative communities and cooperative networks

In the framework of contemporary society, cases of social innovation are continuously emerging in the form of new behaviour, new forms of organisation, new ways of living. Some of them are even more un-sustainable than the previous ones, but some others appear as interesting moves toward more sustainable ways of living. These cases may be defined as ***promising cases*****. i.e. examples of initiatives where, in different ways and for different motivations, some people have re-oriented their**

gathering single producers and consumers together in a participatory non-profit institution. According to ICA (International Co-operative Alliance) the principles are: the universality of associate member qualification, democratic participation, fair distribution of resources, autonomy, training, co-operation between co-operatives and community commitment. Aggregation of single consumers (and producers) to deal with their suppliers from a position of greater strength (collective bargaining).

behaviour and their expectations in a direction that appears to be coherent with the principles of social and environmental sustainability.

Even though, at the moment these promising cases are the expression of a few social minorities, and confronted with the main-stream ways of thinking and behaving many of them tend to disappear, they are crucial for promoting and orienting the transition towards sustainability. In fact they can be seen as social experiments and, as a whole, as a *large laboratory of possible futures*. A laboratory where different ways towards sustainability may be examined and assessed. As in every laboratory, nobody can say a priori which experiment will really be successful. Nevertheless, every attempt is a useful experience if we are able to recognize it and to learn from it.

In the following notes we well consider two clusters of promising cases: *creative communities* and *collaborative networks*.

5.1 Creative communities

Observing society as a whole in all its contradictoriness, we can see that alongside numerous worrying tendencies, signals are also emerging that indicate different and far more promising developments. Signals, still weak, but all the same stating clearly that another way of being and doing is possible.

For instance: groups of people who re-organise the way they live their home (as in the *co-housing* movement) and their neighbourhood (bringing it to life, creating the conditions for children to go to school on foot; fostering mobility on foot or by bike). Communities that set up new participatory social services for the elderly and for parents (such as young people and the elderly living together, or micro-nurseries set up and managed by enterprising mothers). Communities that set up new food networks fostering producers of organic items, and the quality and typical characteristics of their products (as in the experience of the Slow Food movement or of solidarity purchasing groups and fair trade organisations)[32]

The list of examples could continue, showing their variety, but also their common denominators[33].

In fact, considered as a whole, these promising cases tell us that, already today, it is possible to do things differently and consider one's own work, one's own time and one's own system of social relationships in a different light. They show that there are people who are able to act outside the dominant thought and behaviour pattern and organise themselves, and cooperate with others, to achieve concrete, positive results.

We will refer to them with the expression ***creative communities*: groups of innovative citizens organising themselves to solve a problem or to**

[32] See examples of promising cases in the SEP/EMUDE repository: http://www.sustainable-everyday.net/EMUDE/

[33] We refer here to the results of on-going research activities and, in particular, to the results in progress of EMUDE-*Emerging User Demands,EU* Specific Support Action.

open a new possibility, and doing so as a positive step in the social learning process towards social and environmental sustainability[34].

5.2 Collaborative networks

Something very interesting is happening in the field of organisation and the way people participate in collaborative projects. The starting point of this phenomenon is the organisational model emerging from the Open Source software movement[35].

Over the last decade the principles behind this highly collaborative approach have increasingly been applied to areas beyond the coding of software (Lessig, 2001; Stalder, Hirsh, 2002). And now, we can observe that these principles have been highly successful in proposing collaborative and effective organisational models in several other application fields.

For instance: the building of new common knowledge, as in the case of *Wikipedia*, the encyclopaedia that, in a few years, has become the largest one in the world. The realisation of new forms of social organisation as in the cases of *Meet-Up, SmartMobs* and *BBC Action network*: *"platforms for actions"* that enable people interested in doing something to get together (from renting a bus for a journey, to cleaning a river bank) and, once the necessary critical mass is achieved, to support them in doing it. The application of the peer-to-peer approach to health care activities, as in the case of *Open welfare*, a project led by the British Design Council.

The innovative character of these new models has to be underlined. All these examples of *collaborative networks* are characterized by motivations and ways of doing things that were unimaginable until a few years ago, , and that now appear to be possible. They are able to catalyze large numbers of interested people, organize them in a peer-to-peer modality, build a common vision and a common direction, and develop even very complex projects on a global scale (as in Wikipedia) or on a local one (as in *Meet-Up, SmartMobs* and the *BBC Action network*). Quoting the British Design Council, that refers to them with the expression *Open model*, they are: **new forms of organisation that do not rely "on mass participation in the creation of the service. The boundary is blurred between the users and producers of a service. It is effectively often impossible to differentiate between those**

[34] We have defined these people as "creative", because they are groups of innovative citizens who are creative enough to invent new ways to solve a problem and/or to open new possibilities (Manzini, Jegou, 2003). Considering the dynamism that characterize these creative communities we can connect the discussion on them to the old debate on the *active minorities* (Moscovici, 1979) and to the most recent one on the *creative class* (Florida, 2002), the *cultural creatives* (Ray, 2000) and the creative cities (Landry, 2000). Even though the kind of social creativity that interests us here (the creativity of citizens who are involved in creative communities) do not coincide with the one usually considered when talking about the creative class or cultural creatives, we can assume that they face similar problems and opportunities.

[35] The best-known open source collaborative experience is the Linux software, originally developed by the Finnish graduate student Linus Torvald. Anyone can use Linux for free as long as any changes or new features are shared with others at no cost. Simple rules, shared goals and clear yardsticks for judging performance, allows this global community to share ideas and, as a result, to improve the software, which is a *shared, public good.*

who are creating the service and those who are the consumers or users of the output" (Cottam, 2004b).

To conclude this part, it is useful to underline that *creative communities* and *collaborative networks*, until now, have been two different and rather separate phenomena. Except for some minor overlappings, they have been generated by different people with different motivations. Nevertheless, I think that, in the near future, they will converge and become a unique complex driver of social change. Doing so, they will strongly reinforce each other: creative communities will bring the lively richness of people involved in real, daily problems, and collaborative networks will bring the new opportunities that have been opened by their brand new forms of organisation[36].

But there is another important reason that makes them and their possible convergence so important: taken all together, they can become the building blocks of a new vision: the vision of sustainable *multi-local society*. A society based on a new relation between "local" and "global.

6 Multi-local society and distributed economies

Within this context, a promising emerging economic model to tackle the environmental, social and ethical dimensions of sustainability is that of a **multi-local society** and **distributed economies**.

Contrary to what was thought in the past, the joint phenomena of globalisation and increased connectivity have given rise once again to the local dimension. By the expression 'local' what is meant now is something very removed from what was understood in the past (i.e. the valley, the village, the small provincial town, all isolated and relatively closed within their own culture and economy). The new local combines the specific features of places and their communities with the new phenomena generated and supported world-wide by globalisation and by cultural, socio-economic interconnection.

As a matter of fact what we see are *creative communities* and *cooperative networks* who invent unprecedented cultural activities, forms of organisation and economic models that are the point of intersection of two complementary strategies: a balanced interaction between the local and the global dimension, on the one hand, and a sustainable enhancement of local (physical and socio-cultural) resources, on the other hand.

What appears is a kind of *cosmopolitan localism* (Sachs, 1998, Manzini, Vugliano, 2000, Manzini, Jegou, 2003), intended as the result of a particular condition characterised by the balance between being localised (rooted in a

[36] Looking at these emerging phenomena, it is reasonable to assume that the same principles of peer-to-peer organisation can be extended to facilitate the emergence and diffusion of new creative communities and, with them, of new ideas of welfare and well-being (Cottam, 2004b). On the other hand, we can also assume that the convergence between creative communities and cooperative networks can, and eventually must, be facilitated by an appropriate mix of bottom-up/top-down initiatives. I.e. in order to succeed, it requires *new forms of governance.*

place and in the community related to that place), and open to global flows of ideas, information, people, things and money (Appandurai, 1990). This is quite a delicate balance as, at any time, one of the two sides can prevail over the other leading to an anti-historical closure or, on the contrary, it can lead to a destructive openness of the local social fabric and of its peculiar features.

Creative communities, *cooperative networks* and *cosmopolitan localism* are, as it has been said, the building blocks for a new vision: **the vision of a sustainable society that can be defined as a *multi-local society*. I.e. a network of interconnected communities and places, at the same time, open and localised.**

6.1 Small is not small and local is not local

In the framework of the multi-local society the dominant ideas of "global" and "local", and the ones of "large" and "small" are challenged. In fact, for its nature the multi-local society is a highly connected world. And, in this kind of world, *the small is not small*: it is instead (or it can be instead) a knot in a network (the real dimension of which is given by the number of links with other elements of the system). Similarly, and for the same reasons, *the local is not local*, but it is (or it can be) a locally based, cosmopolitan community.

In this conceptual and practical framework, the *multi-local society* appears as a society based on communities and places[37] that are, at the same time, strong in their own identity, embedded in a physical place *and* open and connected to other places/communities[38].

In other words: in the multi-local society, communities and places are junctions of a network, points of connection among short networks, which generate and regenerate the local social and production fabric and long networks, which connect that place and that community with the rest of the world (De Rita, Bonomi, 1998). Junctions that connect "long global networks" with "short local networks" and that, doing so, provide support to organizational forms and production and service systems based on the *subsidiary principle* (that is: to do on a larger scale only what cannot be done on a smaller scale, i.e. at a local level).

Today, the vision of the multi-local society is still far from the mainstream, but it indicates a direction that, for several reasons, can be

[37] It is important to underline that the vision of the multi-local society doesn't propose at all a nostalgic view of the past: it doesn't refer to little, local autarchic entities, but to places, communities and systems that are, as it has been noted before, highly interconnected.

[38] It should be added that cosmopolitan localism generates and is generated by a new idea of well-being. This well-being is based upon the awareness of the way and the extent to which some local qualities can contribute to the possibility of feeling good; moreover the awareness of how and the extent to which, for example, the sense of security resulting from a still active social fabric, the healthiness of the places, the beauty of the landscape etc. can contribute to well-being (Censis 2003). This awareness regarding the positive role of quality of context in the definition of well-being is what, first and foremost, distinguishes localism, on which we are focusing here, from the traditional local "village culture" (which, normally, did not attach any value to these characteristics of physical and social context). This awareness, combined with the delocalising potential of information and communication technologies, leads to the spread of new forms of local-global activities which strongly concur to the definition of cosmopolitan localism: why be a broker, a musician or a potter in an inhabitable place, when one can do the same in Tuscany without losing one's necessary international contacts?

successfully undertaken. In fact, not only is it *locally practicable*, given that, as it has been said, it is based on *real cases of social innovation* (the creative communities and the collaborative networks), but also it is coherent with (another) *strong driver of change*: the rise of the *distributed economies* as a potentially successful option.

6.2 Distributed economies as a viable option

In the last decades the adjective *"distributed"* has been increasingly used in relation to several different socio-economic systems: information technologies, and *distributed computing*. Energy systems and *distributed generation*. Production and the possibilities of *distributed manufacturing*. The processes of change and *distributed innovation*, *distributed creativity*, *distributed knowledge*. And, finally, in relation to the overall socio-technical systems, the rise of new, more effective economic models: *distributed economies*.

Some of these concepts became mainstream two decades ago (the "classic" distributed computing). Some of them have a strong position in the international arena (such as the concepts of distributed generation and distributed manufacturing). Some of them have emerged, and are emerging, in current years and have a wide and growing audience (distributed innovation, distributed creativity, distributed intelligence and distributed economy).

In all these cases, what the term *distributed*[39] adds to the substantive to which it is related, is the idea that it has to be considered as a web of *interconnected, autonomous elements*, i.e. elements that are capable of acting autonomously, being, at the same time, highly connected with the other elements of the system.

In different words: **what the adjective "distributed" indicates is the existence of a *horizontal system architecture* where complex activities are accomplished in parallel by a high number of connected elements (technological artefacts and/or human beings).**

Considered as a whole, the diffusion of this particular system architecture can be seen as the result of two major *drivers* and of a new *technological platform*.

- *techno-economic driver*: the search for flexibility, effectiveness, waste reduction, system robustness and security.
- *socio-cultural driver*: the search for being creative, autonomous and responsible, as a basic human inclination, particularly developed in the contemporary society among a growing group of people .
- *new technological platform*: the present higher degree of connectivity and the possibility that it offers to manage very complex systems.

The perspective of the distributed systems could be an interesting model per se: a very productive line of socio-technical innovation to be explored in all its possibilities.

But the same perspective becomes even more important considering its environmental, social, cultural, and political implications:

[39] *to distribute*: to divide something into portions and dispense it (from: Wiktionary – the wiki-based Open Content dictionary).

- *socio-economic implications*: by bringing a large part of the value creation process to a local scale, distributed economies generate, and maintain, local wealth and local jobs. At the same time, intensifying local activities and interactions, they reinforce the *social fabric* and prepare a favourable ground to optimise use of , and regenerate, the existing *social resources*.
- *environmental implications*: by reducing the scale of their individual elements, distributed systems permit optimal use of local resources and facilitate forms of industrial symbiosis (and, therefore, reduce waste). In parallel to this, by bringing production nearer to both local resources and final users, they permit a reduction in the average transport intensity of its activities (and, therefore, a reduction in congestion and pollution).
- *political implications*: by bringing the power of decision nearer to the final users and increasing the visibility of the systems on which decisions have to be taken, distributed systems facilitate democratic discussions and choices. In particular, given that the advantages and problems that are related to a choice can be better compared, they facilitate individuals and communities in taking responsible decisions.

The concrete possibility of developing distributed systems with high environmental, socio-economic, political implications depends on several issues. One of them is a better understanding of their potentiality and the ability to recognize potentially successful cases.

7 The evolution of sustainability in design

What we have been describing so far is probably the most fertile territory on which design too, must be able to (and understand how to) work. However, it is useful to trace briefly some fundamental moments through which sustainability has been and has been interpreted by the design world, in order to gain a better understanding of the role of design research and practice in relation to sustainable consumption.

Historically, since the environment question was raised during the second half of the last century, the approach of mankind has moved from damage remedy policies (end-of-pipe approach) to actions increasingly aimed at prevention. In other words, we have moved from action and research focused exclusively on de-pollution systems, to research and innovation efforts that aim to reduce the cause of pollution at source[28] (or more generally, of the environmental impact).

In this framework we can identify some fundamental moments in the evolution of sustainability in design (Vezzoli, 2005; Pietroni, Vezzoli, 2004).

A first level on which theorists and academics have been working, is the choice of resources with low environmental impact: materials in one direction and energy sources in the other. Fundamental requirements have been and still are that resources should be: innocuous, recyclable, biodegradable and renewable.

[28] The watchword of the United Nations Environmental Programme, and other institutions, became “cleaner production”: defined as “the continual redesigning of industrial processes and products to prevent pollution and the generation of waste, and risk for mankind and the environment”

In the second half of the nineties, attention partially moved to the product level. i.e. to the planning of products with low environmental impact. The environmental effects attributable to a product and how to assess them became clear; in particular the concept of life cycle was introduced, and the concept of *functional thinking* (Mont, 2002) (more technically: functional unit) was recontextualised (from an environmental point of view).

Over the last few years, starting with a more stringent interpretation of sustainability, that tells us we must work radical changes in production and consumption models, attention has partially moved to design for eco-efficient system innovation, therefore to a wider dimension than that of the single product.

Still more recently, design research has opened discussion on a possible role for design in the socio-ethical dimension of sustainability. In other words on various questions associated with the principle of equity in the availability and distribution of resources.

For a succinct understanding of the state-of-the arts in the discipline as a whole, we have charted these dimensions in a diagram that highlights, on one hand, the level of disciplinary consolidation (derived from the results of design research) and, on the other, their level and dissemination in planning practice (and in HEIs). With reference to the following diagram (fig 1), we find the new research frontiers in the bottom left hand corner (0% consolidation and dissemination); and in the top right hand corner (100% consolidation and dissemination) the point towards which we should steer the various dimensions of the discipline; i.e. towards a high degree of consolidation and widespread dissemination in planning practice.

In this chart, the choice of low impact material/energy and the LCD/eco-design of the product are positioned at a good level of consolidation (Vezzoli, Manzini, 2002; Vezzoli, 2004) and a discreet level of penetration in planning practice.

For eco-efficient system design, the level of consolidation is inferior and practice is, logically, far more sporadic.

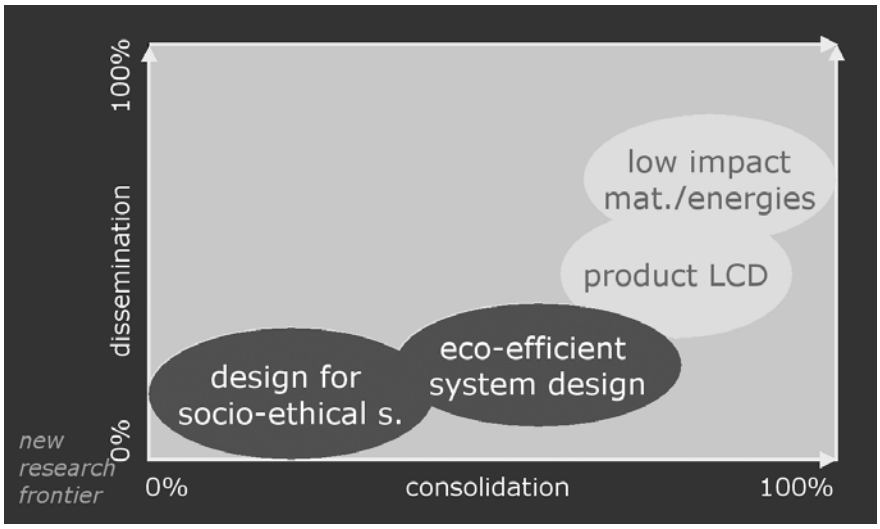

Fig. 1 Chart showing the consolidation and dissemination levels of design for sustainability

On the design for socio-ethical sustainability front, little has been elaborated at a technical level (it is, as we say, a new research frontier) and there are obviously very few teaching proposals.

If we then examine the theoretical contributions made by design culture in the field of consumption, not all of them are necessarily recent. Already at the end of the sixties, for various reasons, the theory and culture of design in Italy anticipated a critique of consumption patterns[31], or at least some of the leading figures in the culture of design acted as spokesmen for issues relating to the responsibility of designers for consumption patterns, although in different ways and not directly and exclusively associated with environmental impact. We can recall the criticism of consumer society made in denouncements by some Italian exponents of *Radical Design* on the one hand, and the reaction of Tomas Maldonado on the other, who appealed to a new "design hope". The question of designer responsibility was again brought up at the beginning of the seventies, though never resolved in its implications for design practice. Victor Papanek and Tomas Maldonado express similar positions, as far as regards the role of consumption. Papanek writes: (design can and must become a means for young people to take part in the transformation of society" (Papanek, 1973).

Over the last few years, starting with a more stringent interpretation of sustainability, contextualised in the development framework we have just outlined, attention has partly moved to **design for eco-efficient system innovation;** therefore to a wider dimension than that of single products. This all intertwines with the opening of discussion on a possible role for design in the **social and socio-ethical dimension of sustainability** (associated with the principle of equity in the availability and distribution of resources).

[31] For a further study of the Italian situation see (Pietroni., Vezzoli, 2004).

When addressing socio-ethical sustainability, the equity principle of sustainability is directly addressed, and not indirectly as a potential result of a radical resources reduction in industrialized contexts (as we see before with the approach to system design for eco-efficiency).

In the following paragraphs we shall therefore focus our attention on system design as far as regards eco-efficient innovation and on social and/or socio-ethical design as far as regards sustainability because, as we have been saying, these are the most significant ambits in which to act to promote radical changes for sustainable consumption (also through design), seeking to identify the correlated design skills.

8 System design for eco-efficiency

Over the last few years some design research centres, starting with a more stringent interpretation of environmental sustainability (that requires a systemic discontinuity in production and consumption patterns) have reset part of the debate on design for sustainability starting from system innovation. Some authors have observed that the criterion for product lifestyle design meets obstacles in traditional supply models of product sales (Stahel, 2001; Cooper, 2000).

They therefore state the necessity to widen possibilities for innovation beyond the product, particularly to innovation of the **system** as an integrated mix of **products and services** that together give "**satisfaction"** to a particular demand for well-being. Systems where attention is paid to the eco-efficiency deriving from the possible partnerships/interaction between socio-economic stakeholders belonging to a particular value chain, or as Normann defines it a particular value *constellation* (Normann, Ramirez, 1995).

Taking the definition given by the United Nations Environment Programme (UNEP, 2002), a Product-Service System (PSS) is described as: "the result of an innovative strategy that shifts the centre of business from the design and sale of (physical) products alone, to the offer of product and service systems that are together able to satisfy a particular demand". It is also claimed that a systems approach can "lead to a systemic minimisation of resources, as a consequence of innovative stakeholders interactions and related converging economic interests".

To clarify this concept we can take the system of "satisfaction" in having clean clothes as an example. For this *satisfaction* I do not need only a washing machine, but also detergent, water and electricity (and the services that supply it), and maintenance, repair and divestment services. So when we talk about system innovation in this context, we mean an innovation that involves all the different socio-economic stakeholders in this *satisfaction system:* the washing machine and detergent producers, the water and electricity suppliers, and those responsible for maintenance and divestment[36].

[36] In reality, this interpretation of system innovation forms part of the foundations and criteria already expressed in *Life Cycle Design.* However, here it emerges more clearly (as the basic assumption), that the starting point is the reconfiguration of the system that achieves certain results. The environmental value must in any case be assessed on the overall effects of the life cycles of the products and services that make up the system on offer.

We shall try to describe very briefly why a PSS is potentially eco-efficient. The fragmentation of stakeholders in the various phases of a product's lifecycle (in the traditional economic framework of industrialised countries), means that the eco-efficiency of the *lifecycle* system does not coincide with the economic interests of the individual constituent stakeholders. For example (fig.2), the producer (of the washing machine, but also of the detergent and the electricity) has an interest in reducing material and energy consumption during the production phase. On the contrary, he has no direct economic interest either in limiting consumption during use, or in reducing divestment impact and valorising the resulting waste. Sometimes the producer is even interested in selling products with a short life span, with the only aim of accelerating replacement. So, we shall talk about eco-efficient system innovation as that deriving from a new convergence of interest between the different stakeholders: innovation not only at a product (or semi-finished) level, but above all at configuration level, i.e. when setting up new forms of partnership/interaction between different stakeholders in a *satisfaction system.*

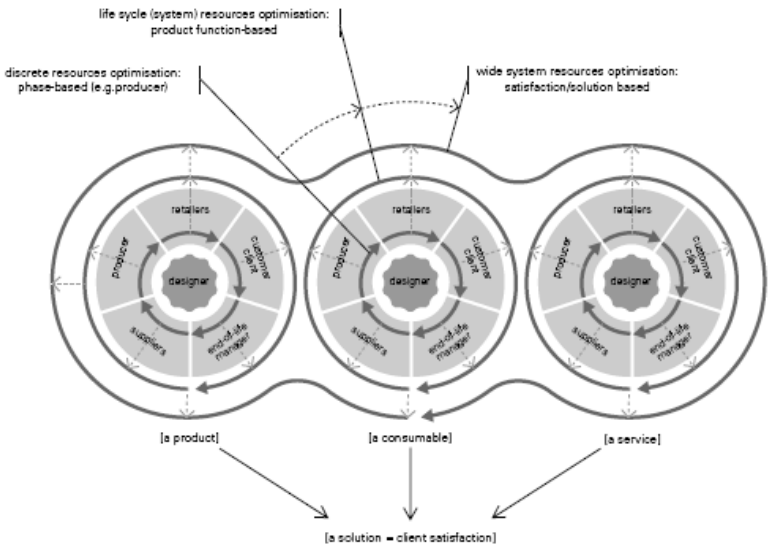

Fig. 2 Convergence scheme between the interests of stakeholders in a satisfaction system, working towards system sustainability

Let's take a real example to better clarify these concepts.

The 'solar heat service' is a service providing a result, consisting in 'selling' heat as a finished product. Hot water is produced by new equipment that combines sun, energy and methane, with economic and energy savings. Solar plants are designed in order to maximize the contribution of solar energy. Hot water is measured by means of a specific heat meter and the whole system is monitored, in order both to control in real time how the system works, and also to apply the Guarantee of Solar Results, a specific

contract through which the installer makes a commitment to get a pre-determined level of efficiency. AMG has already tested this service in a Tennis Club in Palermo city (Italy), providing hot water for the dressingrooms. The innovative feature of this Product-Service system is that AMG will not invoice the client for the methane consumed to obtain hot water, but rather, hot water is sold as an entire service. AMG sells heat, and calculates the thermal kilowatts consumed by its clients; for instance, in 2001 one litre of hot water costs 0,2 euro cents. With AMG the consumer pays for receiving a comprehensive service, from the installation, to the thermal-energy meters, and to the transportation of methane to the boilers. With equipment maintenance provided as well, the customer is overall buying a 'final result'. This new product-service mix is sold as a complete service, which can significantly benefit the environment. The combination of methane and solar energy used to produce hot water supplies is 70% of what is needed. The company thus becomes motivated to innovate in order to minimize the energy consumed in use. Billing is by unit of service and not per unit of consumed resources. The less methane consumed (the higher the use of solar energy and the system efficiency) the higher the income for AMG. AMG estimates this will lead to a decrease in emissions of 100 tons of carbon dioxide per year.

Other examples could be given to illustrate possible convergence between economic and environmental (eco-efficient) interests in a systems approach, but it is as well to observe that, naturally, not all Product-Service Systems are eco-efficient. For this reason, in terms of the development of new systems it is expedient to operate and adopt appropriate criteria and guidelines[37].

Coming back to design, the introduction of Product-Service Systems (PSS) into design for sustainability, requires new skills of a more strategic nature. We shall now attempt to clarify this statement.

Firstly, it means that we must learn to design products and services together.

Then (a more complex question and somewhat foreign to today's design culture) we must learn to promote and facilitate new configurations (partnership/interaction) between different "stakeholders", to find innovative solutions able to lead to a convergence of economic and environmental interests.

To visualise the mode of approach it may be useful to think of and draw a parallel with the design questions that more typically concern a "traditional" designer, who in designing a product defines the technical, performance and aesthetic characteristics of its components and its connections, in order to

[37] The criteria that achieve and determine (or otherwise) system eco-efficiency, have been drawn up inside a design tool called *Sustainability Design-Orienting* (SDO-MEPSS) toolkit (developed in a European research project entitled MEPSS, Method for PSS development, funded by EU, 5FP, Growth. Use/access free: www.mepss-sdo.polimi.it):

- optimised system life
- reduced transport/distribution
- reduced resources
- minimised/valorised emissions/waste
- increased renewability/biocombatibility
- innocuous/poisonous

describe the configuration of the product components that are not characterised by materials (with specific performance functions) and by their connection systems. In this way a systems designer for sustainability must imagine and promote innovative types of "connections" – partnership/interaction – between appropriate components – socio-economic stakeholders – of a system responding to a particular social demand for satisfaction. In other words the components of a satisfaction system are characterised by socio-economic stakeholders (with their skills and abilities) and by the interaction occurring between them (partnerships, or more generally, interaction). Therefore designing the configuration of a system means understanding who are the best socio-economic stakeholders (components) and what are the best interrelationships (connections)[40].

In the perspective described of design that contemplates several socio-economic stakeholders active at the same time, designers must likewise equip themselves with the necessary skills to operate in a participatory design context (i.e. among different entrepreneurs, institutions, NGOs, associations and services) for system development that includes the offer (products and services).

We could say that these skills are part of so called *strategic design.*

Such considerations have started on a pathway towards a convergence of system design for environmental sustainability with the *strategic design* area. For this reason the expression **strategic design for sustainability** has come into use (Manzini, Vezzoli, 2001)**.** Therfore design for environmental sustainability must use and integrate the methods and tools of strategic design (and vice versa).

The required skills can be summarised as follows:

- the ability to design products and services together to fulfill a given demand, and to design an integrated system of products and services coherent with a "satisfaction-based" perspective
- the ability to promote/facilitate new stakeholder configurations (interactions/partnerships) aiming at system convergence of interests
- the ability to operate/facilitate a participatory design process among entrepreneurs, users, NGO, institutions, etc.

These are skills and abilities that are relatively new for a designer, but as we said are connected to the disciplinary area known as strategic design (Manzini, Collina, Evans, 2004) or Product-Service System design (van Halen, Vezzoli., Wimmer, 2005), areas already endowed with their own body of theory and their own methods and tools.

As far as design practice is concerned, the first design methods and tools have recently been developed, such as tools for the development of design orienting scenarios, for the strategic convergence of different stakeholders, for interaction designing and for the generation of ideas for highly sustainable systems. For example: qualitative brainstorming tools focused on the devising of partnership/interaction between eco-efficient valid stakeholders (Vezzoli, Tischner, 2005); or tools for the design and

[40] It could be found the terminology of Sustainable Innovation Networks (SINs).

visualization of the material, information and economic flows and relations between socio-economic stakeholders in a particular system of offers (Jegou, 2005; Sangiorgi, 2005).

9 System innovation for socio-ethical sustainability

When addressing socio-ethical sustainability, the equity principle of sustainability is directly addressed, and not indirectly as a potential result of a radical resources reduction in industrialized contexts (as we see before with the approach to system design for eco-efficiency).

As we said, the design area has recently opened - or re-opened – the discussion on its role in the socio-ethical dimension of sustainability, or rather, on the possible role of design in the general questions associated with the various forms of social injustice.

This recognised reality takes into account (as in the assumptions of the concept of sustainable development) the so-called *principle of equity*, whereby every person, in a framework of fair distribution of resources, has a right to the same *environmental space*, i.e. to the same availability of global natural resources; or to put it better, to the same level of satisfaction that can be had from these in different ways.

What we can observe is that when the issue of sustainable consumption crosses that of socio-ethical sustainability, the spectrum of implications, of responsibilities, extends to several different issues such as *(*World summit on sustainable development, 2002): the principles and rules of democracy, human rights and freedom; the achievement of peace and security; the principles of world equity in the availability of resources (reduction of poverty and injustice); improvement in the circulation of information, of training and of employment; respect for cultural diversity, regional identity and natural biodiversity.

As discussed in a previous paragraph the socio-ethical and environmental dimensions are closely linked. The question is extremely complex, but can be summarised in the following questions: how can we foster new quality criteria to free the social demand for well-being from a relationship that is directly proportional to the increase in consumption of resources, characteristic of mature industrial society? How can the reduction in consumption of resources per unit of satisfaction move side by side with their fair distribution on a local and global level?

If, as in this context, we talk about design, it is important to identify the answers that design culture and practice can give to these questions.

Today we can observe new, although sporadic, interest on the part of design research to move on this territory; to specify a possible design role in the socio-ethical dimension of sustainability; to trace its boundaries and understand the possible implications. This is an extremely vast and complex issue (and its implications for design have been little analysed and are difficult to face without falling into easy, hardly constructive moralism). Therefore to formulate a research hypothesis on a possible role for design, not only in terms of understanding the complexity, but also of a possible

design world operativeness (specific capacity to work changes) some practical, though still provisional, definitions have been drown up.

Some criteria on which a possible design role could be organised; criteria by which design could orientate, (and assess) the results of a design process (Tischner, 2005). The following criteria are the result of a recently concluded European research project[41] that attempted to bring the complexity of the socio-ethical issue in line with a possible design activity[42].

- **equity and justice/stakeholder relationship**
- **living conditions/quality of life**
- **health and safety**
- **employment and working conditions**
- **respect for cultural diversity**
- **socially responsible consumption.**

Associated with such criteria some researchers[41] the following (operative and provisional) definition of **"emerging contexts"**: **socio-economic areas** (not necessarily countries) in which some or all of the (above defined) criteria by which to evaluate/orientate the socio-ethical character of satisfaction systems, presents more or less seriously critical aspects **.**

With this definition we can find emerging contexts in the metropolises and the rural areas of both developing and newly industrialized countries, and of mature industrialized countries. We also presuppose a very elastic use of the word "emerging", in so far as it tends to include contexts with different levels of criticality in relation to different criteria (contexts may even be included that are critical only with regard to one criteria).

Obviously, the definitions and criteria given have many limits and are liable to all the successive re-definitions or subdivisions. However, at this early stage they resulted useful in setting up research.

At this point a good (and useful) question with which to start exploring the issue is the following:

Is system innovation (PSS) also applicable in emerging contexts?

In effect this question was put to a group of international researchers[43] some years ago, in a project funded by the United Nations Environment Programme (UNEP). The question was put, simply because what had been studied, said and acquired on the development of Product Service Systems,

[41] MEPSS. Methodology for Product-Service System Development, EU 5FP, growth.

[42] For a further study of the criteria and their use cf. Vezzoli, Tischner, *Sustainability Design-Orienting toolkit (SDO-MEPSS)*, use of design support software, free on www.mepss-sdo.polimi.it, 2005.

[41] Being part of LENS (LEanring Network on Sustainability), informal network, that involves seven universities from the following countries: the Indian Institute of Technology; the School of Architecture and Urbanism, Universidade de São Paulo (Brazil); the Academy of Art and Design, Tsinghua University, (China); the School of Design, Hong Kong Polytechnic University, (China); the Dept. of Industrial Product Design, Istanbul Technical University, (Turkey); the Ewha Woman's University from South Korea; Politecnico di Milano University.

[43] The work involved a group of researchers (including the author) from several countries in the more or less industrialised world; it was set up in 2000 and ended with the publication in 2002 of: UNEP, *Product-Service Systems and Sustainability. Opportunities for sustainable solutions.* United Nations Environment Programme, Division of Technology Industry and Economics, Production and Consumption Branch, Paris, 2002.

had been studied relative to the environmental and economic aspects, and for mature industrialised contexts. Not for the socio-ethical dimension and for what we have called *emerging contexts.*

This question is the forerunner of another: if the answer to the first is affirmative, can a system approach favour the socio-ethical qualification of these contexts as well as their eco-efficiency?

And if so, with what particular characteristics?

The response to these questions, from the above mentioned international group of experts sponsored by the UNEP, is the following hypothesis:

PSS (system innovation) may act as business opportunities to facilitate the process of social-economical development of emerging context - by jumping over or by-passing the stage characterised by individual consumption/ownership of mass produced goods - towards more advanced service-economy "satisfaction-based" and low resources intensive (UNEP, 2002).

To be clearer let's look at some examples (collected by the group engaged by UNEP).

Greenstar solar e-commerce and community center.
Based so far in India (Parvatapur), Jamaica and Ghana. It isa modular, scalable, highly portable "station" is delivered for villages in the developing world, as e-commerce centres. It is solar powered and connected to the web through a satellite or digital modem.Residents of remote rural communities can sell their wares world-wide and become shareholders in Greenstar.

Virtual station: virtual offices.
Based in Fortaleza, Brazil. It supply a full range of services and infrastructure for a complete office. clients only pay for the periods of use; spaces are equipped with computers, printers, scanners, access to internet, TV, copiers etc; reception, personalised phone answer, answering and remittance of fax reception/transmission. Infrastructure/equipment sharing leads to intensive use and access to the most efficient. facilitate the set-up of small company.

GAS Lambrate, a solidarity purchasing groups.
It is a solidarity purchasing groups based in Milan. It is a group of 40 persons debating on consumption and organised to a collective purchase, with shared criteria:
. cost reduction duet to de-intermediation
. preference for local, season and biological produces
. preference for small local producer or social cooperatives
. direct contact with suppliers + production site.

More generally the following opportunities for environmental and socio-ethical sustainability, in development and system innovation in *emerging contexts,* have been highlighted (UNEP, 2002; Soumitri, Vezzoli, 2002; Penin, Vezzoli, 2005).

First of all, if PSS are eco-efficient at system level it means that they may represent opportunities, at least at a macro level, for a context with fewer economic possibilities to respond more easily to unsatisfied social demands.

Secondly, PSS offers are more focused on the context of use, because they do not only sell products, but they open relationships with the end user. For this reason, an increased offer in these contexts, should trigger a greater involvement of (more competent) local, rather than global, stakeholders; fostering and facilitating a reinforcement of the local economy.

Furthermore, since PSS are more labour/relationship intensive, they can also lead to an increase in local employment and a consequent dissemination of skills.

Finally, since the development of PSS is based on the building of system relationships and partnerships, they are coherent with the dissemination of "networked enterprises" that start from the local (towards bottom-up re-globalisation).

This last consideration is very important because it takes us back to the intermediary consideration made earlier in this paper, where we discussed the convergent strategies between environmental and socio-ethical dimensions.

Starting with these observations reported, it has been proposed the system approach as an opportunity and coherent mode of linking environmental and socio-ethical dimensions. So, the revised hypothesis is as follows[42]:

A system Innovation (PSS approach) may act as a business opportunity to facilitate the process of social-economical development in an emerging context - by jumping over or by-passing the stage characterised by individual consumption/ownership of mass produced goods - towards a more "satisfaction-based" and low resource intensity advanced service-economy, characterized by the development of local-based and network-structured enterprises and initiatives, for a sustainable re-globalisation process aiming at a democratisation of access to resources, goods and services..

10 Design for fair sustainable consumption

Assuming this hypothesis and criteria for an exploration in the field of design research, we must first of all ask ourselves what skills and abilities a designer or design researcher should have and exercise to contribute to this type of innovation.

10.1 Strategic design for sustainability

We shall now address this issue in relation to an ability which recalls/adjusts what we have already said for eco-efficient system design, in relation to a strategic-type ability to operate. By which a designer for (environmental and socio-ethical) sustainability should possess such skills and abilities as to be able to **promote and/or facilitate new sustainable "networked enterprises" starting from local (human and material)**

[42] Hypothesis defined within the LENS (see previous note), on which the network is working on.

resources (that can be integrated into more extensive networks) (Manzini, 2005; Penin, Vezzoli, 2005)**.**

This ability can be described as the ability to:

- promote/facilitate new locally based "sustainable network enterprise"
- elaborate and/or co-elaborate orienting scenarios to build up partnership/ interaction between different stakeholders aiming at sustainable value production
- facilitate participatory design among different stakeholders to define their relationships and offer systems (products, services, communication).

These are skills and abilities that are relatively new for a designer, but as we said are connected to the disciplinary area known as *strategic design* (Manzini, Collina, Evans, 2004) or *Product-Service System design* (van Halen, Vezzoli, Wimmer, 2005).

They are skills, abilities and tools that will necessarily have to be reinterpreted and adapted to the specific conditions of *emerging contexts*. Adapting or reinterpreting means understanding what aspects of these design methods and tools will remain valid; it means understanding what specific characteristics will mark the partnerships and interactions most likely to emerge. Some example could be: social co-operatives that include emerging/marginalized people, who offer similar products; or eco-fair trading districts that create local synergies in multi-satisfaction based product and service offers, building on collective, co-operative and collaborative relationships.

The first signs of this of such a design research focus has emerged. Penin (Penin, 2006) has adapted few strategic design tools for emerging contexts. Those tools have been tested recently in an *incubator of social cooperatives*, based at the University of Sao Paulo (Brasil).

Finally, it is obvious nevertheless not all system innovation are socio-ethically sustainable. But so far very few are the tools and methods developed to orientate the strategic design process. among this it could be mentioned the section on socio-ethical sustainability of the *Sustainability Design-Orienting (Sdo) Toolkit* (Tischner, 2005)[43].

In the detailed framework of different dimensions that design research and practice must face, we can foresee that system design for environmentally, socially and ethically sustainable innovation will represent (very complex, but at the same time also stimulating and ethically rewarding) grounds on which to find work hypotheses and disciplinary answers.

10.2 "Migrant" design creative-thought

While considering the transition towards sustainability, complementary to the above argumentations, we can observe that we need an **outstanding amount of creativity** to produce social and sustainable innovations. We must be able to create (to imagine in order to innovate) as much as we have to change.

[43] Edit by Vezzoli and being part of the already mentioned MEPSS, EU 5FP research.

While reasoning on creativity at a socio-cultural innovation level, it is necessary to frame it within the multicultural and interconnected context in which we are living (as previously called to mind). It is now useful to recall a UNESCO document entitled *Our Creative Diversity* (UNESCO, 2005), which relates the issues we are discussing here to matters of social creativity. "How can countries define cultural policies directed at encouraging a truly constructive pluralism in which **diversity is made a source of creativity**? […] In our "infinite world of questioning and doubt", **creative imagination** and initiative on the part of **individuals**, **communities** and **societies is ever more required**. What are some of the ways in which creativity should be promoted today, not just in the arts, but also in the domains of science and technology and in the theory and practice of governance?"

This concept is well expressed by the term ***transculturality*** (Welsch,1999): meaning an attitude (within a multicultural and interconnected society) that emphasizes the dialogue nature of cultural influences, moving towards a concept of interaction in which nothing is ever completely "other" (foreign and extraneous). An attitude characterized by the willingness to **interact starting from the "intersections"**, rather than from the differences and polarities. It proposes a vision of flexibility, movement, continuous exchange and **re-negotiation of identity** (Brancato, 2004).

In the above framework, some researchers and educators proposed to adopt the following working-hypothesis. A **design creativity drawing inspiration from transcultural cross-fertilisation may lead to ideas with a high social and sustainable innovation profile; and some of those ideas may contribute to building visions of possible changes, and become the seeds of everyday sustainable solutions** (LENS, 2005).

In the above perspective, it seems quite clear that we would need to develop a way of thinking design that is able to move between different ideas, recognize the differences and find concrete possibilities for integration, or create/re-elaborate starting from intersections and connections.

So, creativity in a *transcultural* design process can be summarized in the idea of **migrant creative-thought** (Vezzoli, 2005): a design process that builds up its own ability by passing from one way of thinking to another, opening up to codes of structures and different meaning systems. What is required is **a design attitude able to decentralize from its own cognitive references and values, reach into those of other cultures and return to its own (culture) enriched by the confrontation experiences (and also able to disseminate into other cultures).** If design for sustainability requires a transculturally creative attitude, generally speaking we can observe that what is needed is the **ability to operate in a complex context**[44].

In short, design for sustainable system innovation could start with the local, but at the same time (to avoid being limited to localism) develop a transcultural attitude so as to be endowed with an effective social creativity, able to become part of the wider transition towards sustainability.

[44] This is not a new issue for the culture of design, but in this case there are new connotations and implications.

11 A role and agenda for design HEIs

This is indeed a very complex path to follow, and, the Higher Education design Institutions (HEIs) could have a key role to play (Penin, Vezzoli, 2004; Vezzoli, 2005).

The first step for this (as every) new research front is to build a scientific community of reference, to clarify and verify the research hypothesis with reference to other hypotheses or theories that dwell on similar themes.

All this can start taking place in HEIs, since these are by definition delegated with research and the training of new generations of designers.

On these grounds we propose a possible agenda breakdown in three points. HEIs not only as places for (advanced) education, but even as:

- **diffusers** of sustainable ideas and
- **incubators** of sustainable (locally based and "networked") enterprises".

11.1 Disseminators of ideas for sustainability

Universities should then look outwards, becoming disseminators of sustainable ideas and innovations. In other words we should rethink HEIs as places for the promotion of new ideas for sustainability.

One interesting possibility[53]is that of taking the campuses of these universities as "workshops" and "display windows" for sustainable ideas and innovations.

Briefly, the idea is to see the campus as a sort of prototype community. A community where different human activities occur and whose characteristics make it an excellent laboratory for radical socio-technical innovations. However, at the same time the visibility universities have with respect to enterprise, but also more generally for society at large, makes them good display windows[54].

11.2 Incubators for sustainable locally-based "networked enterprise"

Finally, HEIs as facilitators in the creation of sustainable locally-based "networked enterprises".

This could occur through the development of appropriate incubators whose aim should be to create enterprises that involve several local stakeholders, that promote long-term local development, with local, regenerative, low resource intensity solutions.

The target would in the first place be emerging/marginalized local stakeholders, who could then involve other (not only local) stakeholders such as institutions, NGOs, companies, etc.

As typically happens with incubators, the university would supply the place, the work facilities, and certain internal skills. Among these skills is also that of design (system design for sustainability), that we shall now hypothesise in some of its basic possible characteristics.

[53] This concept has actually been experimented within the informal LENS network mentioned in a previous note.

[54] For further examination see (Penin, Vezzoli, 2004).

Similar incubators actually already exist. For example, in Brazil we can find Popular Co-operative Technological Incubators (ITCP). These are part of the university corpus and have the aim of creating new jobs for groups of people with low incomes, in a perspective of local development and in a context of a solidarity economy, through the dissemination of technical and scientific know-how produced within the university (Penin, Chiara, 2005).

What we can initially hypothesise is a specific characterisation of these incubators by design skills. Coherently with what has been said earlier, these design skills and services are not (only) those that come traditionally to mind, i.e. those of product or communication design, but they are those of system (or strategic) design: in other words, the **promotion and facilitation of unprecedented partnerships/interactions between "stakeholders" (networked enterprises) in satisfaction systems seeking a convergence of their socio-ethical, environmental and economic interests.**

In this hypothesis, the offer modalities from such a design service could be of two types, at an initial stage.

The first elaborates *sustainable orienting scenarios* (Manzini, Jegou., 2003) for building of partnership/interaction in specific areas, and consequently identify possible stakeholders to involve. Herefore this would be a pro-active role on the part of those managing the incubator.

The second modality starts with the request and acceptance of one or more stakeholders to join the incubator. From their specific skills or areas, sustainable orientation scenarios can be co-generated for the constitution of partnership/interaction starting from the specific participant skills. This could be followed by the identification and involvement of other stakeholders.

For this approach, as mentioned previously, it would be possible to draw on skills, abilities and tools that have already been developed in the ambits of strategic or system design, operating the necessary adaptations for the particular conditions of specific *emerging contexts.*

Some first pilot projects have been developed where these complex, but crucial areas of design research for sustainability can be investigated. In conclusion, a field trial on such complex issues is not only to be hoped for, but is absolutely necessary before attempting to formulate credible operational hypotheses.

12 Conclusions

When talking about design for sustainability, we have seen how part of the pathway has already been trodden. However, for design research we anticipate fundamental years for the promotion and orientation of the system innovation, not only technical, but also social, cultural and ethical, that the transition towards sustainable development requires.

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Chapter 15 Design for (Social) Sustainability and Radical Change

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1 Introduction: Design as part of the problem or part of the solution?

The role of design in a society that faces more and more socio-economic and environmental problems must be different from what designers used to do in the last 100 years:

Design must fill the gap between production and consumption in a way that leads to real problem solving and radical changes towards more Sustainability of production and consumption systems. Designers must become facilitators between consumers and producers or create new systems of (co-)production and (co-)design that fulfil needs and solve real problems with the maximum benefits for consumers, producers and the natural environment.

Today without any sustainability considerations a lot of companies start conquering the mass markets of so called developing countries such as India and China because of the billions of potential customers of the future. Despite of the fact that so called developing or emerging countries cannot simply adopt the industrialised country's life styles without catastrophic consequences for the natural and social environment this kind of "globalisation" or new colonialism takes place and governments hardly can control the developments.

Thus we urgently need intelligent and sustainable solutions that fulfil the needs of the people especially the world's poor, that create equal opportunities for socio-cultural and economic development especially in less-industrialised countries and that enable people to live under an acceptable quality of life standard without compromising the carrying capacity of our planet.

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2 What to do?

Instead of continuously trying to improve and re-style products for saturated markets and the societies of abundance, more and more designers start tackling the real problems and searching for feasible ways how to contribute to real solutions. There are design projects for "the bottom of the pyramid" (BOP) that aim at creating more quality of life and economic opportunities especially in socalled developing countries. There are educational programs on Humanitarian and Sustainable Design (cf. www.designacademy.nl, Master Man&Humanity). There are a lot of creative initiatives directed at groups in society that suffer under man made or natural disasters, there are more and more designer networks that aim at creating eco-efficient and sustainable solutions and experience exchange (cf. www.o2.org, www.ecodesign.at).

However, this quest for design becoming part of the solution instead of creating (global) environmental and social problems is far away from being a mass movement, and a lot of activities are still relatively idealistic and lack a bit of professionalism. Still some tools and methodologies are missing, among which are especially the following:

- Evaluation tools and methods to include the socio-cultural dimension of Sustainability in design activities and go beyond Eco-design and eco-efficiency
- Tools and methods to leapfrog to drastically improved more sustainable innovation and go beyond incremental improvements
- Tools and methods to do sustainability oriented market research
- Tools and methods to involve customers/ consumers and other stakeholders more direct in the design activities, i.e. participatory design processes
- Tools and methods to create innovations throughout the complete value chain, i.e. upstream towards the suppliers and downstream to end-of-life actors.

The sustainable design research community works to close these gaps and fill in the blanks. The following chapters introduce activities and results that were generated in a German research project on sustainable system innovations "The Sustainable Office" (see www.econcept.org) by econcept, Agency for Sustainable Design and Institute for Ecological Economic Research (IÖW) and in SusProNet and MEPSS, two European research/ network projects on PSS (Product Service Systems, see www.suspronet.org and www.mepss.nl).

Experiences from these kind of research projects suggest that for designers to work in a professional way and contribute to the Sustainability of production and consumption systems, it is necessary to get an overview about the social, environmental and economic Sustainability of current systems first. For this, tools are still relatively new and missing.

Then multi- and interdisciplinary teams/ groups of stakeholders have to come up with creative visions and solutions how these systems can be changed towards more Sustainability. Participatory planning processes and co-design processes need to be organised starting with the consumer/ customer needs and aiming at maximum social, environmental as well as economic Sustainability. At the end the results can even be completely new

business models and radical system innovations that would never occur, if only one company tried to develop new solutions.

In the Sustainable Office[45] project these kinds of methods and tools were applied, and results show that the role of designers in these processes is much more in the facilitation of creativity and group dynamic democratic processes, and much less the egocentric design guru that knows how the world should look like.

2.1 From incremental to radical and system innovations

In scientific and socio-political discussions on sustainability the term system innovation is frequently used (cf. Bierter, 2002; Maßelter & Tischner, 2000; Sauer, 1999; Vergragt, 1999). With its origins in innovation research, system innovations are considered to be a decisive factor for a sustainable transition of modern societies. Yet much is unknown about what system innovations are and how they are different from other innovation types. This factor was the starting point for the conceptual and analytical part of the research project "Sustainable Office". The aim was to develop a criteria-based classification scheme for the determination of the innovation type and its sustainability potential.

Innovation types generally are distinguished as incremental or radical innovation (e.g. Clark & Staunton, 1989; Freeman & Perez, 1988):

Incremental innovations are relatively small changes of processes and products. They take place more or less continuously in all industry sectors, depending on a combination of demand, socio-cultural factors and technological possibilities. Often they are not the result of directed research and development (R&D) but rather the result of

- *learning by doing*, particularly from findings and suggestions coming from engineers, based on experience and normal problem solving activities, or
- *learning by using*, based on initiatives and suggestions of users.

Radical innovations on the other side occur discontinuously and are normally the result of targeted R&D of companies, (related) universities or other research institutes. They are unequally divided over industry sectors and over time. Examples are nylon, atomic energy and the birth control pill (Freeman & Perez, 1988).

The concept of ***system innovation*** allows further differentiation between incremental and radical innovations. In this concept, changes occur in technological systems that affect several industries and can lead to completely new industry sectors (Freeman & Perez, 1988). They are based on a combination of radical and incremental innovations, connected to organisational and managerial innovations, which affect more than one or a few companies and lead to new socio-technical configurations. Examples are synthetic materials (Freeman & Perez, 1988), electrification and centralised energy supply (Kemp, 2000).

[45] The Sustainable Office research project ran from 2002 to 2005. A final report of the project was published in July 2005 (Konrad, Tischner, Hora, Scheer and Verkuijl, 2005). The project was funded by the German Federal Ministry of Education and Research (BMBF).

A further differentiation is made for innovations that are based on behavioural changes and changes in use patterns: so called ***behavioural innovations*** (Hoogsma, 2000).

Table 1: Case Studies for the four innovation types

***Incremental innovations*:** network living, UMTS and WLAN, airbag acceleration sensor, high-temperature materials for gas turbines, and lightweight constructions of steel.
***Radical innovations*:** inkjet print head, micro-engines, keyhole surgery, exhaust-gas catalytic converter, and adaptronic materials.
***Behavioural innovations*:** bike-sharing, employee mobility system, emissions trading, energy contracting, e-commerce considering an example of online bookselling, electronic paper.
***System innovations*:** electronic road pricing (German truck toll system), personal rapid transit systems, magnetic levitation (maglev) train, stationary decentralised fuel cells for home energy supply, solar power generation – photovoltaic, Stirling motor, energy-efficient homes, multimodal human-computer interaction, online trade (barter) of audio files, microelectromechanics, smart labels, soil-resisting glass coatings based on nano-materials, polytronics.

2.2 Innovation types and Sustainability Potential

Now it is essential to identify the sustainability potential of the different innovation types. Traditionally two different positions can be found: one assumes that incremental innovations bring significant environmental improvements (Clausen, Petschow & Behnsen, 1997; Clayton, Spinardi & Williams, 1999). In contrast, the other position suggests that small improvements connected to incremental innovations are not enough and that for substantial improvements in the state of the environment radical technical innovations are needed (Kemp, 2000; Weaver et al., 2000).

The fact, that in many industry sectors the environmental benefits caused by incremental technological improvements is more than compensated by the industry's growth, makes focussing on more radical improvements indispensable. On the other hand, technological innovation alone seems not enough, because of potential rebound effects (e.g. using the highly efficient eco-car as the 2nd or 3rd car in the household). Therefore also user-oriented changes, like the switch to non-ownership consumption types, also discussed under the headline of "Product-Service-Systems" (PSS, e.g. car-sharing), are needed to really move towards overall improvements in production and consumption systems (cf. Hirschl, Konrad, Scholl & Zundel, 2001 and Tukker, Tischner, 2006 in prep.).

Against this background the following assumption was formulated in the Sustainable Office project: positive sustainability effects on a larger scale involve those innovations that connect organisational transformations, social innovations and the intelligent use of new technologies in order to create an effective combination of technological and socio-cultural changes. These innovations were hypothetically called ***sustainable system innovations*** and illustrated with the following figure.

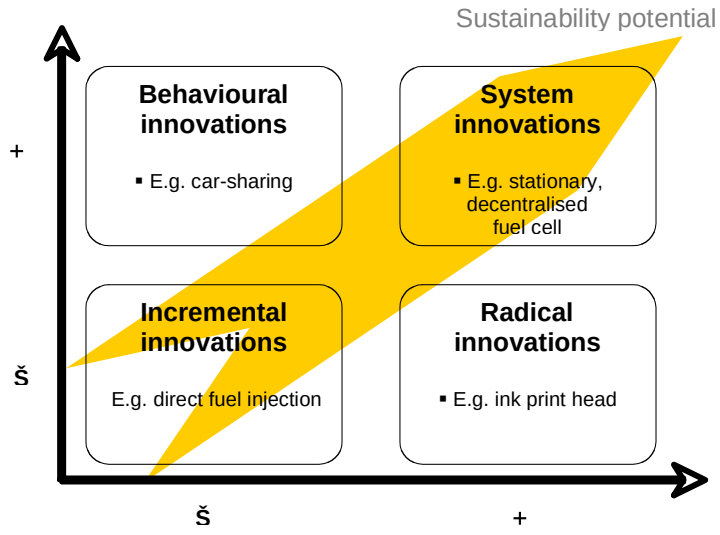

Figure 1: Differentiation of innovation types and their sustainability potential (Source: Konrad et al., 2005).

2.3 Criteria for System Innovation and Sustainability

2.3.1 How to identify System Innovations

To create a methodology to recognise and distinguish system innovations from other innovation types, a set of criteria was developed in the Sustainable Office project that is based on the two general dimensions 'knowledge, technology, organisation' and 'market-actors relationships'. For the two dimensions sub-indicators were formulated to check for the innovation under analysis, how big the changes in the sub-categories are, and conclude accordingly if it is a system innovation or not:

- *Dimension one: knowledge, technology, organisation*: (fundamental) knowledge, multi-disciplinarity, recombination of technical elements, combination of products and services, infrastructure, organisational processes and structures.
- *Dimensions two: market-actors relationships*: market structure, combination of actors, networks, participation of actors from civil society, context of use.

Those innovations were identified as system innovations, that created extensive changes in at least four sub-criteria of the dimension 'knowledge, technology, organisation' and extensive changes in three sub-criteria of the dimension 'market-actor relationships'.

2.3.2 How to identify Sustainability Potential of System Innovations

The method for the sustainability assessment in the Sustainable Office project was based on the concept of three dimensions of Sustainability: the environmental, the economic and the socio-cultural dimension (cf. United Nations Division for Sustainable Development, 2001):

- *Environment*: environmental-friendly use of resources, eco-efficiency, protection of ecosystems...
- *Economy*: sustain/ growth of financial assets, protecting/ improving competitiveness, improvement of market mechanisms...
- *Socio-Cultural*: equal opportunities, improvements in employment rates and social security, creating opportunities for (personal) development, improvements in quality of life and health...

The sustainability potential of an innovation can be estimated using a similar procedure as was used for determining the innovation type. This means that for the three dimensions qualitative scores can be given, using criteria like mentioned above. An innovation can have positive, negative or no influence on any of the three dimensions. When the scoring for a dimension is not possible because the innovation results in both, positive and negative influences on the same dimension, and no decision can be made which influence outweighs the other, the particular dimension is marked as ambivalent.

Positive scores on all three dimensions result in a *strong sustainability potential*. Positive scores on two dimensions and one neutral or ambivalent score result in a *medium sustainability potential*. Two neutral or ambivalent scores and only one positive score on the dimensions results in a *weak sustainability potential*. All other combinations imply that there are no improvements in sustainability and that the innovation is ambivalent in regard to reaching the goal of a sustainable development.

A similar qualitative Sustainability Screening tool was developed in the SusProNet project as is shown in table 1.

Table 1: PSS Screening tool as developed in SusProNet (cf. Tukker/ Tischner 2006 in prep.)

A) Economic/profit aspects	Score (1 = better, 0 is equal, -1 is worse)
How profitable/ valuable is the solution for the providers? (can be a consortium of companies), including cost of production, cost of capital and market value of the solution for the provider(s) ? Is it cheaper to produce than the competing product ?	
How profitable/ valuable is the solution for customers/ consumers? Are there a concrete, tangible savings in time, material use etc. for the customer ? Does it provide 'priceless', intangible added value like esteem, experiences, etc. for which the customer is willing to pay highly? (both in comparison to a traditional product system)	
How difficult to implement and risky is the solution for the providers? Can a promised result be measured and delivered with a high probability, or has the client a high and uncontrollable influence on the costs? When is the return on investment expected ?	
How much does the solution contribute to the ability to sustain value creation in the future? Does it give the consortium that puts the PSS on the market now and in the future a crucial and dominant position in the value chain?	
TOTAL	

B) Environmental/planet aspects	Score (1 = better, 0 is equal, -1 is worse))
How good is the solution in terms of Material efficiency (including inputs and outputs/waste)	
How good is the solution in terms of Energy efficiency (energy input and recovery of energy without transportation)	
How good is the solution in terms of Toxicity (including input/ output of hazardous substances and emissions without transport)	
How good is the solution in terms of transport efficiency (transportation of goods and people including transport distances, transportation means, volume and packaging	
TOTAL	

C) Social/people aspects	Score (1 = better, 0 is equal, -1 is worse)
Does the PSS contribute to quality of work in the production chain (Environment, Health, Safety; enriching the life of workers by giving learning opportunities, etc.)	
Does the PSS contribute to the 'enrichment' of life of users (by giving learning opportunities, enabling and promoting action rather than passiveness, etc.)	
Does the PSS contribute to intra- and inter-generation justice (equal wealth and power distribution between societal groups, North-South, not postponing problems to the next generation, etc.)	
How much does the solution contribute to respect of cultural values ad cultural diversity, e.g. customized solutions, contributing to the social well being of communities, regions etc. (cultural values)	
TOTAL	

Results: Main aspect	Score (between –4 and +4)
A) Economic/profit	
B) Environmental/planet	
C) Social/people	

Both the case studies and the demonstration projects in the Sustainable Office project have been assessed regarding their type of innovation and Sustainability potential using the methods mentioned above. Some results are presented below.

3 How to do it: The Sustainable Office, a pilot project

In the German research project “The Sustainable Office”, an interdisciplinary team of managers, engineers, designers, architects and other stakeholders related to the office area were invited by econcept to develop sustainable (system) innovations. The challenge was to invent new solutions for the office of the future that extend beyond pure products and include social, organisational and institutional changes and as much as possible positive Sustainability effects.

The practical targets were:

- the development of a network of actors/ stakeholders from the office area that would participate in the development of real system innovation projects for offices,
- the elaboration, application and assessment of suitable design tools for sustainable system innovations

- the assessment of the sustainability potentials of the developed innovations, and
- the preparation of market launch of the most promising innovations.

In the course of the project a trend analysis took place, then in different workshops using different methods and tools innovation groups created ideas, that were evaluated and finally six promising innovations were chosen and elaborated. The whole process was facilitated by the design experts of econcept.

Starting point of the innovation projects was a clearly visible trend: the shift from stationary, rather material, reproducing, individual office work towards more virtual, non-stationary, creative office work. Other important trends are demographic changes in the office work force, or the dematerialising and virtual ICT technology etc

Taking these trends and developments into account for designing an office that is prepared for the future, it is necessary to plan process oriented and to focus on the changing needs of office workers. This means e.g. the introduction/ design of the following elements:

- Information: access to networks and knowledge databases everywhere.
- Communication: meeting points, which allow both formal and informal communication.
- Interaction: areas equipped with versatile technology that support teamwork.
- Organisation: optimal coordination of all areas.
- Place to retreat: a customised place that can be used for solitary work.
- Storage: infrastructure for (virtual) storage.
- Vitalise: catering, exercise, entertainment, sport, play, fun, and all vital interests.

3.1 Sustainability and the office

In the office sector the topic of sustainability is currently discussed related to health, productivity and eco-efficiency issues. However, this does not cover all the dimensions of a sustainable office environment. Therefore, the definition of a sustainable office and the set of sustainability criteria were further specified for all the three dimensions of Sustainability (environment, economy and socio-cultural issues) in the Sustainable Office project. These criteria were used later on to inspire and evaluate the innovative ideas and solutions.

Table 2: Definition of the Sustainable Office in the research project

A sustainable office is an office environment that: cost effectively gives optimal conditions for productive work (profit), is healthy and allows the user to fulfil his/her needs (physical and psychological), offering a satisfying combination of business and private life, and is eco-efficient in terms of inputs (space, materials, energy) and outputs (waste, emissions) over the whole lifecycle, and reduces the need for transportation (people/goods).

Table 3: Criteria of the Sustainable Office in the research project

Economic Criteria => Cost per workplace (as low as possible) e.g. reduce the cost for the office building and infrastructure, increase the use time, longevity, flexibility and efficiency of office equipment and building, value stability and increase in value of building and infrastructure, return on investment, amortisation, etc. => Work productivity (as high as possible) e.g. also work stability, low illness rates, good qualification of employees, productive infrastructure, e.g. ICT technology, information and knowledge-management systems… => Long term planning, risk minimization, risk management e.g. by multi-functionality of space and infrastructure enabling divers flexible uses, avoidance of mis-investment and -calculation, pro-active consideration of legislative and political conditions, longer term horizons for planning…
Environmental Criteria => *Material-efficiency*, including Building, equipment, consumables…over the whole life cycle => *Energy-efficiency*, including heating, light, ICT technology… (excluding transport and mobility) => *Space-efficiency*, incl. building, interior, workplace... => *Hazardous substances and emissions*, include. indoor climate, noise pollution, Electro-smog… (excluding transport, mobility) => *Re-use, Recycling possibilities, Waste and Disposal*, incl. Consumables, Building, Equipment… => *Transport and Mobility*
Socio-ethical Criteria => *Healthy work environment, physical:* equipment and infrastructure making work easy and comfortable, Ergonomics, Safety at workplace etc. => *Healthy work environment, psychological:* work load adequate to qualification, adequate reward, avoidance of unhealthy stress and mobbing, motivation and satisfaction, self-determination => *Fair Wages, Quality of Jobs:* Accessibility and Permeability for different qualifications => *Socially responsible corporate culture:* Equity, barrier-free und respecting different ages/ different cultures, participation, innovative and creative climate... => *Social infrastructure and services*: e.g. education and training opportunities, respect for family background of employees (childcare opportunities), combination of job and private life, service offers at work place (food, shopping, laundry…), excellent mobility and transportation opportunities.

3.2 Process: methodology and tools

The actual work in the demonstration projects was done within the framework of several workshops and innovation teams. In the course of the project many (creativity) tools were used, some were developed for the project some were successfully applied before. E.g. moderated discussions, Metaplan-method[46], progressive abstraction, scenario building, role-games, brainstorming, brainwriting. Especially developed or adapted for the project were Sustainability-portfolio-diagram, Sustainability evaluation checklist (see above), Sustainability Scenario Building. Table 4 shows the different phases of the demonstration projects alongside a timescale and a listing of the tools used. The workshops were conducted by econcept, and all the results were made available to the participants and were published on the project website[47].

The following paragraph introduces four of the six developed innovations.

3.3 Results: Sustainable Innovations for the office

3.3.1 Revital-facade

Under the assumption that conservation of existing office buildings is economically and environmentally more efficient then new constructions, this innovation offers a method to prevent demolition of old and to revitalise existing office buildings. The concept is based on facade modules that enable technical and visual upgrading and renovation of existing office buildings in a highly cost efficient way. The starting point for the development of this idea were the office buildings from the 50's till 80's that are in need of renovation, have a frame construction and became unalluring for investors or tenants because of shortcomings. These shortcomings are caused by the normal ageing process and by the changing zeitgeist.

The modules can also be used in new buildings. The modular facade can include heating, ventilation, decentralised air conditioning, electrical and ICT cables, lighting and shade elements, solar modules combined according to the specific needs in the building. Unlike a classical renovation, the installation of the modules is possible without much interrupting of working processes.

A central and neutral company with a lot of construction experience (facade planning, building physics, architecture, building services, statics, fire security, safety engineering) should market this innovation in order to be able to provide optimal consultancy.

[46] A brief introduction of the Metaplan method can be found here: http://www.12manage.com/methods_schnelle_metaplan.html

[47] http://www.nachhaltigesbuero.de

Table 4: Overview of the development phases in the innovation projects, tools used, and timing

Development phases	Tools	Timing
Kick-off meeting **Phase 1: in depth analysis** of the office sector, needs, stakeholders, sustainability issues. Also formation of the innovation teams	Trend analysis, stakeholder-matrix, consumer research	Months: 1 – 4
Start-up workshop In this workshop the goals, the sustainability criteria, the planning, responsibilities etc., were discussed	Keynote presentations, open discussions, adoption of the demonstration projects blueprints, and metaplan (brainwriting, brainstorming, clustering and selection of ideas)	
Phase 2: idea generation	Brainwriting, defining obstacles and drivers, clustering of ideas, moderated discussion, progressive abstraction ('What's it really about?'), scenario and role playing, brainstorming, rough sustainability assessment of the ideas using a portfolio diagram, a standard for defining the innovation ideas.	Months: 6 – 11
Halftime workshop Exchange of experiences and reflection on each others ideas.	Description and presentation of the system innovation ideas with a prepared format, assessment of the ideas using a sustainability checklist, assessment of the marketability and feasibility combined with sustainability with a portfolio-diagram, moderated discussions.	
Phase 3: detailing the concepts. In this phase five teams detailed the selected system innovation ideas. Each team was managed by one or two participants and was supported by one of the research partners.	Workshops in smaller groups, making 2D and 3D impressions, simulations or animations, Interviews and surveys with potential partners and users, expert workshop with external experts, standard powerpoint and reporting formats, orienting life-cycle assessments.	Months: 13 – 22
Phase 4: implementation tests After the detailing of the five innovations concepts, all concepts were tested and prepared for a potential implementation.	Marketing plan, business plans, simulation of the demonstration projects in scenarios, presentation at a trade fair, assessment of market opportunities: obstacles, drivers, sustainability factors, Building of an extended stakeholder network, final reports.	Months: 23 – 27
Final workshop The results of the demonstration projects were presented in February 2005 in an open conference.	Description and presentation of the system innovation ideas with a prepared format	

Figure 2: Revital-facade; this upgrading example (right) shows one possible makeover.

Sustainability evaluation: The main benefits of the Revital-facade compared with alternatives like demolition and new development, complete renovation and similar facade renovations with special solutions, are the savings on total investments and lower investment risks. Short reconstruction time and high cost efficiency as well as extended use time and higher attractiveness of the buildings lead to increased profitability.

Ecological benefits are the prevention of demolition, an environmentally conscious renovation and decreasing energy use.

Implementation status: the concept is currently elaborated by one of the project partners into a marketable concept. A pilot project can be expected at the earliest in 2006.

3.3.2 Rent-o-box

Traditional stationary work is steadily replaced by flexible work. Office work becomes increasingly more virtualised and the infrastructure more decentralised. For modern working-nomads a complete and energy-autarkic mobile rent-o-box was designed to fulfil the needs for time-flexible office-space: users can rent it for an hour, a day and for meetings up to 6 persons. The Rent-o box is a complete, self-sufficient, mobile office unit that can be placed everywhere. The box offers the most modern dematerialised technological infrastructure for concentrated individual and teamwork, or creative relaxation. It can be booked online or via telephone through an operator service (similar to car sharing). This operator also organises maintenance (cleaning, repair) and the supply (operating resources, beverages, snacks). Preferably the Rent-o-box should be positioned at traffic hubs and frequently visited locations or at locations where no infrastructure is available, e.g. developing countries. This can be out- or indoors but also in or on top of buildings or at construction sites.

Figure 3: Rent-o-box: view of the entrance side, view of the window side and interior

Sustainability evaluation: The prefabricated mobile Rent-o-box solution substitutes and complements immobile office buildings and enables efficient and flexible use of space. The box is very resource efficient (solar panels, rainwater usage and fuel cells) and saves its users the purchase of own office equipment by offering complete and most modern office infrastructure. Thus it satisfies the needs of the modern flexible office workers in a sustainable way, which was proved by a Life Cycle Assessment.

First calculations show that the concept is profitable when users pay between 10 and 20 Euro per person per hour. Important incomes are generated by video screen advertisements on the outside of the box. The operator expenses are minimised because of the extensively automated concept. The maintenance expenses are minimal due to the partly self-cleaning materials and sensible automation.

Implementation status: The development process of the Rent-o-box has nearly reached its realisation phase. Further development should take place in close co-operation between the development team, an investor, and a potential operating agency. For the whole system three levels of organisation are necessary: (a) Producers of the Rent-o-box and its components, (b) a central operator and investors, and (c) decentralised suppliers and service personnel.

3.3.3 Interaction analysis

To virtualise processes in SMEs in a more human way, the interaction analysis offers a consulting concept, which focuses on human interaction and the creativity and well being produced by communication. In the interaction analysis all encounters occurring in a central office today are quantitatively and qualitatively assessed. The result shows, which contacts are necessary to achieve high creativity and motivation, and which can be virtualised and decentralised. Thus a new interaction culture can be created that is very efficient and convenient for the employees at the same time. Aims are to offer mainly traditional SMEs a sensible access to information and communication technology and to strengthen their image for highly qualified employees.

Sustainability evaluation: This concept can lead to an improvement in all three dimensions. It focuses on improving communication and well being of workers (includes also flexible working places and schedules). The result of aligning the office architecture and technology to the new demands can be reduction of space (and also rent), equipment and travelling hours.

Optimised processes and motivated employees can improve the work productivity. And by creating flexible work options, a better combination of job and private life is possible. To avoid rebound effects like increasing technological equipment due to flexible work-models, it is necessary to integrate sustainable guidelines/targets into the consultation-process and to define criteria first (amount of km travelling reduction, telephone costs by new technology, paper by optimised virtual archival storage) to measure the success or to identify weak points quickly.

Implementation status: The interaction analysis is just before its realisation phase and will be applied at an SME as a first test case in 2006.

3.3.4 Sustainable Design of Business Management (sd bm)

The sustainable design of business management is a business model to organise services and equipment mainly for SMEs. The companies do not only rent the office space, but also get additional services such as IT-equipment and administration, central copy station, childcare, professional training and catering. The idea is to provide services for a bundle of small companies, which normally could not afford those offers for their employees.

The sd bm offers fully furnished and technically equipped office-environments for flexible use. All fields of activities outside the operative business of a company are supported by the sd bm. The concept includes measures and services to combine business and private life, e.g. childcare, shopping service, education and personal development. Thus especially the social sustainability and economy of office work can be improved.

Sustainability evaluation: Besides the mentioned social sustainability improvements, the bundling of the services with sd bm also allows optimisation of the following aspects (either costs or the quality): cost per workplace, cost of energy, cost for maintenance, work productivity, and company image and network. Environmental aspects that are likely to be improved are material efficiency (less workspace needed), lifespan of equipment and energy use.

Implementation status: a project partner and an external company currently elaborate the concept.

3.4 Conclusions of the project Sustainable Office

All of the developed innovations within the Sustainable Office project were evaluated using a qualitative Sustainability assessment and showed positive Sustainability effects. For two innovations (the revital facade and the rent-o-box) an orienting lifecycle assessment was carried out. Overall, both innovations showed moderate to high sustainability improvements.

Thus the innovation projects can be regarded as a success in terms of creating office related, potentially marketable and more sustainable solutions. However, according to the set of criteria developed for determining the type of innovation, only one innovation is a true system innovation: the sd bm.

Possible explanations for this result are:

Although the demonstration projects were built around development teams, individual participants, each with their individual competences and interests, piloted and coloured the actual projects. Against this background,

the projects hardly managed to cover every dimension of a system innovation.

During the demonstration projects it became clear that searching for sustainable solutions for the office area made more sense than striving for system innovations. The goal of reaching Sustainability was challenging enough and the concept easier to understand then the concept of the system innovation. Overall, it turned out that the concept of system innovations was too inflexible for practical use.

Thus the research project could prove that with the chosen approach (methods and tools) and a multi-disciplinary stakeholder team it is possible to develop sustainable innovations for a specific field of needs. However the hypothesis that system innovations automatically lead to more sustainable solutions could not be verified.

From the accompanying case studies analysis and evaluation as carried out by the Institute for Ecological Economic Research in the project it became clear that the positive Sustainability effects of system innovations generally depend on a lot of frame conditions and that Sustainability has to be an inherent element in the development of system innovations right from the beginning on to ensure a high Sustainability potential.

4 Overall conclusion

4.1 No golden path but high potential

The concept of system innovations is a promising approach for the development of sustainability oriented solutions but system innovations are not automatically sustainable. They should be designed using tools to integrate sustainability criteria and should be realised with an implementation process that controls the environmental, economic and social impacts.

The qualitative criteria-based evaluation schemes for the determination of the innovation type and its sustainability potential proved to be useful and can be used by future application-oriented sustainability research in order to enhance the implementation of sustainable innovations.

Another decisive factor for Sustainability is how the user will use the system innovation in the end: for example, whether the users of glass with soil-resistant nano-coatings, will actually change their cleaning behaviour and clean less etc. Here the delivery of a Product Service System that combines the new technological solution with a window cleaning service that is specialised on cleaning efficiency might solve the problem. This example shows how important it is for developing processes, which incorporate sustainability issues, to include customers/ consumer/ users and societal actors in the innovation process.

4.2 Supportive Measures

The development, implementation and diffusion of sustainable system innovations are connected to many complex challenges, like knowledge gaps and highly unpredictable processes. Individual actors are usually not capable of overcoming all these issues. Supporting measures are needed both on a conceptual and practical level, e.g. design research, politics and economy/ society levels. Politics basically should create stimulation measures and

economy/society should be open-minded and educated on the concept and development process. Design research has an important role in:

- Expanding the collection of system innovation case studies, also focussing on specific characteristics. For example, which models of interdisciplinary cooperation or which types of networks are helpful for system innovations.
- Provision of resources for studies on the diffusion of system innovations and the obstacles and drivers involved.
- Initiating studies to analyse the control mechanisms that can have influence on the formation and development of system innovations; on a governance, market and hierarchical level.
- Supporting the development and application of tools for the sustainability assessment of system innovations. On the one hand, existing (Eco-design) tools can be adapted for system innovation development. On the other hand new tools can be developed, for example quick and dirty sustainability assessment tools or partnership management tools that are focussed on system innovations.

Here also educational programs are missing and needed that provide knowledge about the subject of sustainable system innovations and PSS to several different disciplines such as marketing, product development/ design, management etc.

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Chapter 16 Guide Me: Translating a broad societal need into a concrete product service solution.

New Initiative Sustainable System Innovation, the Guide Me case

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1 Abstract.

This paper describes a system innovation case that TNO is working on together with a Dutch care and housing corporation for elderly people. To connect a broad societal need on the one side, and specific technological possibilities on the other side, the Sustainable System Innovation (SSI) method is being used and further developed. In the case, an innovation challenge on macro societal level: *'How to enable elderly people to remain living in their own home for a longer time?'* has been connected to very specific technological possibilities in the area of object localization like GPS, acoustic tracking and tracing, local position measurement. This has resulted in an innovation challenge on micro technological and user level: *'How can a personal localization device improve the independence of people suffering from dementia and their partners'*.

Keywords: Sustainable System Innovation, personal localization, Guide Me, Alzheimer, Dementia.

2 Introduction

The growing amount of elderly people in Europe poses a major challenge to society. Most actors working on this issue agree that this issue can not be left to 'the government' to solve or to commercial organizations ('the market') alone. One could say that it could be handled as a joint innovation challenge for companies, care organizations, researchers and government together. When the macro perspective of policy makers can be combined with the more detailed technological innovative capabilities of designers and commercial companies, appropriate answers to this important issue can be shaped. The Sustainable System Innovation (SSI) method aims at supporting

this process by connecting the top down macro perspective with the bottom up technological perspective.

This paper describes a case in which the SSI method has been implemented focusing on a specific 'mini society' being the elderly care and housing organization 'De Woonmensen' in Apeldoorn, the Netherlands. The idea behind this approach is that the selected niche area is used as a testing ground for possible system changes. On the one hand, this research area should be large enough to see possibilities that span a wider scope than an innovation for one single user or organization. On the other hand, the area should be small enough to influence certain aspects that normally could not be changed on a nationwide scale, for instance specific regulations or infrastructural elements.

The reason that De Woonmensen was selected is that this organization is currently in the process of drastically renovating one of their living area's called Hubertus Drieschoten, including a home for the elderly with about 110 inhabitants, 28 homes for independently living elderly people, a neighbourhood centre, a church, a physiotherapist, a children day-care centre and several other functionalities.

Figure 1: Left the current situation, right the planned design of the Hubertus neighbourhood in Apeldoorn

The main focus of the new neighbourhood will be the fact that all people will be living independently, instead of the current more institutionalized elderly home. Only a relatively small amount of people with psycho geriatric illnesses like Alzheimer will be living in smaller communities of about eight people each.

The specific focus of this research is about the determination of the possible benefits of potential technological innovations to support this vision of people living independently for a longer time. During the research, a specific innovation has been selected for further development, being a localization device to locate the position of people named the Guide Me.

Within the same system innovation project, other TNO research departments have focused on among others the realization of ecological improvements like energy reduction in the new neighbourhood. This is not described in this paper.

3 The Sustainable System Innovation method

In the project, a broad societal need defined on macro level, has been translated into the definition of a strategic niche experiment introducing specific innovative solutions on location. The SSI approach takes the total

system involved as a basis for innovation, aiming at creating synergetic advantages between solutions and actors, combining needs and opportunities which are only handled separately in a regular design process. The aim of this integral approach is to create smart combinations of needs and functions to improve the ecological and social footprint of the integrated solution being developed. The SSI approach follows a five step process [3]:

Step 1) Development of future scenario's, based on extrapolations of the present situation, describing what would happen without interference of the organizations involved in the innovation process.

Step 2) Creation of sustainable future visions, describing an 'ideal future', looking ahead 10-15 years, not being hindered by current limitations.

Step 3) Backcasting from the envisioned situation to the present situation, describing how the proposed 'ideal situation' could have been reached.

Step 4) Creating a roadmap showing the steps needed to get from the present situation towards the envisioned situation, clarifying the position of the niche experiment as one of those steps.

Step 5) Creation and execution of a strategic niche experiment [1], to be executed within 1-3 years, as a strategic step in the long term innovation process.

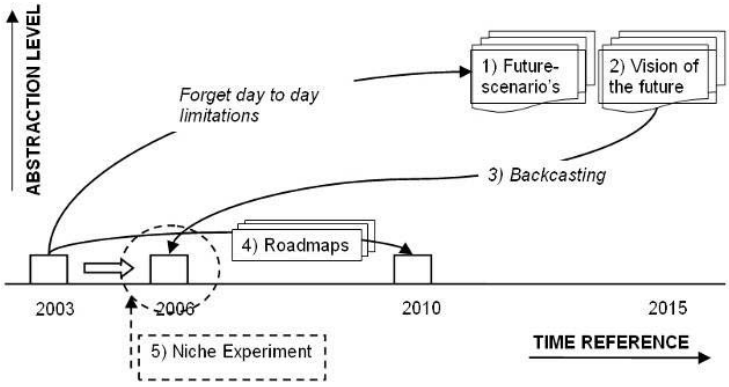

Figure 2: Sustainable system innovation scenario, from [3]

In figure 2, a schematic visualisation is given of the time perspective and abstraction level of each of the steps. In step 1 and 2 the researchers are looking 10-15 years ahead, describing their scenarios and future visions on a high abstraction level, enabling a broad perspective. During step 3 and 4, the focus is shifted towards a more concrete short term perspective. The described niche experiment should ideally be executable with 1-2 years ahead in time, creating the need to be very concrete about the what and how of the experiment.

3.1 The V-cycle for system innovations

In each of the steps described the innovation process needs to take place on different abstraction levels. This can be described using the 'V-cycle for system innovations'. This process is visualized in figure 3, where the top level represents a societal relevant issue described on a relatively high abstraction level. Going down step by step during the process, the problem description gets to a more and more concrete level, where the lowest micro level represents a focused technological innovation track. While evaluating

certain choices during the process, evaluation should be done on the same abstraction level as the problem definition, going up step by step analyzing the impact of a certain aspect on the selected issue one layer higher.

Step 1 and both 2 of the SSI process take place in the top level of the V. Actors involved need to be able to think on this high abstraction level, and often come from government organisations.

In step 3 and 4 of the process, the translation needs to take place from the top level problem definition and future vision description, going down step by step until the bottom level technological issue is defined.

The definition of the concrete actions and proposed niche experiment of step 5 should take place in the meso and micro level, very specifically defining products, services and other relevant elements.

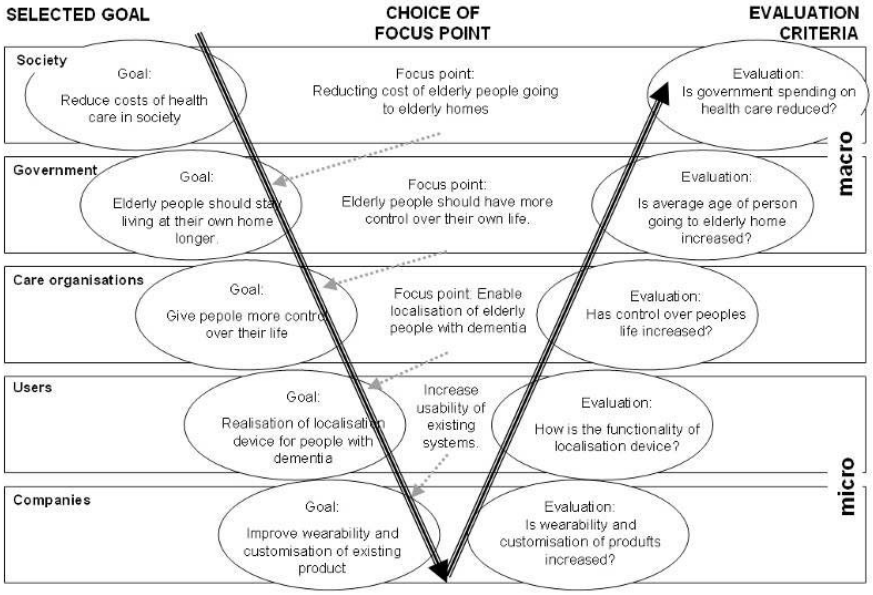

Figure 3: V-cycle for system innovations

4 Case description step 1: future scenario development

The macro level problem definition of the project determines the driving mission behind the whole innovation process, to which every choice in the project should contribute. In the described case, the expected rising pressure on society as a result of the growing percentage of elderly people is selected as main subject of attention. Hypothesis was that technological innovation can assist in reducing these costs, if applied in the right way. The purpose of the innovation process has been described in the following challenge:

'How can technological innovations assist in an appropriate manner to enable elderly people to remain living in their own home for a longer time?'

4.1 Involvement of relevant actors in the process

Where normal innovation processes often start from the commercial perspective of one specific company, one of the main issues in the system innovation process is to involve other actors in the innovation process from the start on. This ensures that the societal relevant issues are taken into account in the innovation process from the start on. In this project, this was

realized by maintaining a close co-operation from the researchers with regional care and housing organization 'De Woonmensen', located in Apeldoorn, The Netherlands. This organization is currently reorganizing their way of working, shifting from rather large elderly homes with 100-200 elderly people living in one institution, to the development of much more independent elderly homes where care is being supplied by the organization but the elderly person remains independent. This shift of focus has created an interest with the organization to find out what opportunities certain technological innovations could bring to this new situation.

Figure 4: Wide range of scenarios, used to get feedback from stakeholders.

During the project, a wide feedback group has been created, involving representatives of all actors like the elderly users, the care personnel, the housing corporation, insurance companies and commercial organizations. By means of workshops and in depth interviews, the various perspectives of the actors involved haven been taken into account. This involved among others commenting on several future scenario's that the researchers came up with.

4.2 Defining the focus points for the innovation process

As a central point in the innovation process, the perspective from the elderly user was taken. In figure 5, the various relations and communication streams of the user are shown. The colour of the arrows shows the frequency of the contact. The darker the arrow, the more frequent the communication takes place. However, it doesn't say anything about the relevance of the relation. For instance, contact with the police doesn't take place very often (light arrow), but in case of an emergency, this contact is extremely important. The circles around the user show the closeness of the contacts towards the user. In most situations, the closer the contact is, the more often the contact takes place.

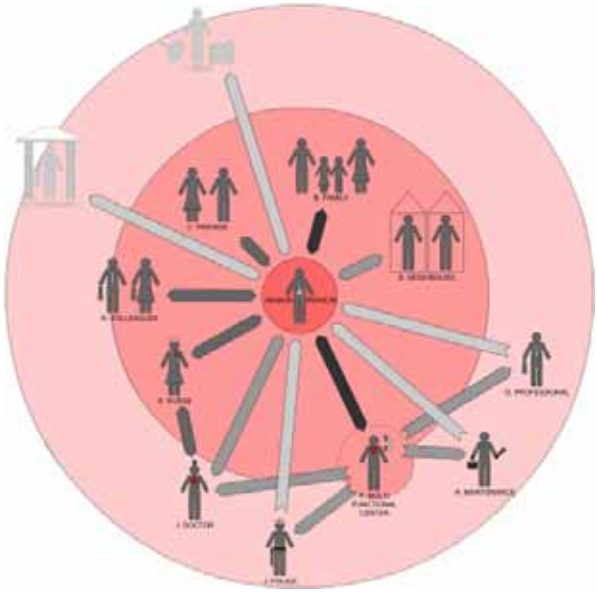

Figure 5: Mapping relationships and communication streams of elderly users

As a result of this analysis, three main need area's have been determined which show the most important issues in the decision making process of elderly people and their relatives about their living condition. They determine to a large extent if a person remains living independently or has to move to an elderly home. The three areas are related to safety, social cohesion and the communication of users with health services.

Figure 6: Main need areas: Safety, Social Cohesion, Health

5 Case description step 2: Development of future visions

The second step of the SSI method involves the creation of future visions, showing a future that solves the described need areas, without worrying about the technological and economical limitations of this moment. The needs that have been selected in the previous step are the basis for the development of these 'sustainable visions'. No choice is made between the various needs, as the idea is to stimulate synergetic solutions that answer to several needs at the same time.

5.1 Setting the innovation guidelines, three kinds of interaction models

As most needs defined in the previous step related to interaction between users and other people, either from a social or from a professional perspective, the future visions have been developed using the level of

interaction as the distinguishing factor. Three levels of interaction have been defined, varying in the level of personal involvement and technical involvement, being described as Relation, Networking and Autonomy. This differentiation is a variation on the Table Guidelines as described in [4, page 56, 57].

Level A: Relation

This type of interaction concerns mainly face to face contact. One really knows and sees the people that one is communicating with, and can actually touch them. Going on a visit, having a chat at home, most things that we normally consider as personal contact. This type of interaction is the most personal, but also often the most time consuming one.

Level B: Networking

With this type of interaction, there is a level of personal contact, often combined with technological assistance to create more options. This form of interaction is more organized, communicating on a somewhat more formal level, for instance meeting on set times and places. One doesn't have to see the other person, as the connection can take place with means of technical devices. However, face to face contact is an integral part of the communication options.

Level C: Autonomy

In this level, the interaction is strongly supported by technical devices to assist in the communication. The technology takes such a strong role that almost no real personal contact needs to be established anymore. The advantage is that people can be more independent from others. The clear risk is the dependence on technology, and the depersonalization of the interaction.

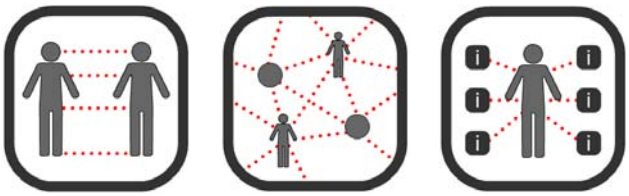

Figure 7: Relation, Networking, Autonomy

Based on these three interaction models (relation, networking, autonomy), focusing on the three defined need area's (safety, social cohesion, health), several future visions have been developed to create an integral vision of a sustainable future. By combining the three need areas, different solution elements can play a synergetic role in addressing all three need area's at the same time. The solution elements have been grouped in three 'extreme' future visions, each called after the respective interaction model that was the basis of the vision.

5.1.1 Vision I: A future based on relationships

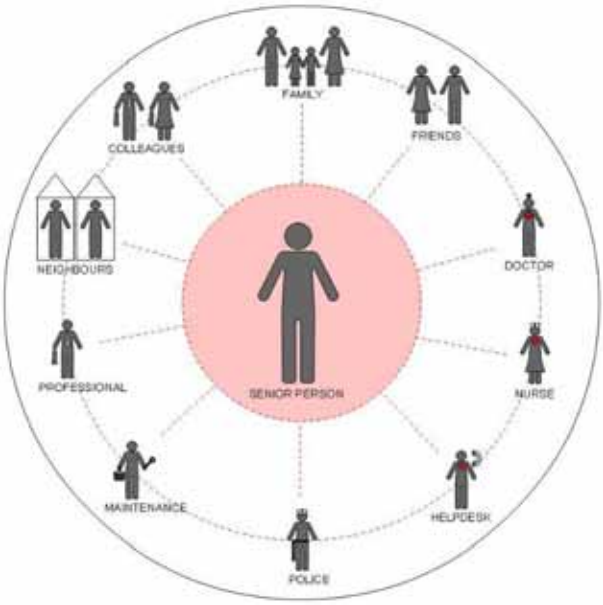

Figure 8: Future Vision I, based on relationships

This first future vision is mainly relationship and service oriented, with a minimum of computer technology used. This future vision can be compared to an old fashioned village where everything is shared, like shared lunches / dinners (where every day changes the cook), shared knowledge (passed by during coffee meetings), shared gardens, neighbours that help each other, shared system for tools and services…etc. In this way, the social cohesion will grow as someone is involved with the rest of the habitants, and a safe and secure environment is encouraged because everybody helps and knows each other, and it seems there are no enemies or strangers around.

Examples of solution elements for this vision are:

- The neighbourhood has dedicated people watching around to keep the common safety. Everyone has a personal nurse that is responsible for health care issues. Also, a local policeman is always present to guard the area and take of all security issue.
- In the neighbourhood there are several 'relation-networks'. When someone is skilled a specific task, he or she can offer this knowledge or service in an exchange centre. If someone needs something it is possible to go to the exchange point and ask if there is somebody that can solve the problem. For each problem that is solved by a person, he or she receives a certain amount of credits that can be used to achieve other services.
- It is stimulated that people live with their relatives, and relatives can stay in a 'family hotel', that enables visiting family to stay for a longer time.
- There is a local news paper/bulletin in which all the things that happen around home are written down. There is information about the neighbourhood; there are articles which are meant to teach people about a certain subject, there is information about

courses and activities. In short, everyone knows everything about everyone…

5.1.2 Vision II: A future based on autonomy

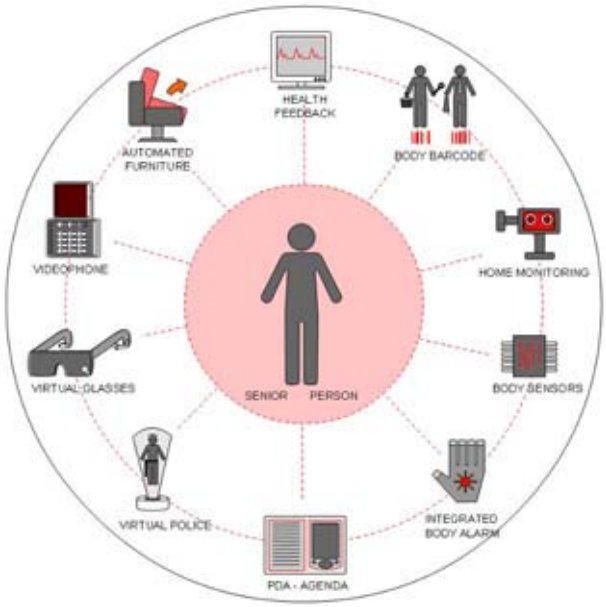

Figure 9: Future Vision II, based on autonomy

The future vision based on Autonomy has a strong focus on computers and other technology. The main part of the functionality is provided with technological means. The human involvement in the solution is kept as low as technically possible. Whenever possible, human actions are replaced by technology. Human contact is still possible, but is maintained mainly by means of virtual interaction. Personal contact is achieved through screens, computers, holograms, 3D glasses, virtual networks and virtual group activities.

Examples of solution elements for the autonomy vision are:

- An automated delivery system takes all goods to people's houses without the necessity to go outside. Foods, medicine and other goods are equipped with a tag that makes it possible that every good consumed is automatically registered. These goods are automatically refilled with the smart delivery system at home.
- Beside the goods, also the inhabitants are equipped with a tag that they have to wear at all times. The tag is used to store information about the person (health situation, hobby's, address, medicine they are taking… etc.) and identify the person at all times.
- Inhabitants that need regular visits from a doctor are equipped with a bed with build in health sensors which are remote controlled by a doctor. Through this bed, they'll receive a regular virtual consult supported by the various body sensors. No more need for doctors visits.
- Intelligent support devices ('smart robots'), are present everywhere in the community. The support devices perform all the routine tasks like cleaning the house, turning off the lights,

watching for burglars, etc. There is almost never the need for a real person to be involved, as the intelligent support devices can solve most issues themselves.

5.1.3 Vision III: A Future based on networking.

In the networking vision, the focus lies on the balance between human involvement and technology. Technological options are used, keeping in mind that the technology should be an extension of the capabilities of people, and not replacing him. Technology is used, but always with the aim of improving human interaction between people. Routine activities can be taken away by technological means, but the technology should support interaction, and never replace eye-to-eye human contact. Although the difference is often a subtle one, the goal should be to enable people instead of disabling them [10].

The solution elements in this vision resemble the ones in the relationship vision, but they are supported by means of technological devices. Examples of solution elements for the networking vision are:

- In the neighbourhood there is an electronic ‘neighbour network’. Everybody can be a member of this network. If something happens to one of the members, the other members can help. With one push on the smart assistant button someone can ask help from one of the others (every neighbour carries a device). The nearest neighbour is located and asked for its help. In this way, care services don’t have to interact when it is not necessary.

- There is a database available in which everyone has a personal file with information about his interests and hobby’s of the habitants. This way it is possible to find and date persons that have the same interests, and join them at a central meeting place.

- Every person is equipped with an alarm device, which works in two ways: either the owner presses the alarm when one is in need. Other people can also send a warning signal when they have a problem or find themselves in a problematic situation. The device links the wearers of the device to each other, limiting the pressure on formal emergency organizations.

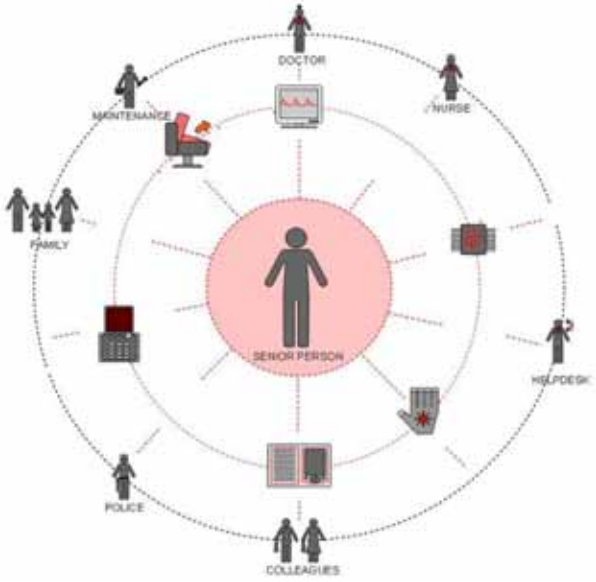

Figure 10: Future Vision III, based on networking

5.1.4 Translating future visions in solution scenario's

As part of the development of the future visions, several solution elements, being smaller parts of more integrated solutions, have been translated in possible implementation scenarios. These have been visualized by means of several storyboards, showing how a certain solution would function from the perspective of a user in his/her surrounding. No specific attention is placed on the technological background of the specific solutions in this phase, only the actual functionality of the solution is shown.

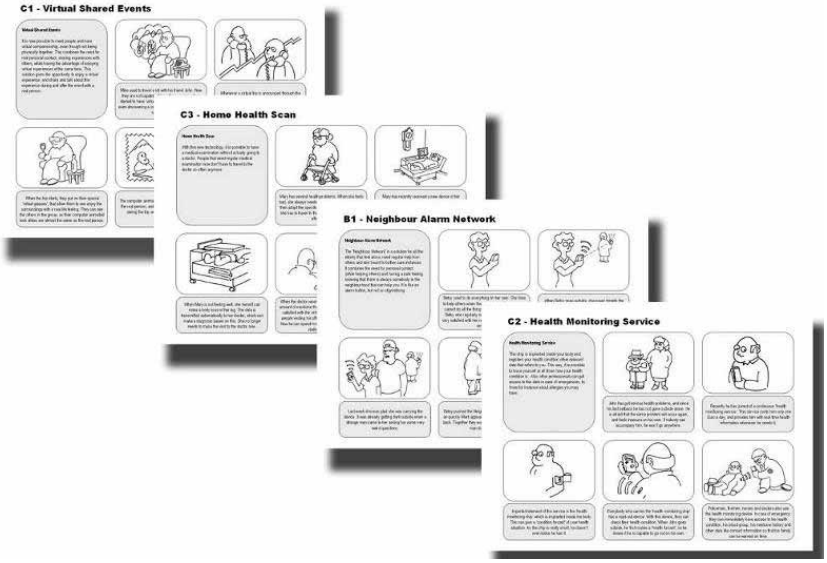

Figure 11: Examples of storyboards based on future visions

Based on these storyboards, each of the relevant actors commented on the scenarios from their own specific technological, organizational or user

perspective. This gave a good impression about the possibilities and bottlenecks to be expected with the implementation of the solutions, all put in a time perspective showing what is possible and when it is possible.

6 Case description step 3 and 4: Backcasting, roadmapping and system design

The backcasting and roadmapping steps from the SSI method are not described in this paper, as they have had a strong technological and organizational focus which is not relevant for the social perspective of the research. Although the overall project is still focusing on several related aspects, this paper describes only one specific track that is elaborated, being the function of localization of elderly people. In brief, the reason for this choice lies in the fact that this group of elderly people is expected to be growing rapidly the coming years48. Alzheimer disease results in the degradation of ones cognitive skills, creating temporary memory loss and resulting in people getting lost and having a tendency to wander off. The principal worry of caregivers is that the patient is outside strolling around, and is impossible to trace to give help or show the way home. At this moment, this wandering behaviour is one of the main reasons that people can no longer life independently but have to move to a closed institution. As the overall goal of the project was to assist people in living independently for a longer time, this focus seemed to support this goal in the best manner available.

6.1 The Guide Me concept

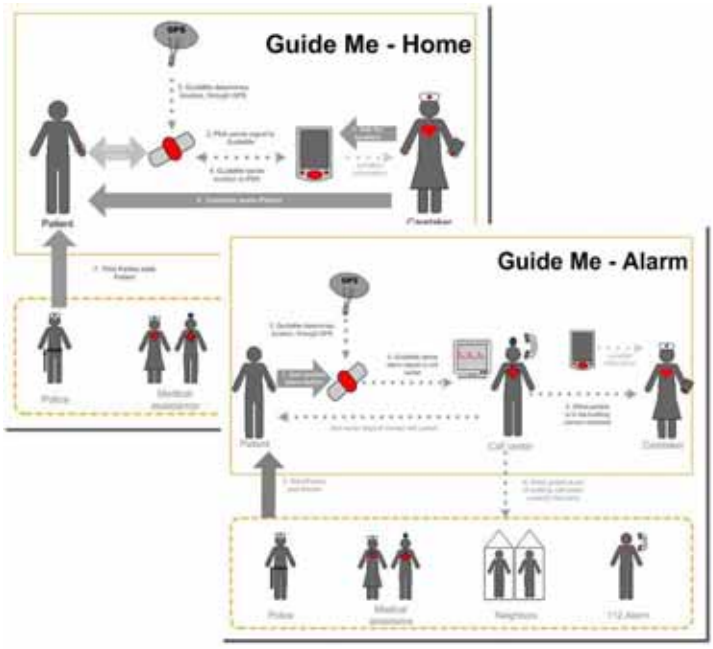

Figure 12: Guide Me system maps

[48] About 130.000 people in the Netherlands suffer from Alzheimer, 180.000 people have a form of dementia. By 2050 the amount of people suffering from dementia is expected to rise to 410.000, of which there will be about 300.000 Alzheimer patients. That is one of every 57 inhabitants of the Netherlands. [8]

The Guide Me concept mainly consists of a localization device that helps the caregiver to know where the user is at all times. The user has to carry a small GPS device that communicates with a computer or PDA of the caregiver. Whenever the caregiver wants to know where a certain user is, he can see the location on a map on the computer or PDA. This functionality enables the patient to go about his/her daily life, for example to go for a stroll or visit a friend, without supervision under a physically present caregiver. From the perspective of the caregiver (either professional or partner), the device is a technological support to give more ease of mind, as the caregiver no longer has to be alert at all times, watching out that the patient doesn't wander off. This results in the prolonged independence of the elderly person, delaying the need to move the person to a closed off living surrounding.

To further analyze the implications of Guide Me system for the various actors involved, the system mapping method as developed in the EUFP5 project Highly Customized Solutions [5, page 107],[6], showing the various information and material streams of the system. In the scheme, the various actors that are involved in the solution are shown, and the communication and material processes that are involved are shown by means of graphical visualizations. At this level, the function of the various products and services becomes clear, and the discussion with the relevant actors can take place.

One of the things that becomes clear from the system maps is the fact that the extension of the Guide Me concept with an alarm functionality has rather big implications for the system surrounding the solution. In the first version, the caregiver can only ask for the location of the user, and all actions are taken by the caregiver. This means there is no extra functionality for the user, which is probably a good thing in the case of the elderly users, as they can not be expected to handle a rather complex device. The second version is exactly the same as the first, with an extra alarm functionality added for the user. However, because this alarm functionality needs be functioning at all times, one sees that the need arises to involve 24h emergency organizations. For the Guide Me functionality, it is chosen to only focus on the extra benefits of the localization functionality, deliberately leaving out the option of the extra alarm function.

Figure 13: Scenario for Guide Me concept

6.2 Defining the exact functionality of the Guide Me system.

To find out the feasibility of the Guide Me concept, an investigation regarding similar existing products and services was done, and the expected bottlenecks when implementing the new Guide Me system were defined. Although several comparable products are on the market, they all have their respective limitations. One of the issues that surfaced was that even when people own product like a wearable alarm device or localization device, they have a strong tendency not to use them at all, or only during a very limited amount of time of the day. This reduces the effectiveness of the device in a big way.

The background of this behaviour was found in three main areas of attention, derived from both the experience prototyping research and the analysis of existing products:

- Existing products are very large and not easy to carry,
- Existing products that are smaller have interfaces that are very difficult to handle for elderly people,
- Existing products often have a stigmatizing appearance.

Next to this more regular user issues, a fourth very important issues came to the surface. With the increasing loss of memory, the functionality of a certain device is not always clear to the elderly person. People who can sometimes not even recognize themselves in the mirror, do not realize the functionality of a localization device that they need to carry with them. The first three issues can be considered as ‘product related’, and can be improved with a rather simple redesign of existing products. However, the fourth point regarding the taking along of the device by the user is a more subtle one that needs specific attention.

As part of the system approach, also the points of attention outside of the end user were considered. The more ‘system related’ reasons why concepts like the Guide Me localization have a hard time to develop are among others:

Financial support of the system by the government or insurance companies is lacking. The device can be considered as a preventive health measure, which at this moment is not covered by the main insurance and governmental organizations.

Responsibility issues from a company perspective. A Guide Me device creates a feeling of safety with the users and their caregivers. However, how real is this feeling of safety? And who is responsible when an accident happens and the device doesn’t function properly?

Responsibility issues from the caregivers perspective. When it is now possible to localize the position of a user at all times, who is actually responsible to perform this task? The following of the location of a patient could add another burden on the already stressed life of the caregiver, instead of relieving the task as intended.

The question is if the benefits of always knowing where the patient is creates enough benefits for the caregivers to make them want to overcome the potential extra burden on their organization. Within this project, a conscious choice is made not to bother about the financial support structure of healthcare in the Netherlands. The assumption is made that a device like

the Guide Me will be covered by insurance or government once the benefits are proven.

7 Step 5: experiments

7.1 Experience prototyping

The experimenting activities have been divided in two parts. The first limited test was especially focused on the potential benefits of the system for the caregivers. For this, the Guide Me Home concept has been researched with representative users by means of experience prototyping. This means that no real device is needed yet, but the functionality of the system is simulated by a computer, and by researchers who 'act out' the solution behind the screens. No commercial companies were involved at this stage.

Figure 14: Users giving comment based on the experience prototyping, simulating the functionality of the proposed guide me system, from [7]

The outcomes of this research has been described in [7]. From this experience prototyping, it was clear that the Guide me concept actually did create more ease of mind for users and caregivers, and a further elaboration of the system could be viable. Having preliminary answered this more system related issue regarding the benefits and burden of the system on the caregivers in this experiment, the next step was to find a way to answer the most relevant user related issue.

How could an elderly user be stimulated to take along a device when this person doesn't see the benefits of this solution? The hypothesis that came out was that the customisation or personalization of the device that is to be worn by the user could possibly benefit the acceptance by this user. When a personal touch would be added to the product, for instance adding a personal picture to the device, this could improve the acceptance of this device by the user. The innovation challenge faced was now described in the following statement:

'How can the customisation of a localization device support the acceptance of this device for the user group of elderly people with a tendency to wander off?'

7.2 Involving the various actors in the second experiment

To be able to perform the actual user test, it was important to find the right industrial partners to deliver the localization functionality. Compared to a regular innovation project, the company was selected in a rather late stage of the innovation process. From a system perspective, this gave the advantage to involve exactly the right company that could deliver the functionality that was relevant in the situation at hand. As the initial research

focused around the Woonmensen organization, it was logical that they would be the testing ground for this new solution.

One of the issues to keep in mind for the researchers is the motivation of the organizations involved. For the care organization, the benefits of the niche experiment is determining the possible benefits of a localization device in their specific care situation. For the company at hand, the benefits are focusing on the possible determination of a potential new market, being the rising amount of people suffering from psycho geriatric diseases like Alzheimer. From a research point of view, the attention lies in the potential benefits of adapting an existing device into a more customized product, especially suitable for the use of one specific person.

7.3 Starting up the experiment

Figure 15: Left: localization device user wearing the device for several weeks. Right, the charging unit also needs a place in the home.

The experiment now planned contains two phases. In the first phase, the existing localization system is given to several elderly users and their care givers (either partners or care personnel), who are using the system for several weeks. During this time, the behaviour and experiences of the users are being determined, and in depth interviews are held to find out the experience with the existing product. The main area of attention will be finding new ways to stimulate users to take the device along, when there is no direct function attached to the product for them. And does the customisation or personalization of the device help in achieving this goal? The other expected challenge is the needed discipline to charge the battery of the product everyday, again without direct functionality attached for the user. No strategy for this aspect is developed at this stage.

From a care perspective, the main area of attention lies in the perceived benefits for the ease of mind of the caregiver. Does knowing the position of the patient actually improve the ease of mind of the caregiver and the patient? One of the main points of attention already signalled lies in the area of responsibility. When it is now possible to know where someone is, does the caregiver actually have to know always where the patient is? This could create an extra burden for the personnel or partner, instead of reducing the burden as intended! When an accident happens with a wandering patient, ‘someone could have known that they were lost’.

In the next step of the research, concrete customisation will take place using the technological basis of the existing product, introducing several customized and personalized devices. These devices will be implemented with the same users again, analyzing their experience with the adapted

product compared to the original ones. Questions to be answered are: Will this customisation or personalization lead to an increased user acceptance? Will this increased acceptance then increase the actual use of the localization system? And does this then lead to increased control over ones own life, thus enabling the elderly person to remain living independently for a longer time? The results of the current test might give answers to these questions.

Figure 16: Various customised concepts for the Guide Me device.

Figure 17: Interface of the tracking unit, based on user feedback.

8 Summary and conclusions

In the project described, a step by step approach has been followed to translate a specific challenge on macro level (‘how can technological innovations assist in an appropriate manner to enable elderly people to remain living in their own home for a longer time?’) into a very concrete technological innovation challenge (‘How can the customisation of a localization device support the acceptance of this device for the user group of elderly people with a tendency to wander off?’).

The various Sustainable System Innovation steps described in this paper have proved to be valuable in translating this macro level need into a micro level innovation issue. One of the main challenges of the described process lies in the selection of issues to focus on when descending in abstraction level. As macro level challenges by definition span a large range of issues, ranging from concrete products to services to government policy, the

influence of each of these issues can not easily compared with each other. Simply said, there is not one ‘magic button’ that solves all problems at once.

An important potential benefit of the SSI approach is the way in which it can influence the various actors involved to all take a step in the preferred innovation direction. The inspirational strength of the future visions play an important role in this process. For this purpose, the future vision should not only envision one or more possible futures, but should be much more the vision of a specific desirable future. The process of deciding on the definition of this desirable future still needs further elaboration. A strong input of users, combined with the input of the other stakeholders, is an important element of this process. However, to translate this ‘objective’ input into a convincing desirable future perspective, the strength of the more subjective design vision is an important condition for success.

In the current phase of the research, the actual benefits of the selected device in their user context are being determined, as well as the potential benefits of product personalization and customisation to the functionality of the system. After finishing that phase, the SSI process has then been followed through from macro level down to micro level (forming the left side of the ‘V-cycle’). The evaluation process then needs to determine if the changes on micro level indeed will result in the goals that have been set on macro level, forming the right side of the described V-cycle for system innovations.

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Chapter 17 Service Notation Tools To Support Strategic Conversation For Sustainability

2 cases-stories of co-design of PSS within different stakeholder contexts

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1 Abstract

The paper will present the use of service notation tools to facilitate strategic conversation between stakeholders within a complex system of multiple actors. 2 case-stories will focus in particular the use of story-boarding and narratives techniques to support processes of co-design of new product-service systems within different contexts such as a partnership of industrialists or a scientific community of experts. In the 2 cases-stories, the innovation focused are aiming at a different mix of sustainable concerns (i.e. enhancing socialization, privacy protection) and are all based on a high technological content.

The case-stories are:

- D3 - development of a peer-to-peer personal device to support local connectivity between IT companies;
- PET - co-design of privacy enhancing design guidelines within a network of international research laboratories in computer science and interaction design;

2 D3 – exploring applications for a peer-to-peer short distance communication device[49]

2.1 Context

The first case presents the definition of the technical specifications of a peer-to-peer short distance messaging device aimed at facilitating connectivity and

[49] This project has been co-developed with Peter Joore and Karl Sewalt from TNO Science & Industry Eindhoven and benefit the collaboration of Milamem Abderamane-Dillah and Goliath Dyèvre from Les Ateliers Paris.

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exchanges within people evolving in the same surroundings. The device can send and receive radio signals to other devices situated within a 50-100 meter distance. The particularity of the system is to be based on a communication protocol where devices are using each other as "hub" to circulate the information. No service provider is needed but only a certain density of devices in the same place in order to ensure a fluid circulation of the information among all the population of users. The device includes also a new technology flat display and touch screen display with particularly low energy consumption.

The project consortium organized by the TNO Industry & Science in Eindhoven is constituted of Orgatronic, a TNO spin-off producing the displays, Chess developing the communication software, Kooymans developing the device design and Strategic Design Scenario developing the scenarios of use.

The initial field of application focused by the two companies was the market of professional trade shows where the D3 device could be distributed as entrance badges and facilitate the exchange of information between exhibitors and visitors and between visitors themselves. Alternative scenarios of use have been developed in order to enlarge the possible applications of the device and define its technical specifications for a broader market.

2.2 Co-development of story-boards

Through iterative workshops and interactions the project partners defines story-boards of interactions in different contexts of use. Strategic Design Scenarios supported the process stimulating the strategic conversation between the stakeholders through inventing narratives making use of the many functionalities allowed by the original new device. Each of the narratives was visualized by a 6-8 pictures story-board and circulated among the different stakeholders for comment and upgrade (Figure 4).

Figure 4: 7 story-boards picturing a range of possible application of the D3 device in different contexts of use

7 contexts of use were defined for investigation:

1. a "e-Care" device to facilitate prevention and support open health care services between patients, their relatives and the medical staff;
2. a "Neighb-Connector" to enhance the socialization and mutual help between inhabitant and especially elderly of the same neighbourhood;
3. an "Active Leaflet" to guide visitors of an art festival or cultural event in a city;
4. a "Tourist Guide" to involve visitors into an interactive exploration of the city by foot;
5. a "e-Flyer" to invite the public to take part and interact during artists happenings;
6. a "Kid Game" to allow interactive role game between children outside the school;
7. an "Active Badge" to facilitate communication and exchange between the visitors and exhibitors of a professional trade show;

Each of the story-boards is based on a background image setting the context of the action and a rough drawing showing the main characters and artifacts involved in the interaction. A short caption on the image quotes the essential of the dialogue between the characters and specifies which functionality of the device is involved. Each story-board was circulated as a slide show by mail between the different stakeholders. Comments allows to fine tune and sometimes reorient the stories. See an example of the final story-board in Figure 5.

Figure 5: Example of story-board of the D3 application as a "Neighb-Connector" to enhance the socialization and mutual help between inhabitant and especially elderly of the same neighborhood

A first pilot was made with one story-board to align the team on the new working process. After, the 6 other story-boards where completed in a period of 3 weeks for the all process.

The following steps consisted in the precise definition of the technical requirements of the device for each of the 7 different applications. A clustering allows to see which ones were easily compatibles. A strategic choice was finally made as a trade-offs between market potentialities and technical development costs. The project team agreed to focus on 3 of them: the Neighb Connector,, the Active Badge and the Kids Game.

2.3 Discussion of the co-design process

This experience underlines 2 important aspects of the use of story-board as a tool to define new product-service systems.

The first aspect is the research and specification of technical requirements through the definition and discussion of narratives. The invention of a user story as the basis of the construction of the story-board is used as an elliptic mode to define the new solution: The creative team looks within a given context of use (i.e. elderly in a neighborhood), for the story that will illustrate in the most convincing way the use of the device in the focused situation (i.e. how to facilitate contacts, enhance socialization without too much cognitive overload or risks to disturb people privacy…). In a second time, the story is assumed as typical and core application of the device and technical specifications are derived from it. This apparently slightly tautological construction process – where technical characteristics of an artifact inspired a new application that in return redefine the initial technical characteristics – is a very efficient design process to orient technical potentialities onto a user centered application.

The second aspect is the facilitation of the exchanges within multi-disciplinary teams. The project related here emerged from a technological push looking for market application. The use of stories allows to reintroduce the user in the center of mainly technical discussion. Compared to lots of user centered approaches based on the explication and discussion of users motivation and perception, the story-boarding is a more direct process enabling non user experts to participate and give inputs. The story speaks to the personal experience of a technical expert, diverting him or her for a moment from the technical expertise to facilitate a discussion from a user point of view. On top of the use of stories a enabler of dialogue, the visualizations in the form a story-board gives event more access and attractiveness in a collaboration process towards the construction of shared views.

3 PET - co-design of privacy enhancing design guidelines for IST[50]

3.1 Context

The second case presents an experience of co-construction of privacy design guidelines within the Ambient Agoras[51] research project within the IST Disappearing Computer Program. Ambient Agoras was developed between 2000 and 2003 and was focused on the development of ambient intelligent environment to support working spaces. As most of the IST Disappearing Computer research projects, Ambient Agoras was dealing with a series of promising concepts on the sharing of personal information, on context aware systems, self-learning processes and augmented working and living environments that may constitute a serious threat to the preservation of the people privacy in the near future. Already today, a growing number of privacy problems are to be seen with the digitalization of personal information (i.e. in health, travel, education, payment, work, leisure…) and the growing of the connectivity between the distributed computing power. The high speed development of information technology exceeds from far the capability to develop appropriate legislative protection instruments and the national and international institutions of defense of citizens rights as well as consumers associations struggle to fight abuses. On the user level, the permanent request for more convenience and service in consumer electronics leads producers to develop ever more complex and opaque systems.

Conscious of this growing threat for citizen privacy, the Commission agreed an additional workpackage within the Ambiant Agoras to explore the possible development of a first draft of Privacy Design Guidelines to orient the work of developers and interaction designers toward privacy enhancing products and services systems.

3.2 Story-telling material to stimulate interviews

The Ambiant Agoras consortium and particularly the Cognitive Design Laboratory of EDF in Paris and Strategic Design Scenarios in Brussels elaborates a first draft of the guidelines consisting of the series of simple and sometimes counter-intuitive design principles inspired by the day-to-day practice of co-design with users in IT sectors and a first review of the privacy problems in the literature.

Although privacy is recognized overall as a relevant concerns, the level of consciousness among the large public as well as between IT experts is still very low. The main reasons is that concrete problems occurred (i.e. illegal transfer of private information, interconnection of users personal data, falsification of electronic payments, abuse of private mail box…) have not

[50] This research project has been conducted in collaboration with Saadi Lahlou from the Laboratory for Cognitive Design (LDC) at EDF R&D in Clamart, Paris and Joëlle Liberman from Egerie Research in Brussels.

[51] Ambiant Agoras, Dynamic Information Clouds in a Hybrid World, Disappearing Computers, IST-2000-25134

yet reached a level of diffusion to become a public focus as well as a concerns for the developers.

Figure 6: 8 illustrated narratives showing interaction based on the design principles of the guidelines were developed to support interviews of experts.

Therefore, it was necessary to define concrete applications of the guidelines in order to support their discussion. A series of 8 narratives (Figure 6) were developed picturing situations of everyday life (i.e. buying an airplane ticket, visiting a conference, loosing his pin code…). Bits of life of an hypothetical character equipped with a personal digital device and evolving in different service environments designed according the Privacy Design Guidelines are described. Their purpose was to allow a third party to compare between the current situation (i.e. how he/she today buys a travel ticket) and the new privacy enhancing situation. From the comparison it was possible to appreciate benefits and risks, assess technical and business implication and finally reacts on the design principles proposed. An example of narrative showing the acquisition of a travel ticket is presented on the Figure 7.

Figure 7: Animated sequence presenting visually the interaction of a user using her PDA to book a travel ticket with a remote travel agent.

For each of the situations a visual animation is played on a remote server in order to support a session of interview. 12 experts[52] from majors international laboratories working on augmented collaborative environment and human computer interface were involved in one hour online session in a shared mediaspace.

[52] The interviews were conducted mostly among the member of the RUFAE network (Research on User-Friendly Augmented Environment) coordinated by the Laboratory for Cognitive Design (LDC) EDF R&D, Clamart, Paris.

3.3 Discussion of the interaction process

This second experience show a new aspect in the use of story-board based narratives. The flexibility of the teasing material to support progresses of an on-going discussion is key to facilitate an interaction process between third parties and quickly upgrade to match participants comments. The story-telling and it's visual presentation in a story-board-like animation is a very efficient support to stimulate the discussion of concepts between multidisciplinary population. The fact-based narration and the presence of visual support allow to quickly focus a question across professional but also cultural and personal sensitivities. It allows also to focus cultural gaps between stakeholders and differentiate between critics to the concept in discussion and comments triggered by its instantiation in the narrative.

The story-board quoted in Figure 7 shows a good example. The initial narrative visualizes an airport situation and focused the booking process of an airline ticket. The privacy enhancing guideline number 4. called *"privacy razor"* illustrated here stated that: *"Subject characteristics seen by the system should contain ONLY elements which are necessary for the explicit goal of the activity performed with the system. No data should be copied without due necessity"*. In particular, applied to selling transactions, it suggests that the identification of the purchaser is seldom necessary for the transaction. As a common sense, nobody would give it's name at the corner bakery to purchase a loaf of bread but it is also now common sense to disclose personal identity for any important purchase. The narrative proposed in Figure 7 is intending to question this practice and suggests other alternatives such as the exchange of temporary pseudo. This hypothesis was highly criticized and regarded as unlikely to occur by the first series of experts interviewed, especially by American experts compared to European. The common sensitivity to airplane security due to recent terrorist attacks was far too important to allow the consideration of the concept behind its instantiation. A new context of use was substituted after the first 5 interviews to change the reference from airplane to high-speed train ticket booking. It resulted in a complete shift in the comments in the last group of interviews and considering the limitation of personal identification as a much more interesting and progressive ideas.

In terms of visualization tools to support strategic conversation processes, the flexibility of the material is key to accommodate cultural barriers in the in the co-design process.

4 Narrative story-boards as a co-design support tool.

The 2 cases presented and discussed in this paper show the main contributions of the use of story-boarded narratives in a process of co-design of a product-service system between different populations of stakeholders.

In particular, the analysis of the co-design process pointed 3 important benefits of this approach:

1. It facilitates the dialogue, the exchanges and the interaction between actors from various cultural horizons and professional backgrounds;
2. More than a static support of dialogue between parties, it is likely to participate to the co-design process it-self and evolves with it.

In terms of sustainability, the examples presented focused socio-ethical dimensions. Other examples could have been brought using the same approach to co-design new solutions to reduce environmental impact.

Solution notation tools in general and story-boarded narratives in particular have a great potential to support strategic design processes to investigate the possible improvement of current solution but also they are particularly adapted to system innovation processes to redefine current solution and explore possible new configuration of players to implement them.

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Chapter 18 The Use of Communication Tools and Policy Instruments to Facilitate Changes towards Sustainability

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1 Introduction

Designers are able to propose more sustainable solutions to consumer's needs and expectations, but these solutions are often not appreciated by the consumers due to a lack of communication between the main stakeholders, in particular producers, retailers and consumers. A lot of times, consumers are not aware of the importance of the problems, which the new solutions have a potential to minimize; other times, the enormous variety of labels claiming different kinds of advantages produces a lack of reliance in the information provided.

The lack of reliable communication tools has been known for quite some time. In the last years, a lot of effort has been put in projects aiming to improve communication between stakeholders. Environmental Product Declarations (EPD) are one example of such tools. A related on-going EU project – Stepwise EPD –, aiming at the development of a step-by-step method suitable for small and medium sized companies is presented.

2 Stepwise EPD

The overall objective of this EU-funded CRAFT project is to develop a method for stepwise environmental product declarations suitable for small and medium sized companies, so that they can join emerging markets for environmentally preferable products and services.

An EPD presents independently verified data on environmental aspects and impacts of a product throughout its life cycle. EPDs are standardized in ISO 14025, which establish the rules for international Type III environmental declaration programmes. A *stepwise* EPD is an initial EPD with simplified data collection and review. The Stepwise environmental

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product declarations method can be a first step into any national or international environmental product declaration programme.

In short, making a formal EPD involves the following LCA activities:

1. A simplified or streamlined life cycle assessment to identify the most significant environmental aspects and impacts of the product;
2. Interpretation of the results of the initial LCA together with interested parties;
3. A detailed life cycle assessment to validate and supplement the results of the initial LCA; and
4. An external verification of the LCA study.

According to ISO 14025 this process typically results in two documents:

- Product Category Rules on how to perform the LCA and how to produce the EPD for a specific product group; and
- The Type III environmental declaration – the EPD.

Stepwise EPD only consists of step 1 and a simplified version of step 4. Thus, *stepwise EPD is a cost-effective way of trying out to work with EPDs*. But it does not go the whole way of engaging the interested parties in the process, i.e. step 2, and making a detailed life cycle assessment, which often means involving the suppliers, i.e. step 3.

The method is being tested in ten SMEs in Denmark, Latvia, Portugal, and Sweden. Research and Technological Development (RTD) institutes in respective country aid the companies with the life cycle assessments and the EPDs. The Stepwise EPD project is based on the following assumptions:

1. An EPD can be used to communicate a product's environmental profile to potential customers thereby creating a demand for such products with improved eco-efficiency;
2. Producing the EPD, or rather performing the underlying life cycle assessment, can be used to identify eco-design options;
3. Together, the customer demand and the identified improvement options will bring about actual improvements in a product's eco-efficiency.

In this paper we will explore mainly assumption nr 2.

The Stepwise EPD consortium is elaborating guidelines – mainly based on inputs from ISO 14025, the Swedish EPD programme and the upcoming Danish EPD programme - for stepwise EPDs, which include mandatory contents (Stepwise EPD guideline, 2005). Headlines are:

- The company;
- The product;
- List of materials and chemical substances;
- Product life cycle information;
- Date of publication;
- Critical review;
- References;
- Endnote.

The list of materials and chemical substances concerns all significant materials contained in the product, in percent of weight, as well as the declaration of substances and preparations that are classified according to applicable EU-legislation and that correspond to the relevant labelling criteria of the directives.

The product life cycle information includes the explanation of the functional unit, a graphical presentation illustrating the system boundary with an explanatory text and environmental parameters: *inventory parameters* (resources – total, renewable, recycled; energy resources – fossil and renewable; waste – hazardous, non-hazardous, to recycling) and *environmental impact category indicators* (global warming, photochemical ozone formation, eutrophication, acidification and ozone depletion are recommended impact categories).

It should be stressed that Stepwise EPDs do not fulfil all requirements of ISO 14025, although its layout follows basically this standard. An alternative layout including the use of normalised impact results and a revised order of the headings is being tested by the Danish partners.

3 Stepwise EPD and ecodesign

There were no statements that the participating companies joined the Stepwise EPD project with the aim of eco-designing their products. The motivation to participate in the project was primarily that of being able to show to the interested parties (primarily the customers) that they act in a transparent way and are willing to disclose environmental information about their products, with some sort of validation or review by an external party.

Nevertheless, the process of performing the Stepwise EPDs – especially the simplified LCA – has given them information that can be potentially used for product improvement. The process of performing a Stepwise EPD consists of four steps (Stepwise EPD guideline, 2005):

1. Scoping *together*. This is a maybe a short day's exercise including introduction to LCA and Stepwise EPD, analyzing and deciding which product or product group to focus on and introducing the data collection procedures.
2. Inventory by the *company* on "Our production" and by the RTD partner on "Before our production", "Use" and "End-of-life" stages of the life cycle. How much time is needed is dependent on the complexity of the product and the availability of data. Various templates are available.
3. LCA-calculations and outline Stepwise EPD by the RTD partner (*LCA expert)*. How much time is needed for the LCA is dependent on how well the inventory has been performed and the complexity of the product.
4. Examination of LCA and drafting of EPD *together*. In this step new knowledge about the product's environmental performance is created. Normally one short day is enough for this exercise, but you may decide to do step 3 again and refine the LCA. Then you would also do step 4 again.

A conclusion coming out of applying this procedure in the Stepwise project is the necessity to involve an LCA expert with access to LCA software and LCA databases in the work, at least the first time a company makes an EPD.

Despite the fact that the participating companies did not join the project to improve their products, many improvement options have been generated and quite a few are being implemented, leading to significant results in terms of product improvement. As part of the project activities, ecodesign workshops were carried out facilitated by the national RTD partner and

additional information, methods and tools were used in order to enable ecodesign options generation. Afterwards the RTD partners are following up the product improvements that happen (or not) and why. The main focus for the project is how to improve and supplement the stepwise EPD concept so that it can be a more effective tool to achieve products environmental improvement[53].

But beforehand, which were the major drawbacks identified? Preliminary results showed the following issues:

- Understanding the data: the environmental results presented in a Stepwise EPD (as well as in an EPD according to ISO 14025) are of very little interest to a designer; the environmental meaning of impact categories is only roughly (if at all) understood by company staff or their clients (except if they have an environmental manager, which is unlikely in SMEs). And moreover the environmental impact category indicators as well as inventory data need to be deployed and related to the materials and processes that are responsible for the environmental impacts. Only then the data in the stepwise EPD is interpreted into usable information for the designers and the product development team as a whole.
- Finding alternatives: the challenge is then to find alternative materials and processes that may improve the environmental burdens that were realized. This is no different from any ecodesign programme but during an international project meeting held last November, companies restated the need for tools to support them in finding more eco-efficient solutions.
- Comparing performance: for the Stepwise EPD companies this has been a very important issue – how does my product perform in comparison with others? Benchmarking is a tool well known in product development and it has been emphasized that the value of an EPD would be much higher if it could enable this comparison.

In order to address these points, the project team has outlined a number of activities and recommendations that are relevant not only for the project but presumably to national and sectoral EPD programmes:

- Understanding the data: generic explanatory information about the project, the stepwise EPD versus the "real" EPD concept and the meaning of the environmental parameters including normalization data (average European person, 1999) has been produced and will be used by companies in their internal and external communication. In addition, at least for some companies, a written explanation of the LCA results in relation to the different stages of the life cycle as well as those materials, components, activities and processes that are mainly responsible for the impacts, are indicated. In Sweden two activities in the Stepwise procedure used facilitates the understanding: Step 4. Examination of LCA and drafting of EPD *together*. In this step new knowledge about the product's environmental performance is created; and an additional step including an idea generation

[53] Note: In this paper we are focusing in product improvements achieved via ecodesign but the (stepwise) EPDs have a potential to facilitate green purchasing as well, which is being explored with the partner companies.

workshop to brainstorm environmental improvement opportunities. In these workshops, the result of the LCA interpretation was presented.

- Finding alternatives: this issue has not systematically been addressed by the project, but RTD partners applied their experiences and ecodesign manuals etc. For instance, in Portugal, additional tools such as the Ecodesign Checklists (Frazao et al., 2003) were applied in the ecodesign workshops. It should be mentioned that the usability of EPDs or any other instrument for ecodesign will only be successful if companies have easy access to complementary tools such as data bases, idea generation tools for ecodesign strategies and others.
- Comparing performance: the EPD programmes rely on the assumption that the clients or customers will include in their purchasing procedures environmental criteria that may be assisted by the comparison of EPDs of competing products. Since the rules for performing the LCA per product categories as well as standardized ways of presenting information and verifying the declarations are established, such comparison is meaningful. But in most of the cases such competing EPD simply does not exist yet. On the other hand, comparisons with competing products within one and the same EPD are not allowed according to ISO 14025. Therefore in the Stepwise EPD guideline it is recommended that comparisons or relations are performed regarding:
  - The company's own prior or existing process or product;
  - Realistic product usage scenarios/options;
  - EU, national or product group average information often referred to as normalization.

4 Integration of ecodesign and marketing activities

Another finding of the project was the benefit of integrating the ecodesign and marketing activities during the process of performing the Stepwise EPD's. Based on experiences in the Danish SMEs a stepwise approach for this integration has been developed:

- Step 1: Draft LCA – done by an LCA expert and part of the learning process for the SME; LCA is not easy to understand and use;
- Step 2: Revised LCA with stories on alternatives and improvement options – both improvement for the product it self but also improvements compared to competing solutions and products – based on questions typically being asked by customers and ideas for improvements from the company and the RTD partner;
- Step 3: Internal marketing analysis – is there a selling story in the environmental improvements – done by the company and if needed a consultant on environmental marketing; also beneficial to involve expertise on the significant environmental aspects and impacts; the involvement of these external consultants is not always appreciated by the companies and the customers as beneficial, though;

- Step 4: Screening market analysis done by the company – who are the customers? Why do they buy from us? Environment, occupational and human health? What is important? – Direct contact with customers (and even their customers when applicable and possible) – will our environmental stories help selling the product?
- Step 5: List of eco-design options: Based on the preceding steps a list of key environmental issues can be made and the connected improvement options - some will be LCA based and some will be there to avoid market barriers;
- Step 6: Marketing strategy and materials – the marketing people of the company will do the final work of developing marketing strategy and materials – in cooperation with environmental and other experts if needed based on the results of step 1-5.

5 Discussion

Life-cycle based tools allow the designer to identify the main problems related to a product or service system, as well as the life-cycle phase where these problems occur. These findings could then be the basis for a new design strategy, or could constitute criteria to choose the best alternative. But besides that, a consensus between the main stakeholders is needed on what are the main problems and why are they problems. On other hand, stakeholders should agree that the new solution do not create new problems also considered to be important. Thus, communication tools are essential in the product or service development process.

However, are EPDs meaningful to the consumer? In what situations? These seem to be business-to-business and business-to-government situations, especially in countries where the environmental awareness of the market is higher. For instance, the only product from the Portuguese companies whose stepwise EPD will develop into a full EPD is the one being sold to Nordic countries.

Business-to-business situations are the ones in which EPDs can be a useful communication tool in the value chain, thus allowing the improvement of a product or service eco-efficiency along the life-cycle. In these situations, the role of designers is essential if integrated into a multidisciplinary approach (design-engineering-economy-marketing).

Business-to-government situations are the ones in which EPDs can be a useful policy instrument in the context of a green public procurement, for example. In this case, a multidisciplinary approach is also needed (design-engineering-economy-policy making) and designers can play an essential role as well.

In a recent report, the IPP Working Group on Product Information (IPP WGPI, 2006) recognizes that the investment of effort by government and business on product information can be highly cost-effective in delivering improvement, compared with ‘traditional’ regulatory mechanisms. However, an adequate framework should be provided, in particular by governments at EU and national levels whose actions must create more favourable conditions to which the market can respond. One of the recommendations is related with improving the delivery of green public procurement at the same

time as creating a strong market 'pull' for standardised forms of product information, encouraging the development of sectoral EPDs.

What we do not know is if EPDs are able to trigger more far-reaching eco-innovations. In fact, our experience shows that EPDs are applicable in redesign processes rather than in new solutions development. More powerful tools to do so are necessary.

Other week point is the fact that EPDs do not consider social aspects. In order to include this kind of issues EPDs must be complemented with other tools able to deal with social issues along the life-cycle. This is a foreseeable situation since social life-cycle assessment methods are being developed (Weidema, 2005).

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Chapter 19 Designing Alternatives

Sustainable Consumption, Lifestyles and 'Responsible Consumers'

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Abstract

This paper presents insights from a current research that aims to understand the notion of 'responsible consumption', its relationship to consumer preferences and expectations, and its implications for product design. The paper discusses existing literature on sustainable consumption in relation to product design and summarizes initial findings from a study conducted among people who consider themselves responsible consumers. Notably, four different profiles of 'simplifiers' are described. The study shows that people who took part in the research adopt more sustainable lifestyles not only because of an ecological consciousness, but also because of perceived personal factors or benefits. The study also reveals that participants have both a close and distant relationship to objects and that they prefer products that allow them to be engaged in the activity of "doing". Design strategies informed by these insights are explored. The paper suggests that designers can support and encourage those already active or interested in orienting their consumption habits towards more sustainable solutions by envisioning appropriate ecologically and socially responsible design alternatives.

1 Introduction

To gain a deeper and more comprehensive understanding of the significance of sustainability for product design, it will be essential to consider the views of those who acquire and use products, and especially the perspectives of people who are aware and concerned about the relationship between sustainability and consumerism. To this end, and within the framework of an ongoing research project, participant observation and in-depth interviews have been carried out among people who consider themselves 'responsible consumers' and promote, in various interpretations, the notion of voluntary simplicity. This research seeks to understand the

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potential of sustainable consumption, the lessons it may hold for product design and production, and the implications for material culture.

A discussion of existing literature on sustainable consumption in relation to product design is followed by initial results from the current research. The relationship between consumption choices/lifestyles and sustainability, and the role design might play in supporting sustainable lifestyles, are also explored. In particular, the paper outlines design strategies for developing more ecologically sounds products. These strategies recognise the notion of 'voluntary simplicity', while also acknowledging critics of the "simplifying" process. Finally, initial conclusions are drawn with respect to the implications for product design.

2 Sustainable Consumption and Product Design

2.1 Ecocitizenship

Many contemporary authors in the field of sustainability suggest that there is a clear need for reorienting consumption patterns and, more fundamentally, the dominant economic system based on unlimited growth in our materially finite world (Cavanagh et al., 2002; Porritt, 2005; Hutton, Jones, 2005). There is a long list of negative impacts resulting from our ways of conceiving and producing "wealth", but there is also a long list of positive and concrete actions that can be undertaken by individuals and groups to contribute to a more sustainable world. Many of these actions relate to our patterns of consumption. In fact, the act of consumption enables citizens to shape, through choices and preferences, larger environmental, political, cultural, social and economic practices. Decisions related to consumption, including the choice not to consume, have direct and indirect impacts on one's immediate community, and the associated repercussions, both positive and negative, extend to other places in the world. Therefore, through the act of *responsible* consumption, people can become "eco-citizens" or "citizens of the world". In addition, although consensus about a precise definition of "sustainable consumption" has not been reached, the idea that people's choices, behaviours and lifestyles play a vital role in moving towards sustainable development is a point of agreement in international environmental policy debates (Jackson, 2004).

In terms of individual initiatives, sustainable, responsible consumption may be expressed through the following elements (Marchand et al., 2004 based on Hansen and Schrader, 1997, and Cooper, 2000):

1. **Abstention**: refraining from consumption or, in some cases, consuming less;
2. **Attitude**: seeing consumption that exceeds one's basic needs as negative;
3. **Awareness**: choosing products on the basis of their broad-based ecological qualities;
4. **Alternative**: identifying substitutes to traditional consumption (e.g. switching from product to service).

2.2 Sustainable Patterns and Lifestyles as a Trend?

There are many indications of changing consumption patterns and lifestyles that, although relatively small, may be positive signs of change towards sustainable development.

According to United Nations Environmental Program (UNEP), consumers are increasingly sensitive to the world that lies behind the products they buy and this heightened environmental and social awareness is a sign of hope upon which governments and industries must build (UNEP, 2002).

One of the main conclusions of the European Roundtable on Sustainable Consumption (ERSCP, 2004) entitled "Meeting Consumer Demand for Sustainable Products" points to increased consumer interest in sustainable products and new lifestyles. This roundtable also underlined the presence of a growing "creative society" that is moving towards sustainability by initiating sustainable alternatives such as co-housing solutions, network trade and barter systems for products and services, and advanced organic food chains.

The Trends Research Institute, says that in the years to come, "America will be going on a long-term downsizing trend where big cars, big houses and big extravagances will be a thing of the past for Mr. and Mrs. average" (The Trends Research Institute, 2006). This trend, they have named "Simplicity Hip/Funky Cool", would notably be motivated by an economy on a down trend, workers suffering from wage erosion, increases in fuel prices and impressively high debt levels among American households. This could lead to a certain philosophy where "less" will be "more" so that in areas "[f]rom food to fashion, high tech to low, the "in crowd" will be seeking quality products that reflect personal styles and are simple, reliable, and can be repaired – not trashed – when broken…". However, it is as yet unclear if such trends will be significant enough to make a real difference or if it will be just an isolated phenomenon.

Although these examples, and others, could be indicative of some movement towards more ecologically sound choices among certain consumers, the steps from green consumption to sustainable consumption remain uncertain (Cooper, 2000). 'Green consumption', which stems from the 1980s, relies more on consuming 'greener products', whereas 'sustainable consumption' is also concerned with the quantity of goods that are consumed and the social integrity of the processes by which they are produced. In addition, an important phenomenon that adds further uncertainty to the question of sustainable consumption, is the rapid economic development in Asia - where an emerging middle class is adopting Western lifestyles, with their concomitant environmental impacts.

Despite the vast uncertainties, we can postulate that by developing "more sustainable" solutions, the field of product design can support existing initiatives and can be a positive contributor to change. Efforts to change consumption behaviour depend in part on understanding the impacts of consumption, knowledge about the existing structures and potential alternatives, the motivations and incentives for change, and the capacity to change in terms resources and infrastructure (Robins, Roberts, 1998). In this sense, new sustainable solutions can positively influence consumer choices,

use and disposal of goods and services. Indeed, people's freedom to make changes in their lifestyles and product choices is constrained by the infrastructure within which life needs to be organised, by habits and social expectations, but also by the range products available (Hertwich, 2005).

2.2 Designing Alternatives

The need to adopt sustainable consumption patterns and lifestyles significantly challenges the designer's traditional focus on new product development. Sustainability provides exceptional opportunities for designers to imaginatively and creatively develop new concepts for material culture. As Cooper (2000) has written, sustainable consumption involves rethinking how products are conceived and how needs are met. In other words, it requires addressing not only efficiency, 'getting the same goods and services out of less', but also sufficiency, 'getting the same welfare out of fewer goods and services' (Carley, Spapens, 1998).

Accordingly, traditional *product-centred* approaches, alone, are not capable of providing sufficient change. Sustainable consumption calls for a *reduced level* of consumption and this notion seriously challenges the seemingly prevalent belief that personal happiness is proportional to the quantity of goods one owns. Highly creative, informed and sensitive design interventions are necessary for the development of alternatives solutions that are ecologically acceptable, socially relevant, aesthetically pleasing, economically viable, technologically appropriate, and individually satisfying.

As Fletcher, Dewberry and Goggin (2001) have noted, a number of design strategies that address the need for sustainable consumption are emerging. These are concerned with:

- ***redesigning*** that which is consumed (consuming greener);
- ***reorganising*** the way consumption takes place (consuming differently);
- ***rediscovering*** the nature of needs and the associated satisfiers (consuming appropriately).

According to these authors, the above strategies for addressing both the quality and quantity of consumption can be organised into three clusters:

- ***product focus*** - making existing products more resource efficient;
- ***result focus*** - producing the same outcome in different (and more sustainable) ways;
- ***needs focus*** - questioning the need fulfilled by the object, service and system, and how it is achieved.

Such strategies require designers to develop new skills, knowledge and tools. Among other things, they also invite us to consult with users in order to understand their perceptions and their reasons for acquiring and valuing objects.

3 Getting involved with 'sustainable consumers'

3.1 Overview of the Study

As part of this ongoing research, in-depth interviews have been conducted among people who consider themselves responsible consumers and who recognize their attitudes and habits in the criteria proposed earlier in *2.1*. The objective of the interviews was to gather insights about the way sustainable consumption might modify our relationships to the material world and the ways in which we experience objects.

The interviewees were people who advocate, in various interpretations and at different levels, the notion of voluntary simplicity. Eighteen individual interviews, each of one to three hours duration, were undertaken with eleven respondents. The interviews explored the ways in which these identified 'responsible consumers' live and experience sustainable lifestyles, as well as their understandings of what it means to be a "sustainable, responsible consumer". The study also looked at the place objects occupy in their lives, the qualities they value in objects, their visual culture, and their thoughts and ideas about sustainable goods. For instance, prior to the interviews, people were invited to take photographs of objects that are meaningful to them, in term of aesthetics, as well as of others products they have personally acquired and consider as "good purchases". These photographs, which were taken in their personal surroundings, were used to focus the discussion during the interviews.

In addition to these individual key-informant interviews, one of the researchers has taken part in existing voluntary simplicity group meetings where people meet and notably discuss different aspects of their experiences in relation to responsible consumption and sustainable lifestyles. Twenty-five meetings have been attended, totalling more than fifty hours of participant observation.

This research experience leads us to some reflections on the role of product design and its potential for contributing to change in the face of contemporary challenges such as sustainability. Some initial insights and thoughts that have emerged from this research are discussed later.

3.2 Voluntary Simplicity

3.2.1 Better living with less

Voluntary Simplicity (or simple living), which might be considered a movement, is an attempt to achieve a better quality of life by minimizing the detrimental impacts of our ways of living on both the human and natural environments. Inspired by ecofeminism, Buddhism, Taoism, and authors in the tradition of Thoreau, it "[…] represents one outcome of the culture of cynicism that has grown up in response to a materialist culture that emphasizes superficial meanings" (Murray, 2002).

According to Burch (2003), the main characteristics of Voluntary Simplicity (VS) include:

- the rejection of a culture of consumption;
- a search for autonomy based on a social conscience;

- the revision of consumption choices and a preference for more ecological modes;
- taking a conscious approach to life rather than adopting impulsive and unconscious behaviour;
- consciousness of a spiritual life.

For instance, as Craig-Lees and Hill (2002) wrote, voluntary simplicity lifestyles "[…] can include city dwellers who make an effort to curb their consumption, executives who refuse a promotion (and the associated increased income) in order to spend more time with family and friends, or people who move to rural areas in an attempt to adopt a totally self-sufficient life-style".

Duane Elgin, author of *Voluntary Simplicity* (1981), from which the movement took its name, and Arnold Mitchell have described voluntary simplicity by suggesting what it is not (Elgin, Mitchell, 2003). They emphasise that VS in not a social movement confined to the United States and that it should neither be equated with a back-to-nature movement nor with poverty. Elgin and Mitchell add that although VS surely traces some of its contemporary heritage from the counterculture movement of the 1960s, its present constituency is certainly not limited to that group.

With regard to sustainability, Shaw and Newholm (2002) assert that the ethical, social and environmental values promoted by voluntary simplicity represent one possible path towards sustainable consumption patterns and lifestyles. Other authors such as Reisch & Scherhorn (1999), De Graaf et al. (2001), Maniates (2002) and Etzioni (2003) see in the VS philosophy a direct response to consumer culture and a movement that holds lessons for a more viable, sustainable society.

3.2.2 The Marketing Hook and the 'Liberal Gentry'

For authors such as Miller (2005), the "simplicity" trend has already been recycled by marketers and is actually feeding the capitalist system. Miller thinks that the voluntary simplicity movement is hitting a nerve. He believes that, even if many members of consumer societies are tired of "glitzy gluts of ever more stuff", marketers respond not with worry but with appreciation. According to him, "[c]onsumer culture seems endlessly capable of turning critique into a marketing hook". Miller takes the example of the supermarket where foodstuffs and personal care products are packaged as plain and "honest" and present "simple" color schemes of beige, lavender and soft green. He also provides the example of the glossy *Real Simple* magazine that can be found at the checkout and which is dominated by images characterized by a soft, minimal aesthetics – a sort of hybrid of Martha Stuart and Zen Buddhism according to the author. The *Real Simple* magazine proposes articles on how simplifying our daily life. It's content is often criticized for being excessively oriented towards publicity for consumption goods, including clothing. Thus, it seems that the potency and power of the market system is its infinite adaptability – ironically, it seems that it is even capable of turning non-consumption into a consumption opportunity.

Another critique of this recent interest for embracing the virtue of simplicity has been raised by David Brooks (2003), author of *Bobos in Paradise: The New Upper Class and How They Got There* (2000), who sees in this phenomenon the emergence of the "Liberal Gentry". He suggests that there is now emerging a new class within middle-aged baby boomers who have accumulated enough disposable income to reject mass consumption and the value of unregulated capitalism. They practice what he calls "status inversion" by "[…] trying to elevate themselves not above those who are economically inferior, but rather above those who are equally rich but morally and aesthetically inferiors". For the Liberal Gentry, Brooks writes, "[t]he farther you can move away from the obvious detritus of wealth, the more elevated you become, so long as you can display the objects of poverty in a way that makes it clear you are just rolling in dough". From French bread ovens, to Shaker-inspired computer consoles, to vast stone fireplaces, they look for objects with rough and natural textures and prize the mix between the grandeur and the simplicity. Still according to Brooks, in order to accomplish their passage to this new class, the "Liberal Gentry" shop intensively to firm up their aesthetic sensibility and to find items that will reflect and confirm their new position. Therefore, they do not actually reduce their level of consumption.

3.3 Insights and Design Strategies

3.3.1 An Attempt to Identify Different Profiles of 'Simplifiers'

While participating in voluntary simplicity meetings, four initial or approximate profiles or types of "simplifiers" were identified. This paper will discuss two of these profiles in more detail because the interview phase, which is the core of the present study, focused on people who presented a profile corresponding to the second and the third profiles described below - where both "efficiency" and "sufficiency" are considered in consumption choices. While this portrait is not exhaustive, it certainly provides material for further reflections.

1. 'Eco-efficient' Simplifiers

This group tends, in a certain way, towards Brooks's "Liberal Gentry" and practices what he calls "status inversion". These people may consume more eco-efficient products but they do not necessarily consume less.

2. 'Better World' Simplifiers

This profile includes the more "altruists-environmentalists" people who work to adopt a more sustainable lifestyle because of perceived personal benefits but, and often in the first place, as a result of a commitment for a "better world". They are concern about social injustice, corporatism, inequity and environmental and social degradation. They are not particularly interested in reducing their working hours and usually see higher purchasing power as an opportunity to bring changes to society. They tend to value an "efficiency" approach to consumption in choosing different products (e.g. perceived as more "sustainable"). Although they do tend to reduce their consumption levels, they are inclined to consume more than the third profile.

3. 'Quality of Life' Simplifiers

This category encompasses people who see a more sustainable lifestyle, first and primarily, as a way to improve their quality of life and, secondly, as a way of ameliorating environmental and social problems. They often have, or are considering, reducing their working hours and are more likely to adopt a "sufficiency" approach to consumption while still opting for more sustainable products. The group tends to consume less than groups 1 and 2, above.

4. 'Involuntary' Simplifiers

This profile includes people who tend to use the simplicity discourse to justify a certain "involuntary" simplicity often because of financial constraints. Although they consume less, they do not necessarily choose "eco-efficient" products as their concern for larger environmental and social issues seems not to be a significant part of their motivation for "simplifying".

3.3.2 The Others, the Environment and Me

An interesting observation made during the fieldwork was the existence of an often unrecognized dimension of responsible consumption. In addition to the social-environmental or "altruist" considerations motivating and guiding these responsible consumers, the presence of a more personal dimension has also become apparent. We have learned that, in varying degrees, before buying a given product these people will often question the very need for it, not only because of an ecological consciousness, but also because of perceived personal factors or benefits. This 'me' dimension was expressed through reflections such as:

> "I realised that my life is more 'simple' and enjoyable when I do not have too many objects to care about. I feel lighter. This explains, in part, why I decided to reduced the amount of stuff that I buy."

> "Will buying this object really enhance my quality of life, considering the time I will have to take to maintain it and to fix it, or have it fixed, if its breaks, and this not without mentioning the associated stress?"

> "Before buying a product I consider its price in terms of the time I had to work in order to acquire the amount of money in question. This way of seeing things allows me to better perceive the cost of a product for my life."

> "In reducing our level of consumption, my partner and I could afford having one of us shifting from working full-time to half-time. We find our new lifestyle healthier in terms of the quality of our family relationships and of our eating habits. In fact, since I am no longer running all the time, I have more time to do home cooking using fresh and healthy products and we all enjoy it very much. We just feel we have more control over our lives."

It is important to more fully acknowledge these more personal aspects of sustainable consumption habits; motivations that are usually neglected in

academic and popular literature. Recognising this dimension could modify the widespread representation of the sustainable, responsible consumer as an individual who sacrifices him/herself exclusively for the sake of nature or for generations to come (something, one could argue, which is really not given to everybody, even in the most optimistic eco-scenarios). *It seems more reasonable, and potentially more effective, to promote responsible consumption patterns and lifestyles in considering these personal and individual perspectives, as well as those related to others and the natural environment.* Based on these observations and with regard to design strategies concerned with ***rediscovering*** the nature of needs, there seems to be an opportunity for design to promote the *individual* benefits of responsible consumption. Design approaches that revisit the notion of personal fulfilment, not simply through product acquisition but within a more wholistic perspective, could support positive changes in making sustainable lifestyles more attractive.

3.3.3 Proximity and Distance in their Relationship to Objects

The research shows a clear desire amongst the interviewees to evaluate their attachment to possessions and to invest emotionally in a few carefully chosen objects. More specifically, they were seen to have a *close* and, simultaneously, *distant* relationship with the world of goods. On the one hand, they spoke of a conscious and thoughtful reflection about the place objects should occupy in their lives, and in evaluating which objects are worthy of their care. On the other hand, a *distance* was maintained, in the form of a certain emotional detachment. However, this position should not be seen as a 'rupture' or 'break' with the material world, but as a different stance towards it. Importantly, those interviewed tended to express themselves through objects by evaluating their position towards objects and by spending time and energy finding products and services that are in accord with their beliefs. In this regard, they are not inclined to impulse buying. Giving themselves some time before deciding to purchase an item also enables them to collect information about a given product or service so they can make an informed decision. It should also be mentioned that they actually find pleasure in such evaluation activities. In addition, they generally tend to consider the object more as a means, for what it allows, rather than as an end in itself. They also said that, by practicing this type of detachment from objects, they feel more predisposed to accept an object's eventual physical ageing.

Attitudes such as these seem to be in line with design strategies concerned with ***reorganising*** the way consumption takes place (consuming differently). In fact, ***results focussed*** design solutions, such as service-systems, are more likely to require users to be able to find satisfaction without 'owning'; something which represents a real challenge for conventional product design. Such directions suggest that designers must look for alternative sources of meaning and pleasure, towards shared products, and products that enable a service, as exemplified by Manzini and Jegou (2003a, 2003b) and Manzini, Walker and Wylant (2004).

3.3.4 The Object and the Reappropriation of the Action

A fascinating theme arising from this research is the concept of autonomy in relation to the experience of products. First, it has been expressed through participants' desire, as they said, to "be part of the action" while using a given object. Importantly, they appreciate that products allow them to have what might be described as a more "direct encounter" with the world - by being engaged in the activity of "doing". Objects which make them feel as if they are the principal actor in an activity are especially valued, whereas less value is given to the types of objects that have been described by one participant as "products that are doing everything for us and that are creating a sort of distance between us and the task we wish to accomplish". For example, we have found that they tend to value and find considerable pleasure in using objects such as a manual peppermill, a manual coffee percolator and a shaving brush and shaving soap. All these objects allow the user to be active in the process of realising the task she or he wishes to accomplish. In the case of the coffee percolator, they explained that they also value such an object for the transparency of the function - as the user can see the process of coffee percolating, in contrast to an electric filter coffee machine where the process is hidden behind a plastic casing.

In addition, the notion of autonomy is also present in what we may term the "intelligibility" of the object. Participants shared an attraction to products that are easily understood in terms of their constitution and their functioning. Such qualities give them the feeling that they have control over the objects and that they can repair them if broken, or at least understand what is wrong.

In terms of **product-focused strategies** that are concerned with **redesigning** that which is consumed, it seems essential for designers to be aware of and to understand these perceptions and ideas in order to design products that are not only less environmentally destructive, but also meaningful and pleasurable to use, maintain and repair.

4 Overall conclusion

Sustainable consumption is not only about production and consumption, but also and essentially about the way daily life is organized (Robins, 1999). Furthermore, as Van der Ryn and Cowan (1996) have said, the environmental crisis is, in many ways, a design crisis; it is about how things are thought about, constructed and used. Therefore, design can realistically and concretely contribute to imagining and proposing new ways of organizing daily life. Notably, this research suggests that designers can support and encourage those already active or interested in orienting their consumption habits towards more sustainable solutions by envisioning appropriate ecologically and socially responsible design alternatives. Indeed, as discussed in this paper, people's capacity to make changes in their lifestyles and product choices are, among many others things, constrained by product availability. Design disciplines can contribute by proposing appropriate alternative solutions – solutions that can, in many small ways, help to transform lifestyles. This paper has underlined the importance for design of understanding sustainable consumer' preferences and expectations, so that the discipline might rise to this challenge. In this regard, the paper

has provided some insights from a study among people who promote sustainable consumption. Firstly, the study identifies four different profiles of "simplifiers" and notes that not all of them a) reduce the amount of goods they consume and b) choose more environmentally and socially sounds products. Secondly, the study shows that people who took part in the research adopt more sustainable lifestyles not only because of an ecological consciousness, but also because of perceived personal factors or benefits. Thirdly, it was observed that participants have both a *close* and *distant* relationship to objects. They consciously evaluate their attachment to possessions and invest emotionally in a few carefully chosen objects. Finally, the study reveals that participants appreciate objects that allow them to be engaged in the activity of "doing", and tend to prefer intelligible products, in terms of their constitution and functioning. These qualities in objects allow them to experience a certain autonomy that they value and appreciate.

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Chapter 20 Eco-Innovative Cities:

A pilot project for sustainable service design in 8 local councils in Melbourne Australia.

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1 Overview

1.1 Introduction

This is early and interim report on a new practical research project with eight local governments in one state in Australia, to redesign services, for which they are legally and politically responsible, to reduce resource consumption. The project - known as Eco-innovative Cities ('EiC')- commenced in November 2005 and will run as a pilot until November 2006. The project sets out to challenge current delivery of council operations, planning and decision-making processes, to shift from a focus on waste and recycling to *designing more sustainable systems*. The participating councils are some of those that have already made significant commitments to reducing greenhouse gases (as part of a program known as Cities for Climate Protection) and many have established green purchasing programs and other sustainability initiatives for local residents. They have not, until now, explored the redesign of their service provision as a way of reducing their own institutional resource consumption or supporting their constituents to change theirs.

In the project so far, the participating Councils have identified some core services, which are important in terms of their social, political and economic role as well as their contribution to resource consumption. Working on a two-monthly cycle, using a service redesign process developed for this

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program by one of the authors[56], two service areas ('*libraries*' and '*road construction and maintenance*') are being tacked by each council.

The results of those activities are then communicated between all the participants for shared learning. Later, the program will consider the design of new services aimed specifically at assisting their constituents to change to more sustainable patterns of consumption. At the end of the trial program a resource 'kit' will be produced and a larger (probably multi-state) program will be launched.

1.2 Participants

EiC is funded by a statuary authority *Sustainability Victoria* recently created by the state government of Victorian and the research and practice is part of a close collaboration between the Australian Centre for Science Innovation and Society at the University of Melbourne and the International Council for Local Environmental Initiatives (ICLEI) Australia/New Zealand.

1.3 Australian Centre for Science Innovation and Society (ACSIS)

ACSIS is a new national Centre created in 2005, based in Victoria, at Melbourne University. ACSIS has been established to bring together researchers business, government and the community to provide a network-space in which emerging technology, science and innovation can be 'shaped' to achieve optimum, social, economic and environmental outcomes.

As a research hub, ACSIS assesses the potential value of investing in different emerging technologies, based on a process of mapping their potential social, environmental and economic outcomes.

As an innovation hub, ACSIS will work closely with its stakeholders to develop the creativity and design skills needed to implement innovative new technological solutions with triple bottom line outcomes.

As a knowledge sharing hub, ACSIS actively explores methodologies and processes for informing the public and framing public debates so that appropriate technological choices are made and implemented.

ACSIS involves a set of tightly integrated activities and services:

- ⇨ Observing emerging areas of science, technology and innovation (STI) and scoping possible outcomes
- ⇨ Researching and analysing social sensitivities and emerging user demands related to the observed areas
- ⇨ Developing innovative methodologies and processes for selecting technologies and shaping their application based on collaboration between researchers, business, government and civil society and informed social judgement.
- ⇨ Identifying new domains for socio-technical innovation suited to local conditions and to triple-bottom-line outcomes
- ⇨ Creatively exploring design and innovation concepts for new products, services and systems in emerging technologies.

[56] The methodology has been developed by Chris Ryan.

Each of these activities deliver analysis and reports for business, government, education and research and civil society, to support the innovation cycle.

1.4 ICLEI - Local governments for Sustainability Australia/New Zealand

ICLEI Local Governments for Sustainability is an international association of local governments and national and regional local government organisations that have made a commitment to sustainable development. More than 470 cities, towns, counties, and their associations worldwide comprise ICLEI's growing membership. ICLEI works with these and hundreds of other local governments through international performance-based, results-oriented campaigns and programs. ICLEI-Australia/New Zealand (ICLEI-A/NZ) is hosted by the City of Melbourne and was established in September 1999.

1.5 The Councils (Melbourne, urban and peri-urban)

Local councils are the third tier of government in Australia (along with the State and Federal government). There are 722 local government bodies in Australia accountable to a diverse range of metropolitan, regional, rural, and indigenous communities. The population and geographic size of councils across the country differ greatly. The largest local government authority by population is the Brisbane City Council with 900,000 residents. The average council population is 26,400. The largest council by area is the Shire of East Pilbara in WA covering 379,000 square kilometres (population 7,000). There are about 6,600 elected councillors in Australia with an average of just under 10 councillors per council. According to the Australian Local Government Association, local councils spend around $A 17 billion each year providing an increasingly broad range of infrastructure, economic and community services to residents. In total, councils employ around 150,000 people.

The roles and responsibilities of local government in Australia differ somewhat from state to state but their functions broadly cover:

- infrastructure and property services, including local roads, bridges, footpaths, drainage, waste collection and management
- provision of recreation facilities, such as parks, sports fields and stadiums, golf courses, swimming pools, sport centres, halls, camping grounds and caravan parks
- health services such as water and food inspection, immunisation services, toilet facilities, noise control and meat inspection and animal control
- community services, such as child care, aged care and accommodation, community care and welfare services
- building services, including inspections, licensing, certification and enforcement
- planning and development approval

- administration of facilities, such ports and marinas, cemeteries, parking facilities and street parking;
- cultural facilities and services, such as libraries, art galleries and museums
- water and sewerage services

Eight local councils, in metropolitan Melbourne and on its fringe, are participating in EiC. Melbourne is the capital of the state of Victoria, located in the south west of Australia.

2 The Context: The State of Victoria - high consumption footprint.

In population terms, Victoria is the second largest of the Australian states (population 4.5 million) with an ecological footprint around 5% higher than that of Australia as a whole at approximately 8 global hectares, (compared to the calculated bio-capacity of the state of 5.4 h) (EPA 2005).

Recent studies have highlighted the critical resource consumption divers for the Victoria, driven by: *population and economic growth* (particularly a reliance on exports of primary produce and mineral resources); *lifestyle* (material consumption per head, particularly housing size and house occupancy rates and the scale of car ownership) and *fossil fuel-based energy provision* (particularly related to transport and electricity from brown coal).

The impact of global warming is expected to exacerbate these pressures. In each decade since 1950, Victoria's average maximum temperature has increased by 0.11 degrees (C) (and the minimum by 0.07 degrees). In 2002, Victoria's total greenhouse gas emissions were 117 million tonnes, with per-capita emissions of 24 tonnes (the Australian average being 28 tonnes per person), amongst the highest in the OECD.

Consumption pressures for the state of Victoria include:

- *end-use energy consumption.* Electricity has an average growth around 2% per annum and a relatively new summer peak demand profile increasing at closer to 3% (NRE 2002). The later is expected to grow due to greenhouse effects. Transport accounts for significant portion of energy consumption.
- *water consumption*. Rainfall in Victoria has decreased significantly over the last 50 years, with predictions of a future 5% decrease by 2020 (CSIRO 2004). Current annual water consumption in Victoria is about 5800 GL, with about 77% used for agricultural irrigation. Both irrigation and urban/industrial consumption has increased by 50% between 1984 and 1997. Current consumption accounts for greater than 85% of sustainable supply (CSIRO 2004).
- *waste and material flows*. Australia's per-capita level of material flows is very high by world standards, with domestic waste per capita second only to the USA amongst OECD countries (at 620 kg/yr). The generation of solid waste in Victoria has increased by 60% between 1993 and 2002.
- *transport, households and urban development*. The increasing

resource-intensity of Victorian lifestyles can be seen in the consumption of electrical and electronic goods (with the average household now having 30 appliances compared to 6 in 1954). In 2004, Australians threw away $2.9 billion of fresh food, $360 million of uneaten take-away food, $876 of leftovers, $596 million of unfinished drinks and $241 million of frozen food (Hamilton 2005). Victorian transport relies heavily on roads and private vehicle use with the number of vehicle registrations increasing by 20% in the last 10 years and private vehicle ownership rates similar to the USA.

3 Concern about environmental issues

3.1 Public attitudes.

In general surveys show that the Victorian public considers health and education more important than the environment and that levels of environmental concern appear to be dropping. Broadly this follows a trend for Australia as a whole. In 2004 57% of adults reported concern about the environment, down from 75% in 1992. Some of this undoubtedly reflects the federal Australian government attitudes to key environmental issues such as greenhouse warming. (Australia has refused to ratify the Kyoto protocol and it is only recently that the government has it been forced to moderate its early public stance that global warming was scientifically uncertain and that curbing greenhouse gases was not economically in the countries best interests). When asked to rank perceived prioritisation of issues by government, 80% of survey respondents said that they thought that the economy was most important to government, 11% heath and education and only 8%, the environment (60 % saying that the environment was considered the least important.) (DSE 2004). However public attitude surveys need to be treated with some caution in the light of the enthusiastic take-up of curb-side recycling schemes and of water conservation programs , which show high and increasing participation rates in Victoria.

3.2 Industry attitudes and action

Surveys of industry and business in Australia also show a generally low priority given to environment as a driver for investment or new strategic development. A 2002 review of a range of such surveys concluded that industry and business has consistently given a low priority to the environment for current and short term strategic planning, although it is usually stated as becoming more significant in the future. However, it seems that regardless of when a survey was conducted, the time when environmental issues would be important always seems to be some years ahead (Greene 2002).

The KPMG International Survey of Corporate Responsibility Reporting 2005 (KPMG 2005) found that reporting rates in Australia are lower than in most of the countries surveyed, by percentage of the top 100 publicly listed companies in each country (quoted in DEH 2005).

Only a relatively small number of companies in Australia (generally those most engaged in the global market) view environmental issues as a significant driver for innovation, investment and new business development.

3.3 Local government attitudes and action

The picture of environmental concern and action at the level of local government in Australia appears as something of a contrast to that of industry and 'the general public'. Where potential environmental issues and actions are often 'evaluated' in strongly economic terms (typically in terms of 'payback periods') there is a sense that at the local level assessment of environmental objectives and outcomes are more mediated, with social outcomes, 'lifestyle values' and longer term views, given higher priorities. There are popular and successful local sustainability programs initiated and supported by local councils (such as the widespread 'sustainability street' program[57]). Australia's most recent and certainly most innovative 'green building' is the new council offices for the city of Melbourne[58]. Local councils have supported the infrastructure of successful curb-side recycling and other resource recovery systems.

The 'Cities for Climate Protection' (CCP) program of ICLEI has over 600 local governments from around the world participating – 210 of those are in Australia, with a coverage of over 80% of the Australian population. CCP empowers local governments to cut greenhouse gas emissions. In 2005 CCP local governments reported emission reductions of 1.55 million tonnes of carbon dioxide equivalent (CO2–e), exceeding the previous year's figures by more than 22 per cent. Total emission reductions over the life of the programme now exceed five million tonnes of CO2–e.

The EiC project builds heavily on the networks and 'good will' generated by the ICLEI CCP program.

4 The Project: aims, process and methodology

4.1 Aims

EiC is a pilot project. Whilst its aim is to optimise an 'eco-service-design' methodology for later use in the context of local government, it is also intended that this first year of the project will identify real options and concepts for the re-organisation of some key local government services. These will be used by Sustainability Victoria as inspiring examples of what can be done to reduce resource consumption at a local level. It is not intended that this pilot project should see the implementation of the ideas developed.

Broadly EiC aims to get councils to:

- understand the idea of 'sustainable consumption' and to recognise that the concept has relevance to the provision of services as well as to production processes and products.
- change their view the process of continuous improvement in service provision to encompass issues of resource consumption, along with the usual attention to economic costs and social

[57] see: http://www.voxbandicoot.com.au/SustainabilitySt/Overview.htm

[58] The building is known as CH2 and is due for completion in the middle of 2006: visit http://www.melbourne.vic.gov.au/info.cfm?top=171&pg=1933

outcomes.

- recognise that issues of resource consumption will require moving beyond continuous, incremental improvements in current delivery and operation of council services to more radical eco-design and 'eco-innovation.

The project assumes *eco-innovation* will be based on a combination of:

- the application and use of new *technology, products or materials*
- changes in the *organisation* of infrastructure and systems of production and consumption
- the adoption of new patterns of consumption or *lifestyles* or changes in consumer behaviour

'*Eco*' innovation refers to dramatic reductions in the *footprint* of services, environments and lifestyles:

- reduction in resource usage (and resource 'flows' in the economy)
- reduction in the generation of waste and pollution
- maintenance and restoration of the stock of natural capital

4.2 Process

Selected CCP councils were offered an opportunity to sign up to the project, to commit to the work and to appoint an officer as the EiC co-ordinator. These co-ordinators have been appointed from those who fill some role within the council related to environmental activities.

The EiC co-ordinators were given some initial training in the methodology (at a half-day workshop) and are then supported by monthly 'issues papers' produced by the research team. The initial workshop was used to define the selection of service areas that would be the case-studies for this first year. The participants selected 'libraries' and 'minor roads', with libraries as the first project.

The first issues paper covered the key concepts and issues in sustainable consumption and the subsequent two papers form part of a draft 'manual' on the methodology.

The EiC co-ordinators are responsible for 'running' the methodology within their councils, co-ordinating the input of council staff and reporting monthly on progress, learning's and results via teleconferences and through on-line 'wiki' forums (see below).

5 The design methodology

5.1 Introduction

The EiC methodology builds on past experience, on the part of one of the authors, in product eco-design, eco-service design and more recent work on product-service systems (PSS)[59]. The EiC methodology is built around a

[59] The methodology developed by Chris Ryan is based on work to appear in the forthcoming UNEP eco-design manual, 'D4S', in particular from *Design Oriented Scenarios*, by Ezio

workshop process and uses the 'constructive tension' between to ways of viewing (two 'approaches' to) the subject matter - an 'incremental improvement' approach and a (radical) 'service redesign' approach, which are described as:

1. *Incremental Improvement* accepts the structure of the existing service and aims to make it more eco-efficient by changing some aspects to reduce resource consumption. This may involve changing products (such as vehicles), extending the life of other products (such as books), redesigning buildings (to reduce energy consumption for example), or adjusting the current service 'system' (the logic or connection between different parts of the service, such as the way that books are purchased).
2. *Service Re-Design* starts from critical reflection on the needs the service is intended to fulfil and looks for different ways in which those needs could be met, *other than through the existing service* (say, 'a library'). The 'service re-design' approach is intended to be the more 'blue-sky' and more 'innovative', a chance to 'rethink' the whole idea. In theory, at least, (although not always in practice) 'service re-design' can deliver greater overall improvement in resource consumption than the process of incremental improvement of an existing service.

The step-by-step process aims to place these two approaches in constructive tension so as to increase the chance that the outcomes will be innovative - delivering solutions which are both novel and achievable. A workshop based on the approach (a) is followed later by another workshop focused on approach (b), after which the analysis and solutions generated from (a) are revisited. The methodology tries to emphasise the need for the tensions between these approaches to be viewed positively:

> *"Although the knowledge on resource inputs and outputs gained from process (a) is useful as an input to process (b) It is important not to allow the work on (a) to constrain the work on (b). Service re-design has to start from an assumption that the existing service is not the only way to achieve the desired outcome. Service re-design is a creative process, 'starting from scratch', it should not be limited by the knowledge gained in (a).*
>
> *"Being 'creative', generating 'blue-sky' ideas and concepts, can be a very seductive way to engage people in a process, especially if you emphasise that, in the first instance, the aim is to generate wonderful new possibilities that do not have to meet any given financial constraints. Most people love an opportunity to be creative, to dream, with an unlimited budget..*
>
> *It is after the first range of new blue-sky possibilities are generated that all that was learnt from (a) will become important. Ultimately, the aim is to select new concepts that can achieve substantial reductions in resource consumption in practice compared to the current system solution."*

Manzini, François Jégou, Anna Meroni and *Product Service System Design*, by Chris Ryan, Ursula Tischner and Carlo Vezzoli, as well as the *Quick Start Guide*, by Chris Ryan, all from D4S.

5.2 The Incremental Approach.

This involves the following steps:

1. Form a team (prepare initial research for workshop)
2. Run a 'workshop':
   - (a) prepare background report - a *service dossier*
   - *(b)* draw a *life-cycle service-system map*
   - (c) draw up a *stake-holder matrix*
   - (d) identify resource inputs and (waste) output
   - (e) 'voting' on priority areas for action.
   - (f) brainstorming initial ideas for improvement
   - (g) deliver a report and a proposal for actions to be investigated
3. Quantification of inputs and outputs (first level approximation of data)
4. First level evaluation of improvement options.
5. Search for other improvement options and evaluate.

The *service dossier* is a short 'background analysis' of the service, produced as a way of gathering information and drawing people into the workshop process. It ensures that those participating in the workshop have some common knowledge base.

The *life cycle system (LCSSM) map* is a simple way of guiding systems thinking. It requires the workshop to collectively develop a visual representation of the life-cycle (or 'flow') of the service. It is assumed that the workshop process will work better if it is done as a visual 'map', even if it is not graphically elegant. The LCSSM should identify all the components of the system – the connections, movements and relationships, necessary for the service to operate.

The *'stake-holder matrix'* (SM) is also collectively developed as a simple table of all the stake-holders involved in the service, identifying the characteristics of the relationship of each stake-holder to the service.

The SM is used as a way of reflecting on the accuracy of LCSSM and as a stimulus to *identifying resource inputs and outputs* within the service system. (These are drawn on the LCSSM as arrows 'in' or 'out' using symbols to represent specific resources and wastes.)

Priorities for action are determined through 'voting' with a simple ranking given to each. Ideas for improvement proceeds through brainstorming using 'sticky notes' for each idea, so that these can be quickly posted around the walls and grouped into related categories.

A simple *Business Feasibility Eco-Matrix* is used as check-system for considering the business case for various improvement options. It can be used as part of the workshop and/or at other times in the post-workshop evaluation. A four cell matrix is used:

1 significant environmental gains - technically and economically difficult	**4** significant environmental gains - technically and economically feasible
2 limited environmental gains - technically and economically difficult	**3** limited environmental gains - technically and economically feasible

5.3 The service redesign approach.

By its nature this approach is less amenable to a structured set of steps. There are, however, some activities and tools that can facilitate the process and add considerably to the outcomes. The methodology includes the following:

1. Developing a 'working definition'(or multiple definitions) of the *purpose of the service*, taking input from a range of people. Such a statement should:
    - Be from the community perspective (what the community should receive from this service)
    - Identify the 'need' that is being fulfilled, trying to get 'beyond' the obvious ('libraries exist to lend books') - aiming for a statement that encapsulates the richness of the service and one that 'looks at it from a different perspective'.
    - Accommodate some divergence of views (but generally, try to restrict these to a small number of alternative statements).

2. Brainstorming new service ideas (again using 'sticky-notes').
3. Elaborating a small range of alternative services (developing an LCSSM and SM for each).

Participants are encouraged to try developing an *Advertising Poster* for each of the elaborated services - a simple visualisation of the services for users.[60]

Finally the potential value of each new service possibility is evaluated using the same matrix as in the other approach.

Then there is an iteration back to 'revisit' the outcomes of the incremental approach.

5.4 Collaboration - workshops , teleconferences and Wiki,

The research process is focused strongly on collaboration - both within the participating councils and between the EiC team leaders. Team leaders undertake internal workshops with relevant staff in council to explore the two methodologies as applied to the topic areas. They

[60] The step forms an important part of the *Design Oriented Scenario* technique of Manzini, Jégou and Meroni from D4S (see footnote 6) .

then report back to the other team leaders via intensive teleconferences and also on a more ongoing basis via a Wiki (see below) online discussion / collaboration forum.

The program recognises that the EiC team leaders in councils are not researchers and that their participation in this process has to be arranged as efficiently as possible, so that it doesn't become a burden on their other program delivery commitments within their Council. ICLEI has found, from its experience in delivering projects such as Cities for Climate Protection, a format and process for teleconferences that allow them to be a very effective mechanism for collective learning. Rather than bringing these dispersed participants together for feedback and discussion , initial face to face workshops have been followed with one hour teleconferences each month. These meetings do not focus on the outcomes of their service-design workshops (which are communicated through the wiki on-line collaborative space) but rather on how the process has gone and how the methodology is working in practice. Teleconferences become a way of generating discussion around any practical difficulties and any new practical solutions or adaptations of the methodology.

Previous projects of this kind have made some effective (but often limited) use of on-line (web or email) discussion spaces. With the advent of the open-source software for the Wikipeda a new and much more collaborative system has become available for web based interaction. ACSIS has already created a wiki system for its own research knowledge base and found that it is able to generate an effective platform for collaborative knowledge sharing. For the EiC program, ICLEI has installed the most user-friendly of the various versions of the Wiki system and combined this with an open source document manager[61]. The issues papers, that had been produced in email/print form and circulated to all the participants in the first months of the project, now appear only on the Wiki site. The progressive discussion in the teleconferences is also entered directly into the wiki and all participants are encouraged to have the page open in front of them during that time. Short training sessions on the use of the wiki have been organised in the councils the structure of the site is being constantly 'tuned' to respond to feedback and to make the systems as open and inviting as possible. It is, however, acknowledged that this form of collaboration will require practice and experimentation on the part of all participants[62].

6 Conclusions: Learnings and Outcomes (to date)

At this time (April 2006) the participants have completed their initial test of the methodology through the exploration of the service of 'libraries'. Some interesting concepts have emerged around various themes:

- the eco-design of the library buildings for low resource demands.

[61] 'Docu-wiki' (http://wiki.splitbrain.org/wiki:dokuwiki) and 'DocManager' (http://wiki.docmgr.org/index.php/DocMGR)

[62] A welcome page is publicly accessible: http://mel.iclei.org/eic-wiki/welcome

- increasing the utilisation rate of libraries (for example by combining the local council libraries with this of local schools)
- using libraries as a resource centre for information about sustainable lifestyles and sustainable consumption (inducing more informed behaviour)
- widening the scope of what is 'leant' through libraries (from books to other important consumer articles such as tools) -increasing resource sharing.
- taking libraries into public-private partnerships - collections in cafes etc. (reducing the distance travelled to and from libraries)

But such outcomes were less important than the testing of the usefulness of the methodology in practice. Participants reported that the methodologies are both thought provoking and stimulated new ideas in service delivery. There was success reported from exercises that both directly involved library staff and those that did not directly involve library staff. Both approaches generated responses and key learnings. The advantage of using library staff was that they generated more ideas on the inputs and outputs to add to the flow chart. The following feedback has been received:

1. Through this process the methodologies also challenge the traditional management 'silos' within councils which are a common challenge to implementing sustainability that is by its nature cross-departmental. Cross-departmental support is important to create ownership and support for a project. Discussion and consultation as stimulated through the methodologies being applied here is an effective way of achieving this at a senior level and also with staff being effected by the changes.
2. Describing the process for redesign is important to ensure that staff do not feel that you are attempting to design them out of a job. It is important to clearly communicate with the group undertaking the sustainable consumption exercise what they will be doing to avoid misconceptions of them needing to take on extra work or spending too much time away from their 'everyday' work. Using pictures, whiteboards, coloured pens and texta's assists in the creative process to stimulate participation and consultation. It is also important to recognise the existing wins by staff when undertaking the incremental approach to reward efficiencies already achieved so that further efficiencies are encouraged.
3. All council officers are busy with multiple priorities and projects so the project has to prove the value of such work, which is what we were hinting about with this whole piloting process. It's not easy to claim people's time when there's so many other things on their, claiming their time.
4. Ideas generated through either methodology must be tested in reality to determine the consequence of a change. For example, providing bikes for staff to ride to work or meetings, may require council to install showers and maintain bicycle fleet that will have other alternate resource impacts. Th EiC process is seen to have value as an educational awareness raising tool for staff to think through the system consequences of planning and strategic decision making.

5. The issue of identifying boundaries around the inputs and outputs (where do you start and stop tracking the resources inputs and life of the outputs) was raised in the first workshop and is likely to be an issue that comes up again as participating councils continue to work through the exercises.
6. The incremental method was thought to be of particular use if a staff person was going to an area in council where they didn't actually know how the service worked and they could use the systems diagram to get an understanding of what exactly they were doing, where the big impacts were and what the opportunities.
7. Participants were not yet sure that the two methodologies have enough in themselves to be drivers of the change program, but rather are actually tools that sit as one of many tools that are useful in an organisational change program.
8. There was potential value seen when applied to a organisation wide management system such as an EMS where there is a need to take a more integrated approach to a lot of projects. Current process where one person leads a project is a very linear approach to project management. There is potential for trying processes sure as those applied here that are less linear and involve all the stakeholders, and therefore make the system explicit.
9. The real value at this stage of the project was that it is an excellent starting point for getting strategic sustainability thinking into the design or review of any service or group of services. This will generate greater ownership of resource efficiency and life cycle costing taken on by the primary stake-holders from the very start.

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Chapter 21 Is a Radical Systemic Shift toward Sustainability possible in China?

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1 Two trivial incidents

Last summer, I traveled to Guangzhou from Hangzhou. I took an afternoon flight, and arrived at Hangzhou airport 90 minutes early so that I had time to have a proper lunch before boarding the plane. After checking in, I went to a self-service canteen at the airport. It was a fine place to eat: the price was reasonable, it was neat and comfortable, the choice of food was wide, and the menu well presented. However, there was a specific condition attached to eating at this canteen: the wasting of food was prohibited. To reinforce this, warning signs advising customers to "take only what you need or pay for the leftovers" **(Fig. 1)** were placed on the food display table.

Fig. 1 *the warning signs on the display table*

However, despite the visibility of these signs, many people who were sitting near me walked out of the restaurant leaving plenty of unconsumed food on their table **(Fig. 2)**, but there was no condemnation of this whatsoever.

Half an hour later, I boarded the plane and settled back in my seat next to the window. The plane was quite full, and most of the passengers were Chinese. A well-dressed Chinese man who I took to be a native of Hangzhou arrived to take the seat beside me. I took no notice of him, pondering as I was the incident that I had just witnessed in the airport canteen, until he switched on the personal spotlight above him to read. This action would not

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have been surprising had it been night and the lights of the cabin turned off, but they were not and it was a sunny day. There was more than enough light

Figure 2 *unconsumed food left on one of the tables*

to read. A moment later I realized that he wasn't the only one. When I glanced across the cabin, more than 80 percent of the personal spotlights were switched on **(Fig. 3)**.

Figure 3 *over 80 per cent of the spotlights were switched on inside the cabin*

These two incidents may seem insignificant, but are rather worrying and alarming when looked at from the perspective of sustainability, and have wider implications.

a) These people seem avaricious, and appear to share the common trait of irresponsible resource exploitation.
b) These people are native Chinese, a group that represents one fifth of the world's population. An emerging wave of unrestrained consumption is therefore foreseeable.

2 The dilemma for China

China is already famous for its recent rapid growth in consumerism. Retail sales of consumer goods topped US$ 157.4 billion in the first two months of 2006 alone, and are forecasted to grow at a rate of 13.2% per annum.(1) China is not only the "factory of the world," but is also becoming the largest market for commodities and one of the most ravenous consumers of energy.(2) China is already the world's second-largest producer of

greenhouse gases, which contribute to global warming and the imbalance of the world's climate. China's carbon dioxide emissions will have easily overtaken those of the current biggest greenhouse gas emitter, the United States, by 2020[(3)] and will dwarf any cuts in emissions that the rest of the world might make. At the same time, rapid industrialization has engendered a highly polluted environment that has cost China dearly.[(4)] It is therefore desirable for China to slow its industrialization and rate of consumption.

However, the rapid economic development and concomitant rise in energy consumption in China cannot be easily decelerated. Such deceleration would not only spawn a huge unemployment problem and cause GDP to decrease, but would also create inflation and result in a loss of capital. Any hiccup in China's economic progress these days would also be likely to affect the world economy.[(5)]

This is the dilemma that is currently facing China's ruling regime. As the pace of environmental deterioration in China accelerates, innovative solutions that are capable of simultaneously conserving the country's natural resources and energizing the economy are urgently being sought. The developed West has moved toward the replacement of its outdated and unsustainable mode of economy with function-based (service-led) sustainable consumption and production (SCP) practices, and these are increasingly being seen as a possible and promising solution for China's development dilemma.

In pursuit of sustainable solutions for China, two series of design and research workshops were held from 2000 to 2004 in various Chinese cities to promote the concept of solution-based design.[(6)] These workshops aimed to generate an initial understanding of the difficulties and possibilities of introducing a radical systemic shift toward sustainability through the switch from product-based to function-based production and consumption.

3 Learning from the workshops

During the first series of design workshops for the promotion of design for sustainability in 2000, three major findings were reviewed.

a) The idea of shifting from "product" to "solution" design to minimize the environmental cost was, in theory, well understood by the Chinese students (the emerging consumers of China).
b) The localization of the design for sustainability concept was one of the major concerns.
c) Many of the participants were doubtful about the actual usefulness and relevance of the "visionary ideal" of solution-driven design for sustainability to China.

To experiment with a hypothetical design process[(7)] that connects the practice of sustainable product-service systems (SPSS) and industrial design, a second series of design workshops was initiated in 2003. One of the objectives of this workshop series was to find the causes of the doubt about the introduction of sustainable services in China that was identified in the first series of workshops. In the workshops, each of which was held in a different city, an introductory discussion session was held. A sample sustainable

service solution called *"Sunwash Laundry"* **(Fig. 4)** was introduced to the workshop participants, and a specific question about this solution was

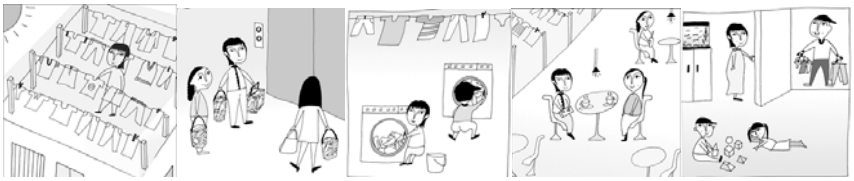

Figure 4 *"Sunwash Laundry"**: a selected sample sustainable service solution***

projected on to a screen or wall, namely, ***"will this sustainable service solution work in this city?"*** The participants were then asked to write down all of the factors that might influence the introduction of the service to the local community on sticky notes to be used during an open discussion.

The sticky notes from the different workshops revealed skepticism about the possible introduction of solution-based sustainable services. Some examples of the doubts of participants are summarized as follows.

(i) There is a foreseeable conflict between new ideals and old customs.
(ii) The possession of physical products is still much preferred.
(iii) Sharing is not favored, and shared facilities or devices are not valued.
(iv) There is a lack of trust and communication among people in general.
(v) The quality of services is very much distrusted (because of the often poor quality of service staff).
(vi) Personal hygiene is a great concern.
(vii) Privacy/information security is very much an issue.

Although some initial feedback was obtained through the two series of workshops, there was insufficient information to draw any sensible conclusions. To substantiate and verify the findings further, additional investigation was carried out to deepen the understanding of the limits to and difficulties in the introduction of SCP practices in China.

4 The context of the limits and barriers to SCP

Four specific contextual aspects of the limits or potential barriers to SCP – political, economic, social and cultural – were studied and analyzed, the results of which are listed in the following.

4.1 Political appropriation

A matrix has been suggested that illustrates four possible political scenarios – open/authoritarian, closed/authoritarian, closed/democratic, and open/democratic – in which the political and economic regimes interact with varying effects on the society and environment of a country **(Fig. 5)**. It has been argued that "whether an economy is open or closed, a politically controlling state is likely to engender high levels of environmental degradation" (Zarsky and Tay, 2000).

Although China shifted to a relatively open economy in the late 1970s, its controlled polity and absence of constitutional rules on the state's economy policy leave room for appropriation and even exploitation by local officials

at the province, city, and township levels. Two examples of political appropriation are given in the following.

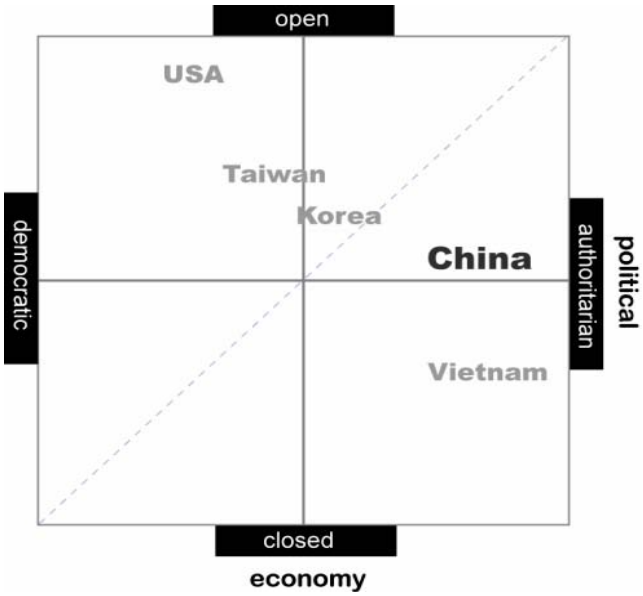

Figure 5 *"Sunwash Laundry": a selected sample sustainable service solution*

4.1.1 Policy abuse

The promotion policy for local officials is based on *successful economic* leadership in the region under control. Hence, local officials will impose measures to boost local revenue at all costs, which include the discouragement of "green" initiatives and the prevention of moves toward social and cultural sustainability. For example, in Shenzhen car-pooling is treated as an act of tax evasion and has been banned.[8] In Guangzhou in 2002, the government insisted on constructing an inner ring road in the city centre to ease traffic congestion and to support the developing automobile manufacturing industry, which it thought would increase the local GDP. Today, with the number of private cars growing exponentially in Guangzhou, traffic congestion is occurring again in the city centre. Thus, the ring road project, which came at the tremendous cost of the demolition of culturally rich old districts and public discontentment as a result of forced resettlement, brought only a temporary solution to the problem.

4.1.2 Misdirected initiatives

In October 2005, the central government initiated a policy to narrow the widening gap between rural and urban China by promoting the construction of a "new socialist countryside." The aim of this initiative is to defuse unrest and turn the country's 800 million rural dwellers into an economically strong force. For local officials of Pinggu, which is on the outskirts of Beijing, the development of a "new socialist countryside" has meant bulldozing the houses of peasants and replacing them with weekend villas for city-dwellers. This has merely served to intensify the disagreement between rural residents and local officials over the long unsettled issue of land ownership.[9]

These are the consequences of the central government being keen to see continual economic growth but unable to prevent the misapplication of policy. The growing mistrust and tension between the general public (especially in rural areas) and the ruling regime will certainly retard further economic reform and cripple any future progress toward sustainability.

4.2 Economic reality

From the economic standpoint, there are three fundamental issues that any systemic reform initiative for a sustainable China must confront.

4.2.1 Material-based economy.

The unflagging 8.7 percent average annual growth in GDP in China has been the result of product-based production and consumption over the past 25 years. China is likely to remain heavily dependant on its manufacturing industry to sustain this level of growth for years to come.[10]

4.2.2 Rising consumerism.

With the steady rise in incomes, Chinese consumers, in contrast to a decade ago,[11] now thirst for "taste" driven and luxury goods. DVD players, mobile phones, digital devices and computers are now the desirable gadgets that Chinese consumers long to possess. Materialistic possession as a sign of "wealth" is a very strong idea in modern China.

4.2.3 Wealth disparity.

There is a sharp difference in income between urban and rural dwellers in China.[12] The urban Chinese earn between three and six times more than the rural Chinese. This great disparity in wealth has created a "digital divide"[13] that prevents the development and adoption of an information and communication technology (ICT) based service economy in China.[14]

4.3 Cultural constraints

China was a predominantly agricultural country for a long time, and its culture originates from the so-called "peasant"[15] community, which had the following four main attributes.

1. National order and social stability were upheld and enforced by the *jia* (family). For example, in the Ming Dynasty (1368-1644 CE) the family was identified as the official unit of the country. In fact, the rule of China until modern times was managed by two basic entities: the millions of kinship-based rural communities and the central administrative body of literate officers under the ruler.
2. The family was also treated as an economic unit called the *hu* (household), which practiced self-sufficient and self-reliant peasant-based production. Parental management and ruling, which was founded on the notion of family hierarchy, prevailed as the main form of system organization.
3. As Chinese society was formed by peasant communities that were based on kinship, a basic belief system was developed that held that the resources of the world are in fixed supply. Resource

competition among various family entities was deemed inevitable (a "zero-sum" assumption). This worldview promoted a suspicious attitude toward "strangers," and hence the social lives of the Chinese in the past revolved around tightening relationships with one's familiars, rather than forming bonds with anyone whose fate was not linked to one's own (Bond 1991). The Western concept of "society" or "community" did not exist in the Chinese mind (Lin 1935).

4. Peasant communities also cultivated Confucianism. The teachings of Confucius promote secular living and living the best one can in one's present life, and self- realization and actualization through one's affiliations, rather than religious dependency. Thus, Confucianism is a kind of pragmatism (Woo 1995). With the centuries of social instability and poverty that have been experienced in China, pragmatism is generally embraced and endorsed by most Chinese people, even today.[16]

Chinese culture is deeply rooted in kinship-based peasant communities, but this has created a system-weak (lacking objective rules and institutions) and pragmatic (short-sighted and advantage-seeking) form of management that has long haunted the Chinese society and economy.[17]

4.4 Social displacement

According to the latest official projections, China's urban population will more than double to 1.1 billion by the middle of this century.[18] Every year, 10 to 12 million rural dwellers migrate to the developed cities of China, and a large population of migrants has rapidly formed in the cities. Urbanization is transforming the social fabric of China at a staggering speed, and new cities and towns are constantly being created. To the newly formed urban population of rural migrants, the city is an alien place and "society" is a strange concept, because for them the close bonds of kinship are what make up their inherit concept of community.[19] In the past, most Chinese people recognized a five-stage process of self- actualization or realization of the individual: first comes the rectification of one's own heart, then self cultivation, family regulation, and on to the right governing of the country, which leads to the pacification of the world **(Fig. 6)**. However, the unfamiliar neighborhoods and environments

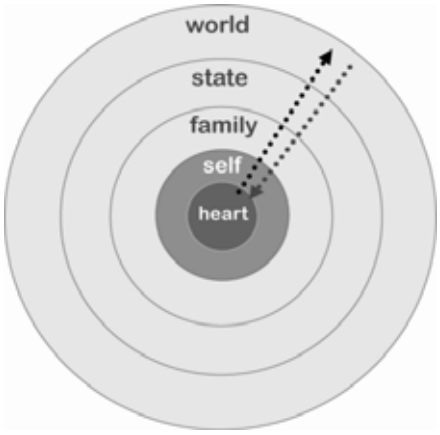

Figure 6 *Five-stage process of self actualization or realization of Confucius.*

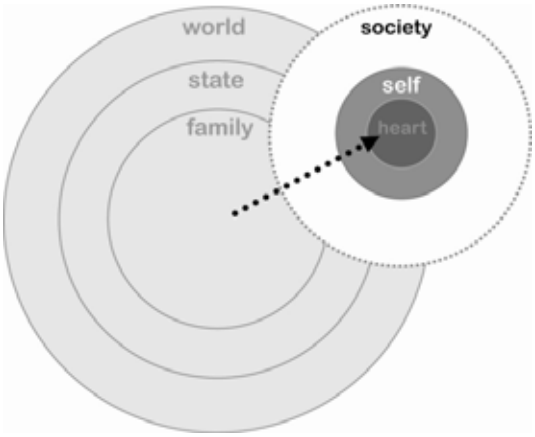

Figure 7 *social displacement in an alienated society*

in which these migrants find themselves serve to break their link with this process of self-realization, and demand the formation of a new worldview. Disconnected from familiar social bonds, mistrustful and lacking in discipline in their daily lives, these new city dwellers may well develop self-interested and anti-social behavior **(Fig. 7)**.

In addition to the aforementioned findings of the workshops, the contextual (macro) and personal (micro) factors that could discourage the adoption or implementation of sustainable consumption and production practices in China can be summarized as follows.

(i) A controlled polity with a lack of constitutional rules on state policy that increases the likelihood of appropriation.
(ii) Exploitation of economic policies by local bureaucrats at the cost of environmental degradation.
(iii) Rising consumerism and materialistic consumption.
(iv) The existence of a digital divide and a low Internet access rate, which cripple the development of ICT-enhanced services.
(v) Rapid urbanization and a rapid rise in the number of urban migrants, which creates social displacement.
(vi) A weak conception of 'civil society' among most urban migrants.
(vii) A prevalence of pragmatism, which engenders self-interested and advantage-seeking behavior that may be anti-social.
(viii) A lack of mutual trust among people and a general distrust of the service system.
(ix) A preference for possession, rather than the sharing of facilities.

These factors seems to be the complete opposite of the criteria that are necessary for the development of sustainable service-based business, such as a relatively democratic polity, an active and strong civil society, an open and developed market economy with an enabled business environment (for example, a high level of environmental consciousness, partnership-orientated, service-driven, stakeholder-responsive, and customer-focused), trust in society and the community, and a developed ICT infrastructure (Manzini and Collina 2004, Angel and Rock 2000, Mont 2000). These criteria have not even been fully met by most developed countries in the West, but in China most are non-existent. These leads to the question of

whether a radical shift toward SCP practices will ever be possible in China in the foreseeable future.

5 The signs of change

A few signs of changes can already be discerned.

5.1 Political will

In the 11th Five-year Plan that was proposed by the central government of China in 2005, one of the key focuses was to "balance both the development of urban and rural and insist on the route of sustainable development for China" (Guangzhou Daily October 2005). Not only were social and economic sustainability targeted, but an increase in environmental spending to US$169 billion, which represents 1.6% of China's GDP in 2005, and the new initiative of Green GDP were promised.[(20)] In addition, various cities have been undergoing greening initiatives. Beijing, Shanghai, and Guangzhou, for example, have launched plans to improve their environment.[(21)]

5.2 Economic environment

Under the WTO agreement, by 2006 foreign financial service firms will be permitted to provide an array of banking services in China. This should help to push access to capital away from state-owned enterprises and toward the private sector. A freer market economy will also deter the government from channeling individual savings to finance state-owned enterprises to blindly expand and over-supply material goods (Harvard Business Review 2004).

5.3 Consumer attitudes

The increase in wealth(22) in China is cultivating a "greener" and more critical middle class and urban population. For example, last winter hundreds of people living on the outskirts of Beijing protested against plans for a new factory because they feared that the factory would pollute the neighborhood. In addition, a recent consumer survey confirmed that 74% of urban consumers claimed that they would reject environmentally unfriendly products and services (Hollyway Consult 2004).

6 In search of an appropriate strategy

Although these are positive signs of a shift toward SCP practices in China, appropriate strategies have yet to be identified to drive the transition.In the following, two initial strategies are proposed to help businesses and NGOs overcome the possible barriers to the promotion of SCP in China.

6.1 Overcoming the economic divide by making technology more accessible

The application of ICT is significant for successful sustainable solution-based business, because it boosts the utilization of such businesses. As China is still a developing country with a massive deprived rural population and a large number of urban migrants, its Internet and information access rates are

fairly low (6.7% in 2004, compared to 68.1% in the United States). However, it is hard to imagine the government increasing information access by funding computing centers or networks, because this would require great expenditure on infrastructure and could engender possible corruption among bureaucrats.(23) It would appear that a radical economic transformation toward a service-based economy in a poor country such as China is therefore unattainable. However, rather than reaching for the impossible goal of system alteration, there is an appropriate piece of communication technology that could be utilized to promote bottom-up development – the mobile phone. There are several advantages in the application of the mobile phone to support sustainable product-service systems in China.

(i) It is handy and comparatively affordable (the cheapest handsets are about US$30 (Standage, 2005)).
(ii) It is already accessible, with a penetration rate of around 26% in 2005 and is projected to reach 33% in 2007. (Market Research. com 2006).
(iii) It requires no fixed network and hence no related infrastructures required.
(iv) Its potential for service utilization has been proven (cashless transactions have been made in Lusaka, Zambia and several other African countries by means of a mobile phone (The Economist, March 2005)).
(v) It can be used by illiterate and literate people alike, and is thus preferable to the alternative of a US$100 laptop.[(24)]
(vi) Telephone operatives would be required, which would create jobs for the millions of unemployed in China.
(vii) It would enable long-term growth, as it has been estimated that an extra ten phones per 100 people in developing country increases GDP growth by 0.6 %. (The Economist, March 2005)

The mobile phone has great potential in facilitating China's economic transformation and advancement, and alternative business models and service systems should thus be developed to improve its utilization.

6.2 Alter social behavior through cultural bias

Any radical shift toward a sustainable China will require a massive social movement. The transition to an efficient, sustainable society is less a technological and more a cultural issue: the challenge is to counteract the prevailing climate of avarice and irresponsible social behavior that has already been noted. The learning and findings from the workshop series and other studies indicate that this behavior is a product of culture, but this means that culture could also be used to nurture the opposite behavior of sustainable consumption. For instance, because of cultural norms and economic realities (that most Chinese is relatively deprived), Chinese people are inclined to care about two issues:

(a) wealth, or being "money minded" and focused on benefit, which originates from the cultural norm of pragmatism, and

(b) health, or being concerned with the body, which derives from the cultural notion of the five cardinal relations, or wu lun.(25)

It is proposed that the concern with wealth (economy) and health ('mirco' ecology) could be developed into a strategy to promote sustainable

solution-based business or initiatives in China. The theory of relevant ecology (26) and the relevance matrix (Fig. 8), which were

developed two years ago to help devise, analyzes, and verify various sustainable solutions, could be used to aid the development of such a strategy. The matrix comprises a vertical axis of three strategic drivers – economic, social, and cultural – and a horizontal axis of three types of relevant ecology – bodily (the most intimate "ecology"), surroundings (immediate environment), and regional.

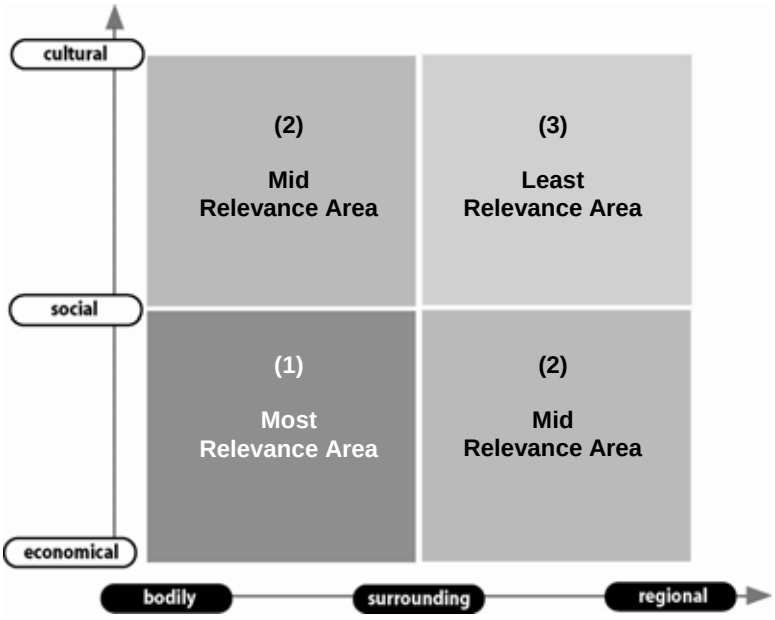

Figure 8 *The "Relevant Matrix"*

Three areas are defined by the two axes in the relevance matrix.
a) Most relevant area
b) Mid relevant area
c) Least relevant area

It is perhaps most interesting to reveal how "cultural bias" works in the most relevant area of the matrix. Business solutions that fall within this area are expected to arouse greater public recognition and acceptance, and hence to have a greater chance of success. Several business operations that focus on bodily health and economic gain have been quietly established and well received by consumers in Hong Kong. They include voluntary organizations such as the group purchase Organic Vegetable Centre and business organizations such as Hong Kong Organic Country Ltd and Greendotdot Company Ltd (Fig.9).

As a matter of fact, the aforementioned strategy could be employed to promote sustainable service businesses which may not be directly related to the bodily and economic issues too, if companies' marketers could visualize and promote the obvious personal gains and losses (economic gains or worsening health) in both quantitative and qualitative terms to the target consumers.

Figure 9 *a retail stall of the Greendotdot Company*

7 Overall conclusion

So can we now answer the question of whether a radical systemic shift toward sustainability is possible in China? One could be skeptical, and focus on the phenomenon of irresponsible consumption that I experienced in Hangzhou, but the aforementioned successful cases of sustainable businesses give a gleam of hope that a systemic shift toward a better and "greener" sustainable economy for China is not entirely impossible.

The next 15 years will be crucial for China, and perhaps for the world, as the "environmental tipping points" [(27)] of the globe become more threatened. China, as the forthcoming largest energy consumers and greenhouse gas emitters, will certainly be one of the key players in shaping the future ecology of the world.

However, one should aware that any possible adoption of systemic SCP in China should be less about forging a consensus on a *universal* theory for promotion than the development of a particular design strategy and its actual adoption in various contexts. This involves indigenous knowledge about *cultural* and *political* differentiation, which is very controversial in China.

Notes:

1. The retail sales of consumer goods were US$509 billion in 2003 and US$569 billion in 2004 (People's Daily Online January 2004, National Bureau of Statistics of China March 2006).

2. According to the Energy Information Administration's (EIA) International Energy Outlook Report (July 2005), China consumes 7.2 million barrels of oil per day, whereas the United States consumes 20 million barrels per day. The total world consumption of oil is 82.9 million barrels per day. China is now the second biggest energy consumer in the world, with an average yearly growth in energy consumption of 7 percent. China's oil demand is expected to reach 14.2 million barrels per day by 2025 (EIA, 'International Energy Outlook 2005 Report #:DOE/EIA-0484(2005)' and 'China Country Analysis Brief').

3. Sydney Morning Herald February 2005, 'China clears the way for Kyoto trade.'

4. Roughly 70 percent of China's rivers and lakes are polluted and contaminated. China's emissions of sulfur dioxide were the highest in the world last year, and about 30 per cent of China is affected by acid rain. In 1997, the World Bank reported that 178,000 premature deaths are caused each year in China by poor air quality. With

346,000 hospital admissions and 6.8 million outpatient visits due to respiratory ailments, the cost of air pollution has been put at $US 43 billion (HK$54.8 billion) a year alone (Yardley 2005, Bezlova 2005, Sydney Morning Herald 2005).

5. For example, the average price of shoes and clothing in the United States has fallen by 35% in real terms over the past 10 years due to the importation of cheaper goods that are made in China. This has pushed wages down and subsequently lowered inflation and interest rates, and naturally leads to the question of what would happen if the export of manufactured goods and the importation of raw materials in China decreased (Economist, July-August 2005).

6. The two series of design and research workshops were held in conjunction with Ms. Elaine Anne, Director of Kaizor Innovation Ltd. in Beijing, Guangzhou, Hunan, Wuxi and Hong Kong in 2000 and 2004 for the promotion of the concept of design for sustainability (with Professor Manzini) and system-product design in China.

7. This hypothetical design process is called ”system-product design (SpD)”. It is a process that is specifically devised to identify and develop products or product systems from a sustainable product-service system based solution (Leong 2002).

8. A few office workers in Shenzhen organized themselves through the Internet to share the use of a private car and the cost of its maintenance. However, the government did not understand the good intentions behind the idea and, instead of providing incentives and encouragement, decided that the car owner’s act of charging a “share” from the other sharers of the car was an illegal act of tax evasion (Tong, ‘Design Vision on the Sustainable Way of Living in China’ in Leong and Manzini 2006).

9. Many peasants state that local bureaucrats have, in effect, become landlords by seizing the land under the auspices of the local government and exploiting it themselves (Economist March 2006).

10. 51% of China’s economy is industrial whereas it is only 18% in the developed West. Thayer School of Engineering at Darmonth College, ‘Service Industry – Industrial Ecology, online.

11. In the 1990s, the six most sought after large consumer items were televisions, washing machines, refrigerators, air conditioners, cameras, and videocassette recorders. By the turn of this century, the most sought-after items were luxury goods and electronic gadgets, such as cars, digital cameras, mobile phones, computers, and DVDs (Harvard Business Review March 2006).

12. The richest ten percent own 45% of the country’s wealth, whereas the poorest ten percent own only 1.4% of the country’s wealth. The average disposable income of Shenzhen residents in 2003 was 23,900 *yuan*, whereas that of Ningxia residents was only 4,912 *yuan* (China Daily June 2005, ‘Income gap in China widens in first quarter’).

13. The Internet penetration rate in Guangdong province is 12.6% (around 11.9 million with Internet access), whereas in Tibet it is only 0.1% (around 70,000 households with Internet access).

14. The application of ICT in a product-service system is believed to allow the substitution of some of the more environmentally burdening processes and activities, such as transportation and publishing, and is thus beneficial for the development of a “lighter” and greener economy.

15. The word “peasant” is used in this context rather than “farmer,” which refers to the more commercial and industrial practice of agriculture (Lau and Yang 1998).

16. Pragmatism is widely adopted in contemporary China, and even extends to the issue of courtship. A social study revealed that “the listing of desired traits in a spouse emphasizes very practical considerations, such as the prospective spouse’s income, ability to provide housing, etc. Romantic considerations like intense feelings and a sense of spiritual partnership are relatively less important” (Bond 1991).

17. Lieberthal (2004), in an article entitled 'The Great Transition' notes that "Chinese managers continue to fail in the critical tasks of systems integration and optimization . . . it will take decades to overcome the ingrained systemic weaknesses that prevent them from designing efficient enterprises" (Harvard Business Review 'Doing Business in China' 2004). Also, similar problems did persist in China's polity for centuries which hinder social reformation and development of China. (Liang 1987, Lin 2002)

18. The Chinese Academy of Science (CAS) predicts that 75% of the population will be urban by the middle of the century, and views the movement to cities as the only way to address many of China's rural problems, including the loss of arable land and rising unemployment. The CAS projects that China's urban population will more than double by 2050 to 1.1 billion.

19. The renowned linguist, philologist and writer Lin Yu Tang once said "public consciousness, community service and civil awareness are all new terms for Chinese . . . They only care about their family, but not society" (Lin 1935).

20. Green GDP is the balance after the imputed environmental cost and environmental resource protection expenditure are deducted from actual GDP. This calculation highlights the interaction between the environment and the economy, and was initiated by the State Environmental Protection Administration (SEPA) of China in 2003 and confirmed by Wen Jiabao, the Premier of the State Council of the PRC, in 2004. Test runs of the adoption of Green GDP have been promised for several pilot regions, of which Shanxi province is likely to be one. One study has indicated that, according to Green GDP measurements, Shanxi's economy has hardly grown at all in the past two decades (Bezlova 2005, Buckley 2003).

21. In January 2005, the "General City Planning for Beijing Municipality (2004-2020)" was approved by the State Council. Beijing was the first municipality to make being a "livable city" one of its objectives. In early 2005, Shanghai's administration set aside Chongming island, which is one fifth the size of Shanghai, for ecological and recreational purposes, such as eco-tourism and organic agriculture. Also in 2005, the City Urban Greening Committee of Guangzhou started its "garden in the air" program, in which 60,000 square meters of buildings roofs will be covered with plants.

22. The average household income in China rose 30% between 1997 and 2004 (Harvard Business Review, March 2006).

23. A similar imitative – the Digital Solidarity Fund – was proposed in March 2005 by the United Nations. It aims to "enable excluded people and countries to enter the new era of the information society". However, the value of the initiative has been queried by economists and social critics (Economist March 2005*)*.

24. As part of a project titled One Laptop Per Child, a hand-cranked laptop that costs roughly $100 was exhibited during the second phase of the World Summit on the Information Society (WSIS) in Tunis in November 2005. The product is expected to be in the hands of schoolchildren in poorer countries by late 2006. The project was sponsored by Google, AMD, News Corp., Red Hat, Brightstar, and Nortel, and was built and designed by MIT Media Lab and the Design Continuum (Wikipedia 2005).

25. According to the teachings of Confucius, one's existence is defined by five cardinal relations: those between emperor and officer, father and son, husband and wife, siblings, and friends. In addition, one's physical being must be taken good care of, because it is a flesh and blood tribute to one's parents (Bond 1991, Sun 1992).

26. The word "ecology" here incorporates both (human) subjectivity and (natural) objectivity, and is related to the ecology of the realms of humanity, the surroundings, and the regional environment, which merge into a global ecology. The word "relevant" refers to the relevance of a particular matter to a given set of people. For example, remote environmental problems may be perceived to be intimate and relevant only if obvious personal gains and losses (for example, economic gains or worsening health) that result from these problems can be visualized by an individual (Leong 2006).

27. Delicate thresholds where a slight rise in the Earth's temperature can cause a dramatic change in the environment that itself triggers a far greater increase in global temperatures that is probably irreversible (Guardian Unlimited 2005).

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Chapter 22 Co-creation: A way to reach sustainable social innovation?

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1 Introduction

From the early nineties sustainable innovation focused on technological and material innovation. This approach led to numerous incremental improvements aiming at the reduction of emissions, and reduction of use of resources, often initiated through top-down governance. Tools and methods for this type of ecodesign have been developed and are more and more applied in practice (Tischner eds, 2000). Nevertheless, over the past ten years it has become clear that this approach seems to have negative rebound effects. (Masuda F., 2005)

The question arises: "What is sustainable innovation in addition to ecodesign and technological innovation?" The object of study of sustainable innovation has slowly transformed from a product focus towards a system focus, as illustrated in the product service system approach. Related projects starting from the early year 2000 are the European fifth framework programme focussing on product service systems and including SusProNet (2003-2004), Designing Eco-efficient Services research project at TU Delft, and the Highly Customized Services-project (HiCS, 2002-2003) This product service systems approach inherently leads to a design act of more complexity involving many different stakeholders.

We also see a movement in society towards the rise of grass-roots initiatives. In this paper the development process of grass-roots initiatives is explored and discussed with regards to its possible merit for sustainable innovation. These grass-root initiatives were gathered as part of the Emerging User Demands (EMUDE) programme of activities. This programme was initiated by Politecnico di Milano and funded by the European Commission's Sixth Framework programme. This paper's results are based on an exploration of seventeen bottom-up initiatives so-called

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promising cases in the Netherlands. Co-creation processes, methods and tools could be linked to the successful development of bottom-up initiatives. Studying these processes and tools will create an opportunity for the sustainable development of initiatives in society: for the local people involved, companies, (local) governments, consultants, and designers.

2 Participatory design and co-creation

Participatory design principles, tools and methods are used in the development of products, technologies or social institutions. The aim of participatory design methods is to develop more responsive to human needs. (www.pdc2006.org). The last decade a shift is becoming visible. One could say that the slight difference between the meaning of "participatory design" and "co-creation" represents a subtle but fundamental shift in the development of the design discipline. The rise of participatory design already put the traditional concept of design as an individual creative activity upside down, and transformed design to being a creative activity in which users really participate. This kind of participation is aimed at achieving design results that really fit the needs of the prospective users. The recent shift from participatory design to co-creation is a further development in which design is becoming a collaborative process (Scrivener eds. 2000). In such a process, the 'user' is not just involved as a source of information, an input for the work of the designers, but the 'users' ARE the designers. The adoption of such an approach has far reaching repercussions for the role of the designer, who has to share the creative part of the process with a group of stakeholders.

There are great benefits in adopting this approach: if this really works well, one could not only achieve a perfect fit between the design and the user needs, but also get a real user buy-in for the design solution. This is particularly relevant in the case of the kind of socio-cultural change process that we deal with within the field of sustainable innovation. Any designed solution is only as good as the amount of stakeholder support, and the quality of the stakeholder involvement. Therefore, it is interesting to explore the tools and methods that are described in the budding literature on co-creation, and see how these could be used in the context of the creation of sustainable innovations.

3 The EMUDE project: methods and tools

The aim of the EMUDE project was to explore the potential of social innovation in Europe as a driver for technological and product innovation, with sustainability goals in mind. While gathering promising cases, we focused on initiatives in society which seem promising in creating innovative solutions that include an integration of social, environmental and economic solutions for problems people nowadays face, thus taking into account the three pillars for sustainable development.

Starting point for the EMUDE project was the assumption that creative communities, and the promising cases or bottom-up initiatives they generate, can both anticipate a possible future, and offer concrete indications as to how technological, product and market innovation could be oriented. (Manzini

eds., 2003) Students of eight design schools from all over Europe collected promising cases of such developments. Tools to manage and record the cases had been developed by the consortium task leader Politecnico di Milano. These tools include:

- a "training the trainers" workshop to inform the co-ordinators of the eight design schools on definitions, materials and method to apply for the process of collecting,
- a training guide to explain the method for collecting and recording the promising cases to the school co-ordinators and students,
- a reporter's book representing the format for interviewing the people of a case,
- a light format for recording preliminary results of literature and media search for cases,
- an in-depth format for a detailed description of a case after validation of the light format by the consortium,
- an Internet repository functioning as a database for the consortium to use for further research.

Before the students were sent to search for cases in society, they were instructed by explaining what social innovation is considered to be in view of the EMUDE-project, and by given examples of promising cases that had been gathered in the test phase of the EMUDE-project. The definition of social innovation as given to the students was: social innovation includes changes in the way individuals or communities act and organize themselves to get a result, i.e. to solve a problem or to generate new opportunities. This definition was derived from the experience and knowledge gathered in the Sustainable Everyday project, captured in the homonymic book of Manzini and Jégou (2003).

One hundred and eleven cases from all over Europe were collected, validated, recorded in-depth through interviews with the case-owners, and uploaded in the Internet repository for research by the consortium.

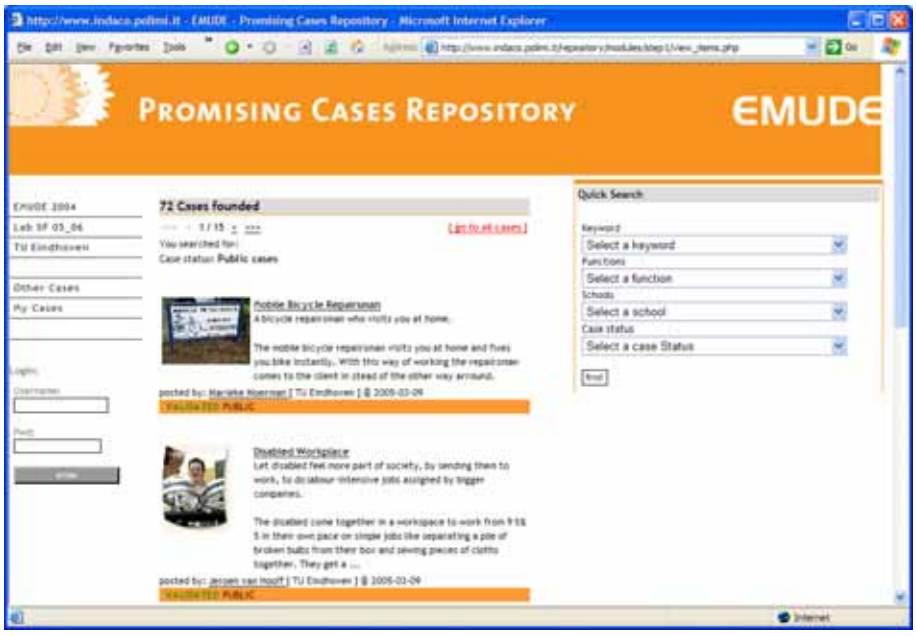

Figure 1: EMUDE Internet repository.

Figure 2: Mood board promising case “de Werfterp” (WER).

Seventeen of the Dutch cases have been elaborated by students of the department of Industrial Design at the Eindhoven University of Technology into a system organization map. This system organization map tool was developed in the HiCS-project (Manzini eds. 2004). This mapping of the Dutch cases took place outside the scope of the EMUDE-project. The aim was to get a more detailed view on how the different stakeholders of a case participate or co-operate, and how flows of information, products, services, and money exactly take place. Each case was elaborated by a different set of two students. Based on the information available in the EMUDE repository they prepared the system organization map (e.g. see figure 4), and questions for a follow-up interview with one or two of the case-owners. These interviews revealed new information on how the cases actually started or work in reality. This new information made it possible to map the cases with regard to complexity and the nature of initiation of a case. After this second analysis of the cases, the students got the assignment to design an intervention to improve the level of sustainability of the case they analysed. The table below gives an overview and short description of the seventeen Dutch cases analysed. In the next paragraphs the mapping of these cases is explained and three cases with their design interventions are described in more detail.

Table 1: Seventeen Dutch cases. The three-character codes correspond to the codes used in figure 3.

	Case Title	Initiator	Nr. of people involved	Key Innovation
DWO	Disabled Workplace	Association "Meare"	unknown	Mentally disabled people feel more confident and part of society, by getting the opportunity to do uncomplicated labour-intensive work assigned by companies.
CIN	Childfriendly Injectionrooms	hospital employee	unknown	Child friendly furnishing of an injection room, so that they do not get scared for the treatment they have to undergo.
KER	De Kersentuin	private persons	start: 5 to 10 people. Current situation: residents association "de Kersentuin" for 94 families.	A socially and environmentally sustainable neighbourhood designed by the inhabitants in co-operation with architects and housing corporation.
AQU	Aquarius	private seniors	start: 5 to 10 seniors. Current situation: 5 people in daily management, 45 inhabitants.	Quarters developed by seniors with the aim to live together in separated houses, helping each other when needed but with high independancy.
WER	De Werfterp	private persons and entrepreneur.	start: 2 private initiators. Current situation: 5 to 10 people involved.	Creating a live-work environment where humans and nature come together.
NIE	Nieuwlande	local interest group of villagers "Plaatselijk Belang"	start: 10 to 15 people. Current situation: whole community involved = 500 families.	Inhabitants initiative to improve living circumstances and the social network in their small village through co-operation with municipality and working groups.
LGA	Loan Gardens	local government + private person	start: 2-5 people. Current situation: 80 people.	Enabling inhabitants of a condominium-neighboorhood, to maintain a little piece of public garden, thus enhancing social relationship between inhabitants.
NSH	Neighboorhood Shares	local government	start: 3-5 people. Current situation: unknown est.>80	Residents take over responsibility from municipality for certain maintenance tasks for their neighbourhood: Residents, schools, members of a certain association (soccer team, dart players) receive money from municipality to complete neighboorhood maintenance tasks.
MAR	Domain Marienwaerdt	farmer/entrepreneur	start: 2 people. Current situation: 12 to 80.	An economically and ecologically sustainable exploitation of the domain which creates a balance in farming, nature, cultural history and recreation.
CHC	Childrens Holiday Card	private person	start: 2 people. Current situation: 4 volunteers involved.	Small free excursions in the fields of sports, nature and discounts at local companies for children that do not go on holidays in summer.
STM	Stichting Milieunet	entrepreneur	start: 1 person. Current situation: 5 people involved.	Internet site and access to a network of suppliers for second hand building materials.
SEC	Senior Club	private seniors	start: 2 people. Current situation: 10-15 people involved.	A space to meet, share experiences and perform creative and relaxing activities for seniors in a new neighboorhood.
BIR	Bicycle Repairman	entrepreneur	start: 1 person. Current situation: 1 person.	A bicycle repairsman who visits you at home with his mobile workshop.
TDV	Tour de Ville	entrepreneur	start: 1-2 people. Current situation: 20 employees.	Fast parcel delivery throughout Eindhoven by bike.
KBD	Komeet Delivery Bike	entrepreneur	start: 1-2 people. Current situation: 13 employees.	Fast parcel delivery throughout Amsterdam by bike.
LRR	Living Room Restaurant	private seniors	start: 2 people. Current situation: 2 people.	Once a month a couple that loves to cook creates the opportunity for unknown people to have dinner at their home.
AIE	Artist Involvement in Education	artist	start: 1 person. Current situation: single initiative.	Challenging (young) people to explore creativity with existing garbage objects to promote the use of garbage in expressive works (artworks) and thereby questioning the image of garbage in general guided by an artist.

4 Mapping promising cases

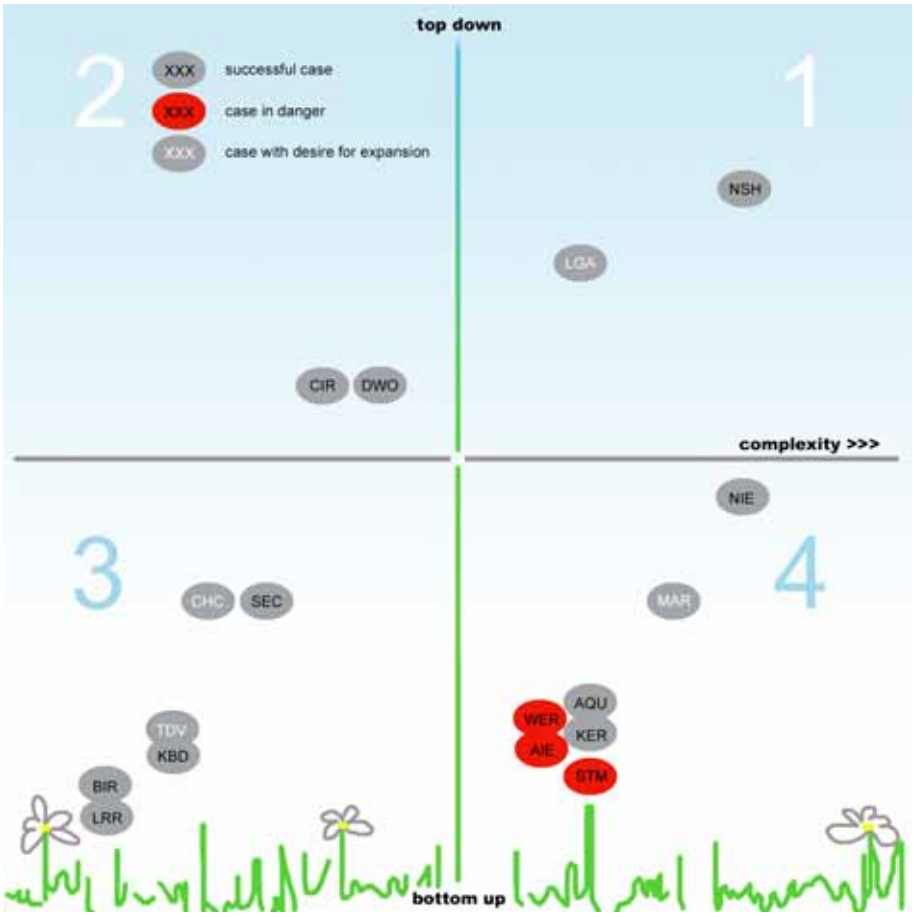

Figure 3: Promising Cases Map.

4.1 Top-down versus bottom-up initiation

One of the distinctions that can be made between the cases after in-depth analysis was that of a top-down versus a bottom-up start of a case. Top-down stands for the level of involvement of government in the initiation of a case. In the matrix shown in figure 3 no distinction is being made between local or higher-level government involvements. It is necessary to remark that all cases have a local character, which is inherently connected to the guidelines that were set for collecting the cases. The level of top-down initiation depends on the governance tools used by government to initiate a case. The most “severe” and direct governance tools are considered to be laws and restrictions, penalties and taxes. Governance tools considered to be less directive and creating an environment for participation is governmental funding, and the actual initiation of a project in participation with inhabitants, local entrepreneurs and the like. The horizontal axis indicates a virtual border between top-down initiation by government, using a set of governance tools ranging from directive top-down tools towards close participation with the people involved in the solution. Below the horizontal axis, local community members initiate cases. A distinction in bottom-up level in the vertical direction is made, taking into account macro-level

interventions of government, that influence peoples behaviour at the micro level. For example the top-down reformation of agriculture over the past twenty years in the Netherlands can be seen as a driver for farmers to start new activities to create an income with their resources and through seeking co-operation with others. In this map the initiative of a farmer would be mapped a bottom-up case, although from a macro level perspective this initiative could be considered to indirectly start through government influence.

4.2 Increasing complexity

Complexity of a case increases with the number of different stakeholders and more flows of information, products/materials and money necessary to make the solution work. One indicator used to determine the complexity of a case is the system organization map.

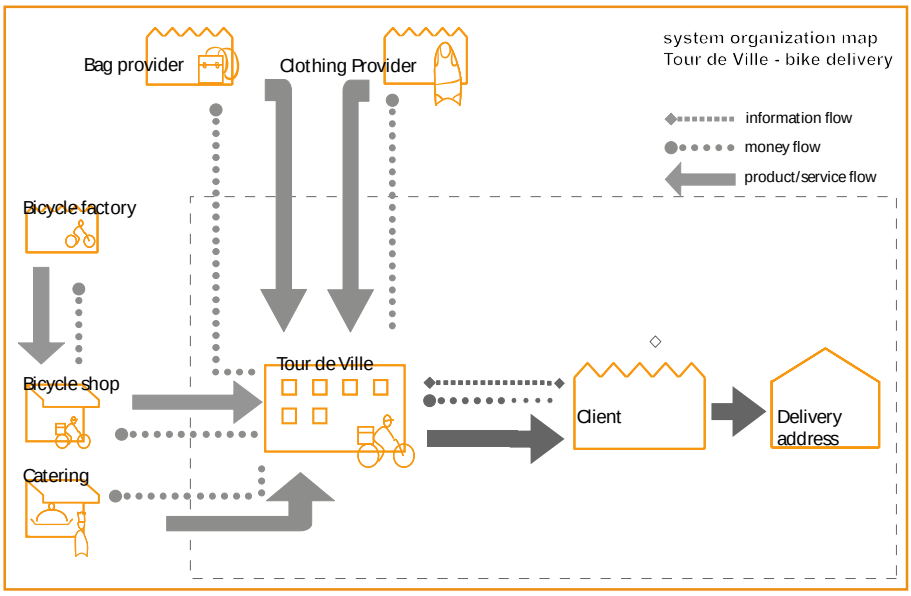

Figure 4: System organization map Tour de Ville (TDV): a promising case with low complexity.

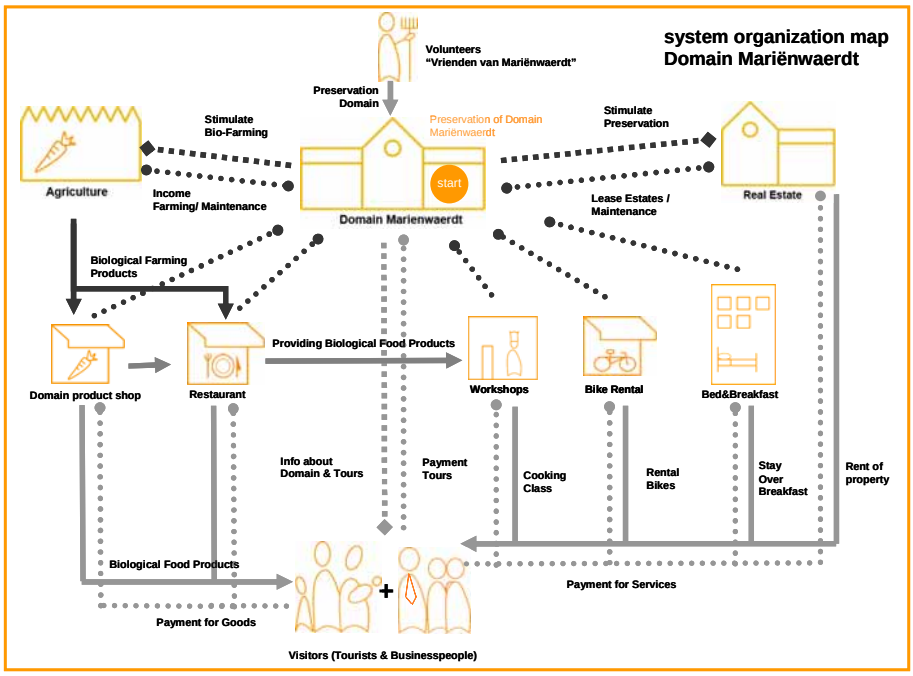

Figure 5: System organization map Mariënwaerdt (MAR): a promising case with high complexity.

4.3 4 quadrants

The first quadrant (figure 3, top right) represents cases with high complexity, affecting a community as a whole. Initiation takes place due to a discomforting/problematic situation in the (local) community, and is initiated by the (local) government. Initiation can take place through various governance tools. Only two cases are mapped in this quadrant due to the fact that the assignment to the students was to explicitly search for bottom-up initiatives. The reason why these cases were included in the database is the lack of exact information about these cases in the first phase of analysis.

In the second quadrant (figure 3, top left) cases are mapped, which are initiated by governmental institutions or institutions closely related to government, like for example health care. Complexity is considered to be lower than in quadrant one, because in these cases the solution includes only a small group of people in society. Again only two cases are mapped in this quadrant due to the fact that the assignment to the students was to explicitly search for bottom-up initiatives.

The third quadrant (figure 3, bottom left) represents cases, which are true bottom-up or grass-root initiatives. People with creative ideas start a small but innovative business or create a solution, which affects a small group of people (less then 50 people involved in the system as being direct stakeholders). Cases in this quadrant might have the potential to grow, which would mean moving to quadrant four due to increasing complexity.

The fourth quadrant (figure 3, bottom right) contains cases, which are grass-root initiatives of higher complexity: the number of different

stakeholders involved in the system is high compared to the cases in quadrant three, and the number of people involved or affected by the solution is high, meaning over fifty people involved.

4.4 Exploring the cases in quadrant 1, 3 and 4 with regard to co-creation and participation.

Through mapping of the cases along the variables “complexity” and “top-down” versus “bottom-up” we found out that especially in cases with high complexity participation and co-creation play an important role (quadrant one and four). As well the success and long-term sustainability of a case depend on true participation and co-creation between the various stakeholders involved. In cases with low complexity, as demonstrated in quadrant three, success is more dependent on the entrepreneurship and enthusiasm of the initiators. In the below sections a detailed exploration of the quadrants 1, 3 and 4 is described.

4.4.1 quadrant 1

Both cases in quadrant one include the professional and active use of participatory design tools. In one case (LGA) inhabitants took the first initiative through seeking participation with local authorities. As soon as local government got interested they took the lead. The solution was developed in close co-operation between authorities and inhabitants. In both cases a professional consultant was involved to guide the process. Participation tools and methods like for example workshops with people of the community, interviews, focus group meetings etc. were applied in both cases mapped in this quadrant. Co-creation, defined as to be a collaborative and even community design process, wasn’t present in both cases. The services and structures that were developed in these cases were first conceived by professionals and then discussed with the people in the communities involved.

4.4.2 quadrant 3

Participation with other stakeholders in the creation phase of the development process hardly takes place, and doesn’t seem to be necessary for the successful development, due to the relatively low complexity of the system that is being developed. The success of a case is highly dependent on the motivation and entrepreneurship of the initiator. Participation and co-creation seem to become important if a case-owner decides to want expand the solution. The cases mapped in this quadrant in grey ellipses and red fonts have indicated this ambition, and might benefit from applying participatory design and co-creation. This drive to expand often has to do with the ambitions of the initiator of a case.

4.4.3 quadrant 4

Initiators of a lot of cases in quadrant four implicitly apply participation and co-creation tools and methods. In only one of the cases in this quadrant (KER) professional consultancy is present throughout the complete

development of a solution and co-creation and participation tools are used explicitly. Cases in quadrant four in which participation and co-creation is missing are less successful or do not work at all as a solution. Examples are the cases “Artist Involvement in Education” (AIE) and “Stichting Milieunet” (STM). These cases both lack the active co-operation between and involvement of various stakeholders, which is needed to sustain the system as it was created initially. These cases started as promising cases but have reverted to single, stand alone initiatives and actions.

Another case in quadrant four (WER) suffers from the lack of active participation and co-creation between the various stakeholders during the development of the case. This case finds itself in the initial phase and the people involved are getting more and more frustrated for not being able to move on. Effort is put in creative sessions together, but participation with different stakeholders is missing. Also the implicit application of participatory design tools and co-creation is missing, due to a lack of knowledge and experience. Case owners in general perceive the development of a solution as complex.

Successful cases in quadrant four all show active participation between the various stakeholders. Solution wise these cases are comparable to the less successful cases described above. Participatory design tools and methods are applied both consciously and unconsciously. In several cases (like “Marienwaerdt” (MAR) and “de Kersentuin” (KER)) true co-creation takes place, in which various stakeholders take part.

In line with the above written exploration of quadrant four, we can say that using participatory design tools and co-creation, is one of the success factors for the development of a complex bottom-up initiative.

5 Three promising cases and their design interventions

Three cases in the consumption areas agro-food, mobility, and housing are described below. Especially the first case illustrates the implicit use of co-creation in the development process. For all three cases design students made proposals on how to improve the level of sustainability of the case. These examples give us an impression of the spontaneous roles design students take in co-operating with the creative communities.

5.1 The Domain Mariënwaerdt

5.1.1 background information

Domain Mariënwaerdt is a domain of in total 960 ha in the town of Beesd, the Netherlands. Since the year 1734 the domain is owned by family van Verschuer. Agriculture was the main source of income at the domain for ages, which hosts 5 rent companies that farm on the domain. Growing of various crops like sugar beets, and corn, keeping cows for milk, and fruit farming were main resources for the past 250 years. Next to agriculture, about 350 ha of the domain consist out of forest. In the 1980’s the domain was a large flourishing agricultural company, but at the start of the 1990’s

revenues started to decline. The domain faced serious problems due to falling subsidies for agriculture in Europe, the introduction of production quota etc.. Renters started to leave and sustainable maintenance of all property became more and more difficult.

5.1.2 key innovation

An economically and ecologically sustainable exploitation of the domain, which creates a balance in farming, nature, cultural history and recreation.

5.1.3 solution description

In the early 1990's it was clear to family van Verschuer that something needed to change. They got funding to have an external consultancy office to give them advice on how to revitalise the domain. Not being pleased by the results of this research, they decided to get together all renters and other people working on the domain to discuss problems and possible solutions. In ten years time, the domain was reorganized to a healthy and well-maintained business based on bio-agriculture. New resources of income, like the production of cheese, jam and other bio-agricultural products, a domain-shop for eco-products, a "bed-and-breakfast" facility and a pancake-restaurant, are now operational. There are still five rent companies, and in total about 50 people are employed by the domain. Ten employees also live on the domain and a number of houses are rented to other people. The owners established a "Friends of Mariënwaerdt" association in 2002 to involve people interested in the development of the domain. Members support the domain through a yearly contribution. They are actively involved in discussions and the decision-making process with regard to the further development of the domain. Figure 5 illustrates the system organization of this solution

5.1.4 design intervention

Sustaining the domain was the starting point and main driver for initiator Mr. Verschuer. At this moment the domain is still in the process of transforming its agriculture into a 100% ecological process. The initiative is very successful, which is also demonstrated by the fact that Mr. and Mrs Verschuer recently received an award for the most creative and innovative local entrepreneur of 2005. The students nevertheless searched for ways to lift the level of sustainability of the domain. The design goal they set was to stimulate children to learn about ecological farming, preserving the natural environment and getting to know more about local history. By organizing events and activities for children, an emotional bond with the domain is created, which might motivate them to support the domain in their adult lives.

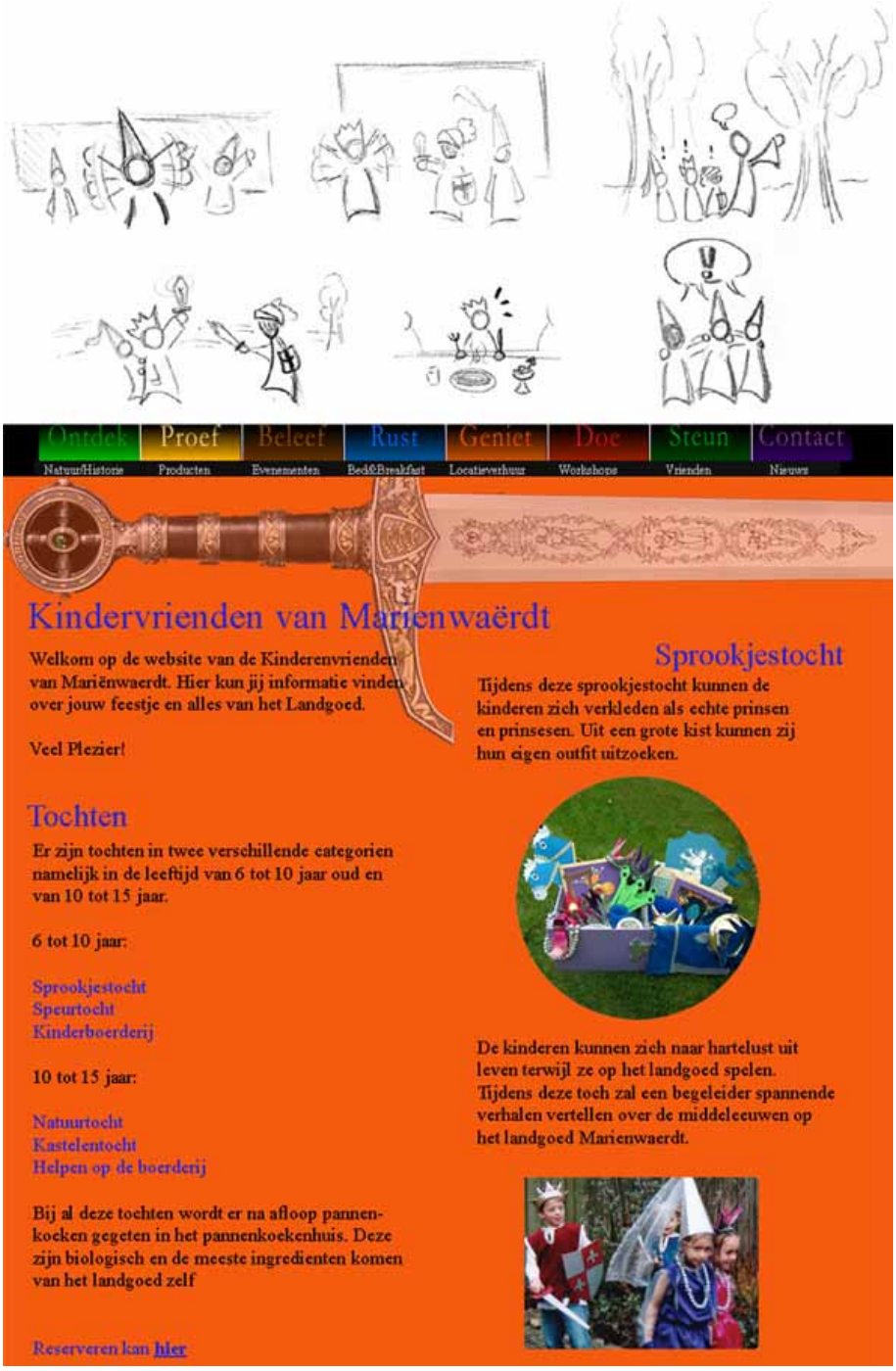

Figure 6: Design intervention Mariënwaerdt

5.2 Tour de Ville – bike delivery

5.2.1 background information

Roads in the Netherlands and especially around Eindhoven are becoming more and more congested. At rush hour and also during the day, it is almost impossible to quickly move through Eindhoven by car. Fast delivery of packages by car is almost impossible.

5.2.2 key innovation

Quick package delivery by bike within an area of 20 km: avoiding traffic jams and reducing the impact on the environment.

5.2.3 solution description

Package delivery by bike in a city like Eindhoven is much quicker and reduces the need to drive around with mini-vans. A group of young people, fanatic in bike racing, decided to transform their hobby into their work. They are well trained sportsmen, who are able to cover a distance of about 15 to 20 km by bike in half an hour. Companies can call a central number and a cyclist will be sent. The client can choose for delivery within an hour or within half an hour. There is also an option for regular service, e.g. the daily delivery of the companies' P.O. Box content by bike.

5.2.4 design intervention

The solution is sustainable from an environmental point of view, even if this wasn't the main goal of the initiators. To make it more attractive for companies to make use of this service, the students came up with a solution of a decentralized system. Through this system, using GPS and mobile telephones, efficiency and action radius can be improved. Cyclist can pass packages to each other, making it possible to serve a larger area. An integrated communication device has to be developed.

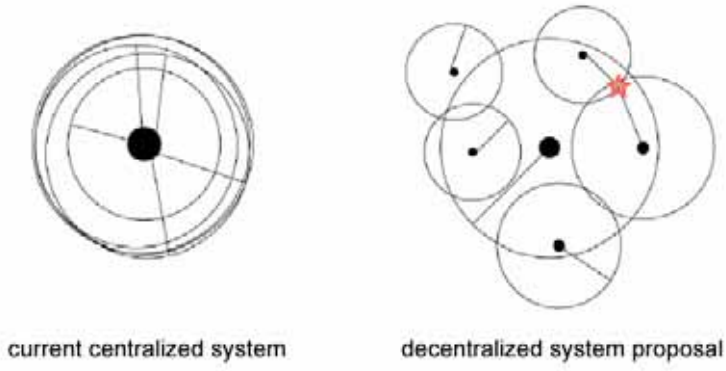

Figure 7: Design intervention Tour de Ville. Decentralized delivery system.

5.3 De Werfterp – ecological living

5.3.1 background information

Marien Faase, architect of profession, wanted to build a house where the experience of living was integrated in the design of the house. The building should combine harmoniously living, working, learning, playing and care. With the help of volunteers, investors and founders the house was built. The people involved want to create a way of living distinct from "the usual": to be connected in the neighbourhood, living in harmony with the environment.

5.3.2 key innovation

To create a live-work community that fulfils the human need to be socially connected.

5.3.3 solution description

At this moment the Werfterp-project consists of a building called “het Werfhuis” and a connected plot of land called “de Werfterp”. The house is nearly finished and provides room to a small school, an architect office, a family house and a smaller apartment suitable for seniors. Plans for the development of the plot of land are now being developed.

5.3.4 design intervention

The in-depth analysis of this case revealed a certain disorganisation. All people involved are dedicated and enthusiastic, but for some reason progress was not being made. We organized a workshop to clarify how the current system works. A system organization map was generated together with the students and the core team of people involved in the development of the Werfterp. This descriptive system organization map revealed the obstacles which caused deceleration. After this intervention the case-owners regained the development of the Werfterp independently.

Figure 8: Design intervention “de Werfterp”. Descriptive system organization map used to distinguish current obstacles.

6 Conclusions

Exploring the development process and categorizing the cases demonstrates the implicit presence of participatory design and co-creation in complex bottom-up cases. Methods and tools, as can be found in literature on participatory design (Sanoff, 2005), are being used by initiators and communities. There seems to be a correlation between the successful development of a case and the application of participatory design tools and co-creation. Studying these processes and tools will create an opportunity for the sustainable development of grass-root initiatives in society: for the local people involved, for companies, (local) governments, consultants, and designers.

The question now arises how to do participatory design and co-creation for sustainable development of bottom-up initiatives. A first answer could be gleaned from the spontaneous roles the design students took while having to improve the level of sustainability of a case. They were creators of innovative and fresh ideas, facilitators in the development process, critical analysts, co-creators, and learners. The outcomes varied from new product ideas, to system changes or the proposal for an extended product-service-combination. A special outcome we observed is the learning effect that resulted from the design proposals. Discussing the design proposals with the case-owners revealed the dynamics of the system behind a case. This leads to an iterative approach in which the design focus would be on the creation of design proposals aimed at learning how to improve the system, instead of focusing at the design of the one and only final solution to one problem.

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Chapter 23 New approaches to welfare and housing in Finland

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1 Introduction

In Europe today we can detect certain weak signals that could have a significant impact on the way we Europeans live and consume in the near future, affecting our attitudes towards food, transport and housing. Many sustainable solutions, organic food circles or vegetable boxes, the slow food movement, recycling workshops and the like, have evolved and have in their turn inspired others to create their own similar networks and services, to answer their own specific needs. We may refer to them as sustainable innovations since they involve a system change – no matter how small – from the existing consumer-supplier-market paradigm.

When it comes to housing and sustainability we may automatically think of green building, controlling the environmental impacts of the structure's inputs and outputs, but eco-design of this kind is often rooted in the traditional market paradigm. The truly instructive – and inspiring – examples of sustainable housing also address the social pillar of sustainability: the lifestyle impacts of the residents themselves, by promoting a much more communal and sharing-driven approach. In the European cultural context at least, especially in Finland, this may seem to be at odds with the existing mainstream culture that values individual ownership of a single family detached dwelling.

Alongside this rather psychosocial drift towards more communal lifestyles is a second notable, and equally inspiring, characteristic shared by many of these new architectural solutions: the fact that they developed in a distinctly bottom-up process. These projects have been stimulated, nurtured, controlled and – to a great extent – 'designed' by the people, the users, the consumers, the residents themselves. This in turn changes the relationship between the expert amateur client, who is emotionally and even ontologically committed to the project, and the designer architect, and the

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resulting participatory design process not only lends weight to the true needs of the active client/resident but may blur the boundary between 'professional' and 'amateur'. As we have seen in the digital world, the 'prosumer' of architecture and design services exists, with the ability to use more advanced 'tools' than his predecessor.

The final characteristic of note is how these solutions fit in with, or indeed stand out from, the existing welfare and social security system. In the health and welfare arenas, European authorities and populations are facing a rapidly ageing demographic, a shift away from 'welfare state' values and an impatience with the state of services today. How these circumstances will collide, and how authorities and active citizens will create innovative new service solutions, is the fascinating game being dealt out at the moment.

2 Oranssi

The Oranssi association is a well-known youth group in Finland that emerged in Helsinki during a deep recession about fifteen years ago. At that time, as now, rents and rental security deposits in the city were very high, and there was very little affordable housing available. Youth unemployment was also a problem. A small group of friends, about 15 to 20 people, all under the age of 20, began squatting activities to protest this state of affairs in 1990, taking over abandoned industrial or residential buildings, only to be removed a few days later by the authorities. At long last the city began discussion with the group and offered them two empty wooden buildings that had been squatted and needed renovating. Restoring costs were too high for the city, but in exchange for cheap rent the group took over the renovation task. A dialogue began whereupon the city offered the group empty houses, and young residents moved in and renovated. Oranssi became well-known in the press, the flats were known to be cheap, and the lifestyle was attractive, so numbers grew from 20 to 600 very quickly.

Through ingenuity, energy, and a persistent lack of resources, Oranssi members over time learned valuable skills in restoring and maintaining traditional Finnish wooden architecture and were able to decorate and furnish their own flats using recycled, free, and/or reclaimed materials. Residents work alongside professional architects, carpenters and joiners, even in roof replacement or heating infrastructure projects. Membership entry remains limited to those under 24 years of age, and only as flats become vacant. There is a clear understanding that living in an Oranssi house entails the physical labour involved in restoring and maintaining the house and the grounds, and offers the benefits of a very community-oriented neighbourhood and instant social circle.

In order to maintain these communal- and ecology-driven values the group does not wish to grow further, but an interesting new phase is currently underway. In a former workers' housing area near the University of Art & Design Helsinki, Oranssi hopes to build a new block of flats from the ground up. The plans have been drawn up with long-time collaborator architect Pekka Lehtinen. Besides working together over the years on residence design and renovation of the Oranssi houses, Oranssi and Lehtinen

have been active in the cultural milieu, voicing their opposition to various city planning proposals that threaten cultural and architectural diversity in the urban landscape.

The Oranssi members responsible for the new building have brought their near-expert experience to the table and participated in the design process with the architect, with well-informed ideas on the planning of private and public space, the environmental impact of all housing functions, and especially the tradition of wooden workers' housing in Finland. The design was to be very simple and clear, and to strictly follow traditional workers' housing ideals in terms of using the entire lot efficiently, and to concentrate more on communal functions such as the placement of the sauna than the individual spaces or rooms. In the words of the architect, Oranssi provided the grammar.

In this kind of context there was no room for grand architectural ambitions or superstar designs; instead Lehtinen enjoyed the narrow parameters and the opportunity to translate clear decisions and directions into a pleasing and operative housing plan. Compared to his architectural work with other clients this process could not have been more different.

3 Loppukiri

Moving to the other end of the demographic spectrum, the second Finnish case study to be described here is the 'Loppukiri' retirement housing project, about to be completed in May 2006 and also a neighbour of the design school. There is a slight irony in the choice of the name, as it may be translated as 'Final Spurt' (i.e. right before the finish line in athletics). The project is the brainchild of the Active Seniors Association (Aktiiviset Seniorit), which, like, Oranssi, formed in a grassroots way based on a real need for a certain type of housing solution not provided by welfare services. The Active Seniors founding members were unsatisfied with the options available to them upon retirement and as they age, and formed a registered association with the intention of designing for themselves their ideal retirement home. As especially one or two of the members already had a wide network of contacts and were media-savvy, the project garnered immense amounts of publicity from the outset.

Loppukiri is committee-based, meaning that the future residents have formed committees based on specific functions and problems, from dimensioning to bathroom finishes. They have made journeys to other countries to research similar projects. They too have clear ideas on how they see the relationships between the public living areas and the personal spaces, i.e. on how to reach a comfortable state of living in a mentally and physically safe environment that provides security both in terms of community and privacy.

Loppukiri is thus intriguing as it too combines the strengths of a proactive, constantly researching group of 'amateur experts' with those of a sympathetic architect (Kirsti Sivén). Moreover, project members have been working in an unusual way with digital design researchers from the ARKI

research group at the University of Art & Design Helsinki, in order to reveal deeper attitudes to health, interests, relationships inside and external to the dwelling, care, and other crucial issues that could guide the architectural and functional planning work. At the beginning of the process, for example, ARKI researchers conducted cultural probe studies using maps, diaries, cameras and other tools to explore the future residents' desires, wishes, and values and to build scenarios.

The two parties then began to work with the coordination of functions in the house, and ARKI's role was to develop the digital support for these functions as booking systems, a shared calendar, archive possibilities, and the like. For example, it is important to all residents that they eat together at certain times of the week, and several persons will then be responsible for the cooking. Besides the obvious social function, this offers the possibility to 'check up on' all residents in a non-intrusive way. There are other shared facilities such as the sauna, a library and guestrooms, which may all be reserved through the house's digital portal. Incidentally, as many of the residents expressed discomfort with the computer as a tool, the group is exploring a voice-oriented, audio diary style method.

It became apparent through the working process and conversations that the group had a highly developed sense for and respect for the media (meaning publishing or the dissemination of information). Very compelling ideas were discussed about how Loppukiri can handle its own 'publishing' or 'broadcasting' activities, in order to transmit knowledge deemed useful, to share memories and stories, and to store this data for family members or future generations. For example, a recipe book has already been published. Many members are keen on travel, and wish to share their travel stories with others. Many are also avid gardeners and will greatly miss the opportunity to garden once they move into the block of flats. Their gardening expertise however could be recorded in, for instance, audio-visual form, and kept for posterity. All these examples are 'services' or 'applications' or practices that one could not imagine in a traditional municipal retirement home.

4 Creative communities and heroes

These case studies aptly illustrate the power of a Creative Community, as they have been named and elaborated in the EMUDE project. (Oranssi is one of the EMUDE cases; for more information see <www.sustainable-everyday.net/EMUDE/>.) It is important to remember that creative communities often gain their impetus from the personal energies of a few significant 'heroes'. It has been said that an '80/20 rule' guides how things operate in our society, that in general 20% of the population does 80% of the work. Active and democratic participation in society takes work; creating something new – social innovation – takes courage, but the action can inspire others to become heroes and leaders as well.

In this spirit writer and journalist Malcolm Gladwell has analysed the phenomenon of the 'tipping point' and astutely describes the key players and personalities that have a role in creating, perpetuating or promoting societal fads and trends. These personalities (Connectors, Mavens and Salesmen) are

crucial to the reinforcing of the weak signals sent out by, in our vision, the innovating heroes of our marginal creative communities. If we, any group of people, want to change attitudes towards a more balanced model of sustainable consumption, is there a way to exploit this social mechanism of the tipping point, to leverage the social competencies of the Connectors, Mavens and Salesmen?

5 Conclusion

The two Helsinki examples presented here would not necessarily exist in their current state if it were not for the open-mindedness of Helsinki city authorities. They opened a dialogue with Oranssi rather than merely offering them extant council or student flats in an anonymous environment. They supported the Active Seniors from the outset rather than leaving them to form their own private enterprise initiative. The lesson is for policymakers and for state and municipal authorities: positive change in future needs a supportive platform today. The creative communities need basic support in order for the Connectors – and thereby the rest of us – to learn about their inspiring behaviour.

The second lesson is for designers and design educators: do we have the skills to design lifestyles as well as products? Do we know how to act as facilitators for actors to self-design their own solutions? In today's milieu of the 'open-source' ethic can we support services built by layman communities, the Wikipedias of the everyday material world? (What exactly will be our role, then, as professionals?) Can we ensure that the services are human- and quality of life-driven rather than technology-driven? It is self-evident that we designers have these skills, that we are naturally and intuitively able to harness our abilities to visualise, to use tacit knowledge, to facilitate design thinking and to create through iteration. We do however need more projects like Loppukiri: the opportunities to develop as professionals in these new kinds of service innovation and development outside the traditional design agency/corporate client/design brief model. While these opportunities seem to be currently rare outside the academic, education environment, designers should not only seek them out but also create them. We must take back the design of our own profession.

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Parallel Session III: Business management/PSS; Special session on Consumption in Eastern Europe

Leader: Matin Charter
Rapporteur: Saadi Lahlou

Note : the contributions of Vadovic and Kiisel were presented in this session, but conceptually were part of Session I on consumption. In these proceedings they hence appear in the part on Session I

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Chapter 24 Sustainable Consumption & Production, Business and Innovation

A DISCUSSION DOCUMENT

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1 A Changing World

1.1 Globalisation

Many of the issues arising from the Sustainable Consumption and Production (SCP) agenda are highly complex and require fundamental changes in the external framework.

Globalisation means that traditional business models and the geographical distribution of design, assembly and manufacturing are changing. Supply chains (or networks) now have major environmental and social impacts on a range of countries, societies and communities e.g. in 'the South', which maybe many thousands of miles away from the point of final consumption e.g. in 'the North'. To enable more sustainable patterns of consumption and production will ultimately mean that new forms of international cooperation and partnership will need to be created between governments and companies.

Many developing and newly industrialising countries have a key position in global supply chains and networks. For example, the design and manufacturing decisions for many products consumed in Europe are increasingly being created and made in India, China, Taiwan, Japan and US and not in Europe. Also for sectors like automotive and electronics, there are a large number of design, manufacturing and assembly decisions in various tiers of a complex global supply chain from component level to final manufacture or assembly. In a European context, a considerable proportion of business is assembly rather than manufacturing and in this context environmental and social impacts are often determined through procurement and suppliers. Therefore, there is a need to focus on international

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mechanisms to enable the reduction of the sustainability impacts throughout the lifecycle.

Understanding what works in the North and then adapting it to the particular circumstances of the South is essential – attempts at straight replication will fail.

The role of the transnational in the global society is increasing being questioned. There are 3 billion people who live on less than $2 per day (Millennium Development goal 1: Eradicate extreme poverty and hunger) – what role and responsibility does global business have in developing *sustainable solutions* to solve these problems within the existing capitalist framework that rewards short-term profitability and quarterly returns to shareholders? Strategies to these challenges will require new approaches to production, pricing, distribution and marketing as illustrated by P&G 's PUR water filters project.

1.1 Sustainable Consumption and Production (SCP)

The North has unsustainable patterns of production and consumption. Rich countries are responsible for 41% of total carbon dioxide (CO2) emissions, and the overall consumption of raw materials is four times greater than that of all other countries combined. So, SCP should be viewed as one of the key components of global sustainable development. Several governments maybe taking a lead on SCP but they are not necessarily integrating the thinking into their own systems e.g. there is a need to 'walk the talk'.

The first phase of the SCP discussion was focused on 'cleaner production' and supply-side issues with consumption, demand-side issues receiving less attention. Consequently, the sustainable consumption element of the SCP discussion is still relatively new but emerging especially around issues such as green or sustainable public procurement. In western society there is a perceived right to consume – and altering this has fundamental implications for market capitalism. The Marrakech process appears to be broadening the discussion and is progressing at the international level with the United Nations Environment Programme (UNEP) now setting its SCP priorities: industrial development; waste management including 3Rs (reduce, re-use, recycle); SCP training and capacity building; sustainable trade and resource consumption; and sustainable energy and mobility. At the SCP meeting in Costa Rica in 2005 further progress was made with various countries agreeing to make contributions to the process through leading working groups: Sweden on sustainable lifestyles, advertising and youth; Germany on co-operation with Africa e.g. leap-frogging; UK on sustainable product policies; and Switzerland on sustainable procurement. For example, the proactive involvement of the UK in the SCP debate and particularly the international product debates indicates a shift of emphasis of UK government's thinking – reinforcing the importance of SCP and products as highlighted in the Sustainable Development Strategy (SDS) launched in March 2005.

Integrated Product Policy (IPP) may increasingly be seen to be part of the European SCP discussion. The implementation of IPP approaches or environmental product policy varies considerably throughout Europe and policy instruments used by Member States (MS) seem to lack coherent and coordinated implementation with different tools applied by different ministries in different ways in different countries. In addition, different MS have different policy emphasis with information instruments still predominantly used. A more strategic, coordinated and smarter use of demand and supply-side (product) policy tools still seems to be an imperative if global lifecycle impacts are to be reduced.

At the interface between 'sustainable consumption' and 'sustainable production' seems to be 'sustainable innovation' – a new and emerging topic.

At a macro-level, eco-innovation (as opposed to sustainable innovation) was explored as a theme within the Dutch presidency of the European Union (EU) in 2004. In the 2nd half of the presidency there was an endorsement of the importance of eco-innovations by the European Council. Work completed identified barriers to eco-innovations as: the market e.g. there is an opportunity for sustainable public procurement and public sector prescriptions such as "use hydrogen buses" to drive eco-innovations; a lack of capital e.g. venture capital, the Dutch have developed a Green Fund Scheme to proactively stimulate investment; policy uncertainty e.g. there is perceived to be too much change by business, which creates increased risk for investment – there is a need for environmental policies that are consistent, flexible and future-oriented; and the business climate – information flows need to be better managed and improved networks need to be built e.g. between scientists, entrepreneurs and large companies (Sustainable Innovation Systems (SIS)). One of the key conclusions was that there needs to be a more positive link made in policy development e.g. eco-innovation needs to be seen as an 'zone of opportunity' rather than just seen as better way to deal with environmental problems.

2 Sustainable innovation

2.1 Introduction

Over the past ten years there has been intermittent events and reports that have raised consciousness of environmental issues for short periods of time – but there is little evidence of long-term changes in behaviour. There has been a lack of system change and this has resulted in the development of green market niches rather than significant shifts in the marketplace. System level interventions are needed as well as a focus on incremental change e.g. pollution per car unit has decreased, but worldwide car ownership has grown hugely. There is a lack of strategic engagement with key role players – who move in and out of discussions over time - resulting in ad hoc and minor changes. To stimulate the development of sustainable innovations there needs to be an on-going building of public policy pressure on both the supply and demand-side.

'Sustainability-driven' Innovation means the creation of new market space, products and services or processes driven by social, environmental or sustainability issues

Source: Innovation High Ground Report, Arthur D. Little, 2004

There is a lack of a commonly agreed definition of sustainable innovation. However it can be argued that there are four tiers to sustainable innovation: technologies/products/services; process; organisational; and business. Organisational and business dimensions of sustainable innovation are particularly poorly understood. Experience from leading companies suggests that embedding sustainable innovation into existing processes and systems is essential. The different levels of sustainable innovation need to be recognised and to stimulate each level and type will need different approaches:

- Incremental; re-design; functional; and systems
- Technologies/products/services; processes; organisational; and business.

For example, the higher the level of sustainable innovation aimed for the more complex the challenge and the greater number of stakeholders that need to be involved. For example, to deal with transport pollution and congestion in a new Chinese city there needs to be the design of a sustainable 'mobility sub-system' within the 'city system' with engagement of a wide range of designers e.g. city planners, architects, civil engineers, product designers and others.

2.2 System innovation

There are a range of issues associated with stimulating sustainable innovation at a macro and micro level. As previously mentioned the current paradigm is focused on incremental change or re-design rather than on higher levels of innovation. Public policy makers need to 'think through' how to stimulate change, however there needs to be a better recognition of the characteristics of and opportunities for the creation of Sustainable Innovation Systems (SIS).

At a macro level, Fichter from Borderstep Institute for Innovation and Sustainability in Germany suggests that there are five key aspects related to sustainable innovation: sustainability requirements; innovation determinants; innovation process; actors, networks, interaction; and innovation effects. To enable sustainable innovation, Fitcher suggests that there is a need for: partner cooperation along the value chain; new arrangements; and demand-side changes. Sustainable Innovation Communities (SICs) may take various forms: contact network; virtual community (for idea generation and evaluation); or promoters of specific projects. The focus of SICs maybe on: research; system solutions; market and users; multi-actors; or on production technology and logistics. SICs aim to support the breakthrough of technical, social, environmental innovation (as distinct from R&D communities or networks). Are SICs communities or networks? They can be both and/or either and can exist virtually, physically, independently, between or within

organisations. For both or either, informal and formal relationships are key components and various levels of interaction may exist: material; information; and understanding. To be successful there needs to be the development of a common basic understanding and self- identification with the community or network. It is essential to shape communications processes/personal encounters for actor cooperation and networking (interaction management).

To progress Sustainable Innovation Networks (SINs) within the firm there is a need for a mission statement highlighting the companies' sustainability commitment and without this legitimacy it is hard work. Other challenges that need to be tackled include organisational 'buy in', manpower and resources. For example, to progress sustainable innovation, Interface Europe took the decision to go outside the company and establish an external expert network that works closely with the company to develop a range of new concepts and projects. There is a need to explore actor interactions e.g. to enable networking and cooperation of employees, customers, suppliers and others, and to design processes (interaction management) that create direct and indirect spin-offs.

A new business development approach that may have beneficial sustainability impacts are Product-Service-Systems (PSS) (see www.suspronet.org) – this enables companies to explore the 'bigger picture' or 'whole system' – thus broadening thinking. However, PSSs are not necessarily more sustainable as much depends on the 'system design' of the solution – as impacts are very case dependant. Designing a 'unique system' can also help protect against copying – but if one component does not function then the system may collapse – financially, socially and/or environmentally. PSS has a range of benefits but its real strength is that it helps companies to focus on the final need, demand or function.

The current paradigm of sustainable innovation is focused on environmental aspects and on incremental change and/or re-design rather than on more radical sustainable innovation. The social dimension of sustainable innovation is starting to emerge but is a new area even for leading-edge companies. To enable long-term change orientated towards towards higher levels of sustainable innovation requires system level interventions that are hard-wired into public policy frameworks

2.2 Sustainable entrepreneurs

People are the centre of the innovation and new business.

> *A sustainable enterprise is "a firm that aligns its operations and growth with providing solutions to the world's pressing social and environmental problems"*
>
> Source: World Resources Institute)

Entrepreneurs that recognise opportunities related to the sustainability agenda create sustainable enterprises. Currently, many sustainable entrepreneurs lack sound business plans and clear business models – and need 'hands on' support. There is a need to identify inter-, entre- and intra-

preneurs to foster sustainable innovation and then mechanisms to foster the commercialisation process.

UK, for example, is a nation of "potting shed" inventors ("sheddies") – opportunities need to be recognised and inventors need to more effectively linked to entrepreneurs, funders and others. Concepts should not be lost e.g. the Baygen clockwork radio was funded and developed in South Africa after being invented in the UK by Trevor Baylis – the invention influenced the market with the original technology adapted by Philips and Sony.

2.3 Opportunities for sustainable innovation

It would also be useful to take a broader look at some of the barriers and opportunities to sustainable consumption and production (SCP) to learn lessons for sustainable innovation.

Poor linkages exist between sustainability/environmental experts, investment community, entrepreneurs and inventors – which means that sustainable innovation opportunities are being missed. A lack of sustainable innovation catalysts means that relevant stakeholders are not being brought together. There is a need to create bridges between inventors, investors, entrepreneurs and academia to enable more effective transference of sustainable innovation research and knowledge into the 'real world'. In addition, the commercialisation process needs to be improved e.g. existing 'start up' sustainable technology/product/service inventors/developers often a lack business and marketing skills. There is also a lack of start-up funding for sustainable technologies/products/services. Coupled to this, successful entrepreneurs are not recognising *green* opportunities and the investment community are generally not engaged due to: business concepts/technologies often being seen as too risky; financial returns not being seen as significant enough to justify investment; and a lack of successful entrepreneurs with track-records in the area. However, there are indications that this is changing in the cleantech sector especially in the US.

A key issue is setting the right framework to stimulate sustainable innovation. A smarter use of demand and supply-side government policy tools (e.g. Integrated Product Policy (IPP)) that set stricter penalties for poor performance and more importantly provide positive incentives for good performance may start to create more opportunities for sustainable innovation. For example, 'producer responsibility' laws in Europe and Japan may provide a platform for a series of sustainable (new) business concepts in Business-to-Business (B2B) markets e.g. 'take-back' services, pay-per-use (PPU) models, etc. Also there appears to be demand-side opportunities emerging for sustainable technologies/products/services in Business-to-Government (B2G) markets in a range of countries. For example, the implementation of the Green Purchasing Law in 2001 in Japan has effectively created a green market in certain categories of public procurement which in turn has acted as stimulus to sustainable innovation by companies on the supply-side.

2.4 Innovation clusters

There is a need to develop a more concrete understanding of what is the role of sustainable innovation in the Sustainable Consumption and Production (SCP) debate (demand-side and supply-side). It appears that many sustainable innovations e.g. technologies/products/services come from the supply-side (e.g. 'bottom-up', 'technology-push'), so a key issue is how to create appropriate demand-side signals e.g. sustainable or green public procurement initiatives that stimulate more market-focused sustainable innovation. Lessons need to be learnt from the Japanese approach to stimulating the demand-side through the implementation of Green Purchasing Law and the establishment of the Green Purchasing Network [GPN] was established in 1996 (that has over 2800 members). In addition, there is a need to explore Marketing's potential role in fostering sustainable innovation – as the business function has a pivotal position at the interface of consumption and production issues – however, as yet, they are not generally involved or engaged in the SCP or sustainable innovation debate.

To enable sustainable innovation there should be consideration of how to design and implement Sustainable Innovation Systems (SIS) through the creation of clusters and/or networks of entrepreneurs, inventors, investors, experts and academics. There is a need to spot sustainable innovation opportunities and raise awareness of these amongst proven entrepreneurs and others. Matching appropriate stakeholders to opportunities for new, or new combinations of technologies/products/services coupled to appropriate funding and commercialisation expertise is essential.

Better mechanisms to stimulate sustainable innovation early in the process or cycle needs to be developed: at the creativity stage of product development (company); and early in innovation/technology cycles (government). There is a need for more work on how to create/nurture/develop the process of sustainable innovation: within large and medium-sized companies; between large and medium-sized companies; within entrepreneurial 'start ups'; between entrepreneurial 'start ups'; within governments; and between governments? In addition, the constraints to innovation and sustainable innovation within large companies need to be better understood.

The possible role(s) for academia in the sustainable innovation debate should be better defined. Some issues include: how to involve Business Schools and their alumni (which will include the existing and next generation of entrepreneurs and investors); better linkages and partnerships between academia and business e.g. improving students/researchers understanding of the commercial realities and implementation issues related to sustainable innovation and facilitating better knowledge transfer; and the potential role as pre-commercial catalysts for radical sustainable innovation concepts (functional and 'system innovation'). In addition, there are many research gaps related to sustainable innovation e.g. there is weak understanding of social aspects, organisational dimensions, etc – these 'missing links' in knowledge provide a range of opportunities for researchers!

3 Changing the Business Model

3.1 Introduction

The changing world is forcing business to develop new models to deal with new concerns. To move towards more sustainable patterns of consumption and production will require a transformation of industrial systems and business models. Developing sustainable (new) business models is an emerging area. There are perhaps three levels of discussion:

- Organisation structures: impact of sustainability on changing business models e.g. 'hollow companies' that exist only as brands, with manufacturing and other business functions outsourced
- New approaches: new business models that aim to reduce environmental impacts e.g. Electrolux's washing solution based on paying for the use of the service
- 'Bottom of the pyramid': new products and business concepts based on providing solutions for the poor in the developing world e.g. P&G's PUR clean water solution

3.2 New leaders, new people, new skills are needed

To accelerate sustainable innovation, vision and leadership is essential – but it is not easy! Many companies are keen to be followers and are not prepared to take risks of taking the first step! To get management 'buy in' there is a need to achieve 'quick wins' and to prove pay-back. Developing new sustainable (new) business models also means involving, cooperating and partnering with people – there is a need to develop trust and 'buy in' amongst all parties. There is a need for new forms of partnership and cooperation to develop more sustainable (new) business models – this is starting to emerge in some areas. For example, industry will need to learn new skills e.g. they know how to assemble, but they don't how to dis-assemble!

- The dominance of a system that has to deliver short-term, quarterly results to shareholders amongst publicly owned companies' limits decision-making freedom. To move towards sustainability there may be a need for publicly listed companies to move back to models of private ownership.
- Companies need to start establishing systems to identify and recognise emerging sustainable (new) business opportunities
- Protecting brands and reputation are becoming increasingly important risk issues for companies

3.3 New management

Organisational and business dimensions of sustainable innovation are particularly poorly understood. Experience from leading companies suggests that embedding sustainable innovation into existing processes and systems is essential. Organisations need to create a culture that rewards experimentation e.g. people need 'room and space' to channel creativity in the direction of higher levels of sustainable innovation. A small number of companies have started to incorporate sustainability into the creativity phase of new technology/product/service and business development processes and

there are still relatively few sustainable innovations (technologies/products/services) being developed on an on-going basis. A key issue is to ensure that appropriate organisational and business processes and models are in place to ensure that sustainability is continuously integrated into existing processes! Few companies have understood the contribution that New Product Development (NPD) can have on achieving sustainability objectives

3.4 New markets and Investment

There is an emerging recognition that sustainable innovation is not just about new concepts but is about commercialisation of technologies/products/services and entrepreneurship. There is a need to develop greener markets e.g. that reward technologies/products/services that have superior environmental and social performance. Currently, addressing market failures is a key issue – and governments need to understand how they can intervene earlier in the product lifecycles to reduce environmental and social impacts of technologies, products and services. Right now, the greening of public procurement provides opportunities for sustainable innovation but this maybe limited outside of specific product and service categories. Reduction of the bureaucracy associated with government purchasing is a key issue that needs to be addressed.

The Socially Responsible Investment (SRI) is gaining increasing influence but it represents a small proportion of the overall investment pool. There is a need to realign capital markets to support sustainability. For investors to be interested in products/markets they need to be shown an appropriate balance between risk and reward – many sustainable innovations (technologies/product/services/ businesses) are seen as risky and don't provide enough short-term reward. A framework needs to develop that rewards long-term investment in sustainable innovations.

4 Conclusion

Many of the issues arising on the Sustainable Consumption and Production (SCP) agenda are highly complex and require fundamental changes in the framework. However, sustainable innovation is starting to emerge as a topic for discussion and opportunities are starting to emerge for proactive companies but there needs to more incentives to reward good performance from the market. There is a need to bring together clusters of often disparate stakeholders to create more optimal Sustainable Innovation Systems (SIS).

On the international level, appropriate incentives are needed for micro-entrepreneurs in the South; in developing countries there is a need to focus on core competences, develop partnerships and localising 'value chains'. At the same time, there is a need to create positive stories (aspirational, inspirational) and avoid negative stories (despairational) – this means working with the media.

The right framework (with appropriate incentives) needs to be created to enable the implementation of both 'push' and 'pull' strategies for sustainable innovation: technologies/products/services; process; organisational; and businesses. There is also a need to provide incentives for companies to

integrate sustainability in R&D e.g. tax rebates, as well as, to provide funding for public:private partnerships to complete longer-term strategic research into sustainable innovation (technologies/products/services; processes; organisational; and business).

Governments need to implement a smarter use of policy tools to create markets that reward improved sustainability performance (demand-side) e.g. green or sustainable public procurement and stimulate sustainable innovation (supply-side). There is a fundamental need for governments to implement sustainable development and innovation policies – and then create bridges between the two areas to enable sustainable innovation.

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Chapter 25 Business models for sustainable energy

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1 Introduction

The energy sector is one of the key areas in which current patterns of consumption and production are clearly unsustainable. Excessive use of non-renewable resources, low levels of energy efficiency, and high levels of carbon dioxide emissions are some of the main challenges that need to be addressed to achieve Sustainable Development. One vision of future energy supply is a move towards distributed generation, where electricity and heat would be generated close to the point of use, and most likely with an increasing share of renewable energy. While several policy efforts are underway to facilitate a transition towards a sustainable energy future, there is also a case for investigating this important sector from a Sustainable Consumption and Production (SCP) perspective, i.e. focussing on the processes that influence consumer demand on one side, and factors that characterize successful firm strategies to match that demand on the other side. In an ongoing research project, we are taking an SCP perspective on investigating the factors that can facilitate or hamper the development of distributed energy systems, or micropower, in Switzerland (Wüstenhagen et al. 2006). The present paper focuses on the sustainable production perspective of this broader picture, by looking at business models for sustainable energy.

2 Challenges in commercializing sustainable energy technologies

2.1 Environmental externalities

Sustainable energy technologies, such as e.g. solar cells, solar thermal collectors, micro-cogeneration plants, stirling engines, or heat pumps (Dunn 2000) use renewable or non-renewable fuels to generate electricity and/or heat at a lower environmental impact than conventional energy technologies

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such as large coal power plants or oil heatings. This reduced environmental impact, however, does not necessarily translate into reduced private cost for the consumer, because the environmental externalities of conventional energy systems (such as the damages caused by CO_2 emissions, or the risk of a nuclear accident) are not fully internalized in market prices. Therefore, switching from conventional to green electricity or from fossil fuels to renewable heating means lower cost to society, but not necessarily lower cost for the consumer. The discrepancy between private and public benefit (and cost) is a serious barrier to both consumer and investor decisions for sustainable energy.

At the same time, most products, including sustainable energy technologies, are characterized by a bundle of private and public benefits. Solar thermal collectors provide emission reductions (public benefit), but also warm water and insurance against oil price increases (private benefit). Generating electricity from biogas on a farm reduces dependence on non-renewable resources (public benefit), but also reduce the farmer's electricity bill and his waste stream (private benefit). As a consequence, while it is certainly desirable that policy makers take further steps towards internalizing external cost, there are already some opportunities today for emphasizing either private or public benefits, and this will be further discussed in the section on business models below.

2.2 Capital intensity and long lead times

Developing new energy technologies takes a lot of time and resources. Compared to many other industries, the energy industry is characterized by a high capital intensity and long lead times. Developing a new energy conversion device, such as a microturbine or a fuel cell, will typically require investments in research and development (R&D) of several hundred million Euros. Setting up a factory for manufacturing solar cells requires investments of at least some dozen million Euros. And buying a new heating system for a residential house will typically require the consumer to incur upfront cost of several thousand Euros, and probably twice that amount if he opts for renewable energy. Therefore, successfully marketing new energy technologies is a challenging task, and finding investors for a new venture in this business is equally challenging (Wüstenhagen and Teppo 2006).

2.3 The power of incumbents

Another consequence of the capital intense nature of the energy business is that huge amounts of capital have been invested in existing infrastructure, and hence the companies that own these assets have a very strong position on the market and tend to be reluctant to do anything that would cannibalize their existing business. This poses serious challenges to new players who want to enter that market, e.g. in order to introduce a new sustainable heating system.

3 Business models

3.1 Business models as a unit of analysis in management research

Over the last years, the business model concept has become increasingly popular in management theory and practice (Magretta 2002, Osterwalder et

al 2005, Shafer et al 2005). In general, a business model can be defined as a description of a planned or an existing business and its specific characteristics with respect to value creation on the one hand and market-orientation on the other hand (Hedman/Kalling 2003, Osterwalder et al 2005, Stähler 2001). The business model concept combines elements of the resourced-based and the market-based view of the firm and thus takes an integrated point of view (Kalling 2004, Morris et al 2005).

Initially, research on business models emerged in the field of e-commerce (Mahadevan 2000, Morris et al 2005, Afuah/Tucci 2001, Alt/Zimmermann 2001, Tapscott et al 2000, Timmers 1998). More recently, the business model has been discussed in a broader set of management-related publications (eg. Chesbrough/Rosenbloom 2002, Rentmeister/Klein 2003, Shafer et al 2005). E-commerce activities seem no longer to be a prerequisite for applying business model analysis to explain value creation (Magretta 2002, Sillin 2004). Even more than academic research, management practice has emphasized the importance of business models (Morris et al 2005). Although a considerable number of publications have tried to explain the business model concept, no generally accepted definition has evolved so far (Osterwalder et al 2005, Porter 2001, Shafer et al 2005). Most practitioners are not able to explain the concept either (Linder/Cantrell 2000). Researchers seem to agree that a business model describes how a business creates value and that it is an important new unit of analysis, highly relevant to both management theory and practice (Belz/Bieger 2004, Chesbrough/Rosenbloom 2002, Morris et al 2005, Rentmeister/Klein 2003). Business model analysis can help to understand and communicate the key success factors of value creation. Furthermore, it can be used to measure, compare or even change the business logic (Morris et al 2005, Osterwalder et al 2005, Shafer et al 2005).

3.2 Key elements of a business model

Timmers (1998) was among the first to put forward a prominent formal definition of a business model, viewing it as a description of the architecture of value generation (across firm boundaries), of the potential value generated for partners and final consumers, of the sources of revenue and of the marketing strategy. Another early definition was given by Hamel (2000) who proposes four business model components: core strategy (including the product or service), strategic resources (ie competences, assets and processes and their configuration), customer interface (by which benefits are delivered) and value network. In this paper, we will follow a definition of the business model as proposed by Stähler (2001), who defines a business model as a description of a planned or existing business including three key elements, namely:

1. Value proposition
2. Configuration of value creation
3. Revenue model

The value proposition describes how the products and services offered by the business create value for the customer and other stakeholders. Regarding the configuration of value creation, the most important question is which steps of the value chain are to be performed by the business. The core processes must be defined, as well as the targeted customer groups of the

business,. Ideally, a business develops core competences by which it can be distinguished from its competitors. Also included in the analysis of the configuration are aspects like cross-selling effects, complementary products and the design of value-step-transcending processes. Finally, the revenue model describes how the business generates its sales revenue (eg by selling the actual products or by selling leasing contracts) and ultimately profits.

3.3 Relevance of business models in the context of sustainable energy

Why is it relevant to look at business models when doing research on commercialization of sustainable energy technologies? By appropriately designing the three elements of a business model described above, a firm can tune its offerings to meet the three challenges of sustainable energy technologies as discussed in chapter 2, and therefore achieve higher market penetration of these technologies as well as commercial success on the firm level.

When it comes to the **value proposition**, as indicated in chapter 2.1, sustainable energy technologies are typically characterized by a strong component of public benefit. This has led to a common misconception that it might be impossible to successfully market these technologies, and that the only way to solve the issue is by means of public policy. Public policy can certainly help, but by carefully focussing on an important customer problem that the product can solve, i.e. by highlighting the private benefit on top of the obvious public benefit, a sustainable energy venture will be able to attract a broader set of customers "beyond the eco-niche" (Villiger et al. 2000).

A properly designed **configuration of value creation** can help to address the second and third barriers described in chapter 2, namely capital intensity and the power of incumbents. In a globalized economy, firms now have the possibility to outsource large parts of the value chain and focus on just those components that are key for their competitive advantage. By doing so, they can reduce capital intensity, as compared for example to the "old economy" model of doing everything inhouse from R&D to manufacturing to distribution. Similarly, configuring value creation in a way that minimizes heads-on competition with incumbents can be a smart way for entrepreneurial firms to address the market power issues that are omnipresent in the energy sector. Cooperating with existing heating manufacturers in distribution may be a wise decision for a capital-constrained start-up developing a new cogeneration system, rather than getting distracted from tackling ramp-up of a new distribution system while at the same time dealing with technology development challenges.

Finally, new innovative **revenue models** have been at the core of success for business model innovators in traditional industries such as EasyJet, and they can be equally important for sustainable energy ventures. Given the capital intensity of sustainable energy technologies discussed above, reducing the upfront cost for consumers is one of the key concerns in marketing innovation in this sector. Leasing or contracting can be successful solutions to this problem. Also, many sustainable energy technology firms tend to be focussed on selling hardware, while other industries have demonstrated that after-sales services are often much more relevant for long-term profitability. Finally, as many governments have set up incentive

schemes for renewable energy, intelligent management of available subsidies may also be seen as an important element of revenue models for sustainable energy.

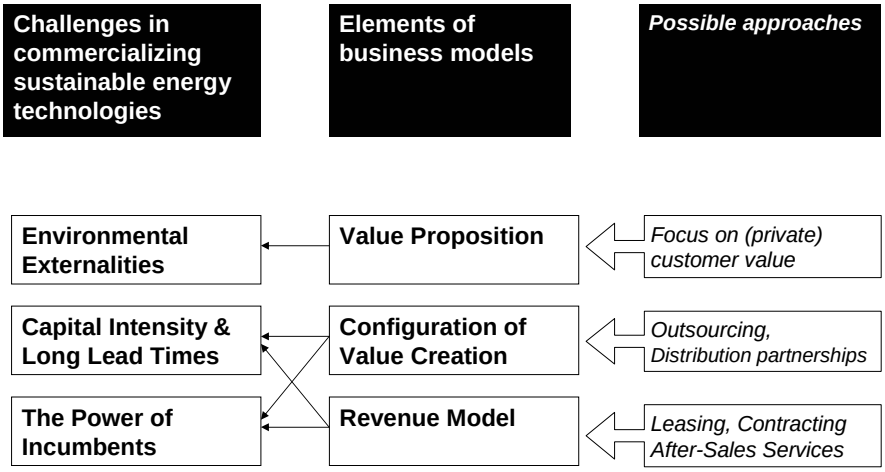

Figure 1: How business model configuration addresses challenges in commercializing sustainable energy technologies

4 Conclusions

Appropriately designed business models are an important opportunity to overcome some of the key barriers to market diffusion of sustainable energy technologies. Consequently focussing the value proposition on the aspects that create the highest (private) customer value, rather than primarily highlighting the public benefits of sustainable energy, is a means to address the challenges posed by environmental externalities. Configuring the value creation in a way that provides for efficient use of own capital, and making use of outsourcing opportunities, can mitigate the implications of the capital-intensive nature of the energy industry. By entering into distribution partnerships with established players, sustainable energy ventures can address both capital intensity (of building up distribution networks) and the power of incumbents. Innovative revenue models such as leasing or contracting, but also the targeted use of available subsidies, should be pursued to reduce the upfront capital cost for customers. If incumbent players, such as installers, are provided with opportunities for offering after-sales services, their resistance to innovation is likely to be reduced.

To summarize, this paper has demonstrated the importance of new business models for enhancing sustainable production and consumption in the energy sector, particularly with regard to successful commercialization of distributed energy systems.

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Chapter 26 Sustainable Innovation and the Porter Hypothesis

How to Innovate for Energy-Efficient Consumption and Production?

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1 Introduction

In 1991, the American economist Michael E. Porter proposed that stringent environmental regulation (under the condition that it is efficient) can lead to win-win situations, in which social welfare as well as the private net benefits of firms operating under such regulation can be increased (Porter, 1991). It is obvious that production and potentially also consumption (in case improvements are product-related) becomes more sustainable as a result of this. Innovations play a pivotal role in this, since they are the mechanism which allows offsetting additional compliance from tightening environmental regulation. However, opponents of the Porter hypothesis criticize the hidden assumption that firms systematically overlook opportunities for (voluntarily) improving environmental quality that also increases their competitiveness or other private benefits. This debate is important for sustainable consumption and production (SCP) since it clarifies limits to a business case for SCP. Relevant is also the differentiation between product and process innovations, and that of radical versus incremental innovation.

An aspect of the Porter hypothesis which is frequently criticized is the assumption that existing regulatory regimes are able to design stringent and at the same time efficient environmental regulation and this critique indeed seems to have some merit. This is relevant for sustainable consumption and production because frequently it is attempted to achieve this objective using (e.g. environmental) regulation. This is very closely linked to aspects of market structure and therefore this paper analyses the Porter hypothesis with regard to two aspects.

Firstly, it will analyse the role of innovation and market structure based on theoretical reasoning behind the hypothesis by discussing and analyzing the arguments brought forward in favour of and against the hypothesis based on different theoretical analyses and models proposed in the field. This will be supported by a short review of empirical studies testing the Porter hypothesis. The analysis of empirical work will allow to assess whether

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theoretical conclusions about the Porter hypothesis are confirmed by empirical research. This first part provides insights about the conditions under which the hypothesis holds and thus in itself gives important information for future policy making on sustainable consumption and production.

Secondly, the paper will expand on its first part by applying Porter's ideas to one specific aspect of environmental quality, namely energy efficiency. This is relevant for both, the consumption and production aspects of SCP. The second part reveals opportunities for firms with regard to new (and more sustainable) business models and additional potential for innovation. These will be discussed as will be the interaction of innovation and market structure aspects in the Porter hypothesis with regard to their relevance for innovation as well as sustainable consumption and production.

2 A review of empirical and theoretical literature

2.1 Stylized facts and evidence

One important focus of research on the Porter hypothesis should be to specify more precisely conditions under which it is most likely to hold. Particular this can be based on the different features and aspects that have emerged from the theoretical and empirical work on the Porter hypothesis. These mainly concerned the measurement of stringency of and approach to environmental regulation, the level on which the Porter hypothesis is analysed, and the role of innovation.

A comparative analysis of the Porter hypothesis between different theoretical models, different empirical studies, theoretical and empirical work and between different interpretations and levels of analysis of the Porter hypothesis revealed in this respect that:

1. there are factors related to capital structure that make the trade-offs implied by critics of the Porter hypothesis less strong and thus the hypothesis more likely to hold (Xepapadeas and de Zeeuw, 1999) but that these may also have reversed effects, especially if learning is taken into account (Feichtinger et al., 2005);
2. asymmetric reward structures for agents can provide incentives for them not investing into R&D despite tightening environmental regulation (Campbell, 2003);
3. a favourable demand side can make the Porter hypothesis more likely, as can firm-internal organisational features or organisational inertia (Reinhard, 1999; Lankoski, 2000; Conrad, 2005);
4. specific (more flexible) types of instruments for environmental regulation (in particular tradable permit systems) bring about more favourable conditions and thus make it more likely for the Porter hypothesis to hold (Alpay, 2001);
5. conditions for the Porter hypothesis to hold seem to be depending on the environmental aspects concerned, i.e. the hypothesis is more likely to hold (more strongly) for some resources, pollutants or environmental quality aspects than for others and trade liberalisation can work both, in favour or against the hypothesis (Campell, 2003).

Concerning empirical work, the consensus that seems to emerge in the literature is that the negative macroeconomic impact of environmental regulation is likely small, but still existing (Popp, 2005), as is its effect on employment in both directions, increasing or decreasing employment (see also Rennings et al., 2001; Morgenstern et al., 2002) and that environmental regulation empirically seems to have led to only very small increases of the rate of inflation and seems unlikely to be a prime cause for negative economic effects. The effects of reduced compliance costs on employment, GDP growth rates and productivity have been shown to be only small empirically and thus environmental regulation is agreeable with economic growth. Nevertheless trade-offs resulting from higher spending caused by more stringent environmental regulation substituting spending leading to an increase in measured GDP, since simultaneous spending on both is impossible. In conclusion empirical research to date makes it likely that although Porter's hypothesis may hold in individual industrial sectors or in more narrow interpretations in specific countries under certain regulatory conditions, it is unlikely to hold (empirically as well as theoretically) in its most general form across all levels of analysis and forms of interpretation of the hypothesis.

2.2 The role of innovation

Porter and van der Linde (1995) note the particular role of innovations as a mechanism for putting the Porter hypothesis to work. This is because the concept of innovation offsets (i.e. private benefits to firms from innovatory activity triggered by stringent, yet efficient, environmental regulation) is central to the Porter hypothesis. Opponents to this view argue that the existence of profitable or at least cost-effective opportunities at the firm, industry or national level to reduce environmental pollution as proposed in the Porter hypothesis are not likely in most industries. In the best case it pays for firms in such industries to pursue emission reductions until they meet their industry's regulatory standards. Over-compliance in these industries is unlikely, since it would only be rational for firms if it can be achieved through cost-effective pollution abatement, which per definition is not possible and therefore regulation beyond the emission level corresponding to the private optimum would increase production costs and in turn reduce profitability and competitiveness (Romstad, 1998).

One important assumption of this last view is however, that firms pursue maximisation and not satisficing (Simon, 1945). In case of the latter, firms may not have explored specific areas of technology or innovation and may be triggered by tightening or introduction of stringent regulation to do so. This seems to however be an interacting process of innovation activities aimed at achieving compliance with novel regulation crowding out discretionary innovation aimed at new product development whilst at the same time compliance-oriented orientation leading to discovery of new areas of product development, to search processes in different fields of technology and to acquisition of additional knowledge and capabilities by the firm (see e.g. Roediger-Schluga, 2003). Given their pivotal role in the Porter hypothesis, future research on the specific mechanisms of how environmental regulation influences innovation seems to have some merit. This could concern the relative influence of innovation drivers such as private investment or government expenditure in R&D, spending for improvement of edu-

cation systems, regulation or price changes and whether innovation policy should focus on for example on correcting for negative externalities, or on eliminating subsidies.

Another aspect may be that environmental regulation in general should be providing incentives for innovation. These characteristics mainly apply to environmental taxes and tradable emission permit systems which should thus be applied more often in practice if it is wished to create conditions favourable to the Porter hypothesis (Endres (1994), Hemmelskamp (1997), see however Montero (2002) for a more detailed analysis of innovation incentives provided by different types of instruments). As is well-known from innovation theory and regulation theory in general, innovation should also not be focused on specific technologies and take into account equally the rate and the direction of innovation. As well, regulation should be close to the end-user of a technology and also consider voluntary agreements as well as standards and labels for environmentally more benign products (see for discussions of specific aspects mentioned here e.g. Hemmelskamp, 1999; Jaffe et al., 2002; Teisl et al., 2002; Rennings et al., 2003).

Despite the limitations of the Porter Hypothesis[63], it provides additional arguments for preferring incentive-based regulations over command-and-control type regulation, since the former likely reduce abatement costs. Incentive based regulation, in particular tradable emission permit systems maintain incentives for firms in an industry to reduce emissions through innovation, provides cost effective allocation and abatement solutions and are therefore likely to limit reductions in the profitability of firms. Economic efficiency of regulations is pivotal here because low cost regulatory approaches are most likely to reduce trade leakages which have adverse effects on overall social welfare and can reduce barriers to international cooperation on trans-boundary pollution (Romstad, 1998). By doing so, regulation can indirectly produce competitive advantages (or at least reduce competitive disadvantages) for firms competing internationally, since it reduces part of the regulatory costs whilst at the same time having the potential to trigger innovation offsets that are at least equal to their environmental costs.

3 The influence of market structure

An analysis of the influence of the Porter hypothesis on sustainability innovation has to take into account the theory and empirical findings of the field of industrial economics and organizations and here in particular the market structure. Market structure is basically defined through the demand side and the industry structure (i.e. the supply side) of an industry. Analysing the overall empirical relationship between market structure and profitability attempts to identify significant empirical links between the structural constraints within which firms operate and the profitability performance they are able to generate. The main insights emerging from several theories of oligopolistic behaviour for the relationship between industrial structure and profitability can be broadly classified into four types of models (Hay and Morris, 1991). The first one focuses on internal competition in markets with homogenous products and non-collusive outcomes (i.e. a Nash-Cournot

[63] For Europe, there has been relatively little research on the Porter hypothesis (for exceptions, see e.g. Albrecht, 1998; Hitchens, 1999; Rennings et al., 2001, 2003).

equilibrium). This model leads to the hypothesis that in an unconcentrated industry (i.e. an industry where firms have small market shares) profitability will be rather low, whereas non-collusive profits will be higher in a concentrated industry where firms have larger market shares. This theoretically derived relationship between market structure and profitability is a first insight for an empirical relation between the degree of industry concentration and the level of profits. The second type of model is based on the first one, but considers collusive outcomes. The occurance of collusion and the extent to what it can be sustained depends to a large extent on the number of firms in an industry. In industries with a high degree of concentration, interdependence is more easily recognisable and co-operation easier to facilitate and therefore, firms in such industries are more likely to collude, resulting in higher profits. Although those profits are higher than non-collusive profits and are determined by different forces, in both models a higher degree of concentration resuslts in higher profitability. Generally in these first two models an effect of concentration on firm's innovatory activity exists, but is unspecified (Needham, 1975).

The third type of model considered here is focussing on potential competition from outside the industry as monopoly power can only to some extent generate barriers to entry and protect an industry from new entrants. Profitability under outside competition ultimately depends on the industry and firm cost structure, especially the nature and extent of sunk costs as well as absolute cost advantages of incumbent firms. Finally, the forth type of model focuses on product differentiation which can lead to higher profitability either through brand loyalty and advertising or can assist in erecting barriers to entry that allow to capture surplus profits. As before, concentration and the effect of demand elasticities have an effect on innovation, but its direction is not *a priori* determined (Needham, 1975).

All four models of course need to be integrated but a separate consideration allows classification of market structures along the three dimensions concentration, product differentiation and scale (in relation to industry). In this framework, perfect competition can be characterised by small relevance of scale, a low degree of concentration and a low level of product differentiation. Monopolistic competition would be described by low concentration, small relevance of scale, but high level of product differentiation. A homogenous oligopolistic industry is defined by high relevance of scale, a high degree of industry concentration and low level of product differentiation. Finally, a differentiated oligopoly can be characterised by a high relevance of scale, a high degree of concentration and a high level of product differentiation. Table 1 summarise these considerations.

Table 1: Overview of market structure aspects

Market structure	**Concentration**	**Scale**	**Product differentiation**
(Almost) Perfect competition	Low	Low	Low
Monopolistic competition	Low	Low	High
Homogenous oligopoly	High	High	Low
Differentiated oligopoly	High	High	High

Graphically, the relation between the market structure, strategy, innovation and the outcomes profitability, effectiveness and efficiency as the fundamental concept in the structure-conduct-performance paradigm (e.g. Moschandreas, 1994) can be represented as in the following Figure 1. As a specific example, also the effect of product differentitaion via loyalty is indicated, because it has a prominent role in the Porter Hypothesis (see section 2.1). As concerns market structure, levels of concentration, scale (economies) and product differentiation can differ as described for the four structure types in Table 1.

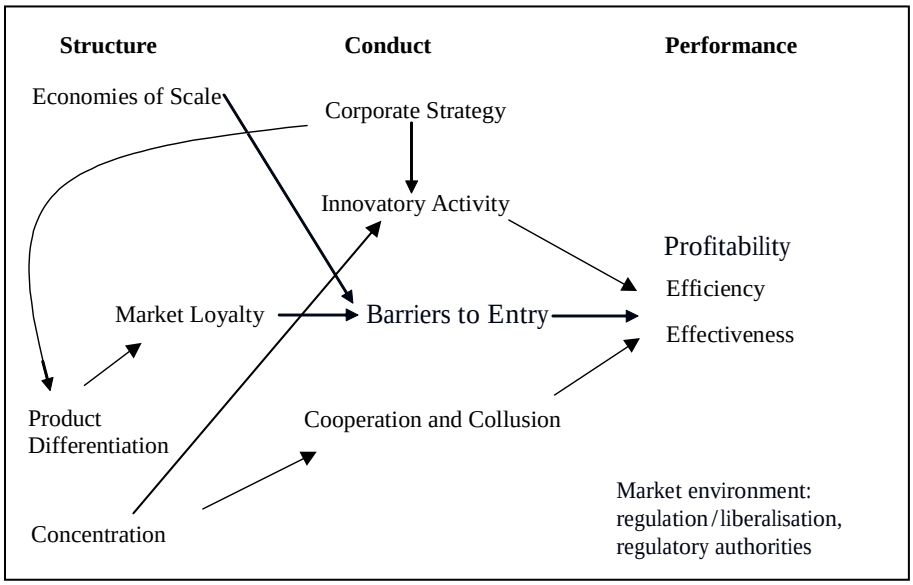

Figure 1: Relationship between market structure and innovation

In order to assess the supply side of the market structure it is necessary to define a market. Once this has been achieved, an industry can then be defined as consisting of all firms that operate in that market. Markets can be defined here based on physical product features, buyer characteristics or producer characteristics (Moschandreas, 1994). The supply side is one important aspect of the market structure that influences the level of innovation, with the demand side being the other important element of it.

The intensity of competition in an industry is an important element of the supply side. The level of competition is usually measured by the degree of seller concentration in an industry, i.e. the number and size distribution of the selling firms in an industry (Moschandreas, 1994). Another measure to assess the intensity of competition between producers is the cross-price elasticity of supply (Alanen, 1998)[64]. The more elastic supply between competing products in an industry, or, equivalently, the higher the level of concentration in an industry, the more difficulty firms experience to pass environmental costs on to consumers.

In the extreme of a monopoly it is possible to pass on all environmental costs to customers (as has been the case for a long time in electricity

[64] The cross-price elasticity of supply measures the percentage change in the quantity supplied of one product in response to a percentage change of one unit in the price of a competing poduct, all other things being equal.

generation). In the case of a perfectly competitive industry, producers have difficulty to pass on environmental costs, since they are price takers. The 5-firm concentration ratio for the UK electricity generation industry in 1996 was estimated to be 74.9 per cent[65], implying a considerably lower degree of concentration compared to Germany where in 2004 the concentration ratio was ca. 80 per cent. However, compared to the situation prior to privatisation and reregulation of the electricity generation and supply industries from 1989 onwards, the level of concentration is now lower. This is a good example how different implementation approaches have resulted in very different evolution of the market structure, here especially the supply side. Whereas in the UK the market was largely deregulated whilst at the same time establishing with the Office Office of Electricity Regulation (OFFER) a very powerful central regulator, in Germany the concentration process on the supply side has in many ways even increased the oligopolistic market structures that existed before. Opposed to this in the UK, the deregulation of the electricity distribution market was finalised with the introduction of full competition for the household retail market.

Next to the supply side, the demand side is another core element of market structure. In the following the relevance for sustainability innovation of both, the demand as well as the supply side is discussed, taking (product- and process-related) energy efficiency in industry, households and commerce as an example. I analyse and discuss for this special aspect of environmental quality how the mechanisms underlying the Porter Hypothesis may bring about innovation that in turn enables sustainable production and consumption. To do so I first review the extant literature discussing economic aspects of energy efficiency and here in particular the question of market failure. Following this, I link this to the Porter Hypothesis and discuss how how changes in regulation and market structure jointly determine innovatory activity that increases energy efficiency.

4 Energy efficiency of households, industry and commerce: the 'energy efficiency gap' debate

4.1 The issue of market barriers to energy efficiency

The re-regulation and liberalisation processes in the European electricity markets had considerable implications for energy efficiency activities, especially demand side measures and other energy services. Amongst researchers and policy makers in the energy field it is controversially discussed to what extent there is an energy efficiency 'gap', i.e. if there is a divergence between the socially optimal levels of investment in energy efficiency and the levels currently observed in practice.[66] According to Huntington et al. (1994), some of the several issues that have to be addressed to proceed towards a solution of this controversy are (see sections 4.2 and 4.3),

a) the general relationship between energy efficiency and economic efficiency,

[65] Own estimation, based on the net generation capacity and data published by the UK Electricity Association.

[66] See for example Huntington et al. (1994), Sutherland (1996) or Levine et al. (1994).

b) the identification and measurement of technical inefficiency in energy use and how it can be distinguished from neutral or even energy saving inefficiency,
c) the degree of market inefficiency and possibly market failure in energy markets in regard to energy efficiency and the nature, extent and severity of 'market barriers',
d) the influence of discount rates and hidden costs for energy efficiency investments,
e) inefficient behaviour and bounded rationality in consumer energy decision making as well as the role of information asymmetries and transaction costs and,
f) if and to what extent there are shortcomings of the market mechanism in achieving an optimal diffusion of energy efficient technology.[67]

The issue of an 'energy efficiency gap' is important for policy makers. If energy markets express market failure as far as demand-side energy efficiency is concerned then there would be a need for government intervention.[68] What policies, if any, should be applied to promote energy efficiency, demand side measures and energy services of course depends on the severity of such market imperfections, on technical potentials and on political preferences. As energy-related emissions account for a large part of the global greenhouse gas emissions, the level of energy efficiency, demand side measures and energy services will impact on global climate change. Policy makers therefore have to decide what role policies aiming for demand-side energy efficiency should play in society's response to such change. Several advocates who are in favour of the energy efficiency gap hypothesis however agree that neither he economists' (the operative criterion for most energy policy should be that of economic efficiency) nor the technologists' (a range of cost-effective energy efficiency investments are inhibited by market barriers) concept of the economic potential for energy efficiency correctly represents society's best outcome (Huntington et al., 1994). In the following, some of the previously mentioned aspects surrounding the efficiency gap debate shall be examined in greater detail.

4.2 Arguments for and against the 'energy efficiency gap' hypothesis

4.2.1 The basic points of view

According to Sutherland (1996), proponents of the energy efficiency gap hypothesis have first used engineering economic analyses where the present value of saved energy was estimated to exceed the initial capital investment to support energy conservation programmes and then (as a response to challenges to their position by traditional economics based on economic efficiency) have developed a justification for such projects based on conventional economic analysis of market failures, asserting that energy conservation programmes enhance economic efficiency by reducing market failures. They claim that the level of energy efficiency investments undertaken in uncorrected markets is short of the truly cost effective level

[67] The last two points in this list are likely the ones most relevant for the Porter hypothesis.
[68] Only if this is the case would government intervention by means of regulation be justified and the mechanisms proposed in the Porter hypothesis may also be enabled better.

and that energy efficiency investments that are estimated to be cost-effective should be encouraged by government policy (e.g. energy efficiency labelling requirements or mandated energy efficiency standards) and utility activities (e.g. demand side management (DSM) programmes) to close the energy efficiency gap. Such policy intervention may trigger (as proposed in the Porter Hypothesis) innovations in energy technologies and services that simultaneously increase social and private benefits. These could also be organisational innovations such as restructuring or unbundling of large vertically integrated energy suppliers into smaller or independent units.

Opponents to the energy efficiency gap hypothesis argue that electric and gas utility sponsored subsidy programmes to reduce energy consumption may exacerbate inefficiency by increasing market or regulatory failures and argue that the development of competitive markets for gas and electricity – not utility energy conservation programmes based on subsidies and rebates – will result in the most efficient use of energy resources (Sutherland, 1996). They state that retail markets for gas and electricity are characterised by imperfections and question the future of utility sponsored energy conservation programmes in a more competitive market predicting that, when regulatory distortions that had initially motivated utility conservation programmes will be eliminated, than the rationale for utility programmes would also disappear (Sutherland, 1996).

However, proponents of the energy efficiency gap hypothesis state that there are several common grounds in the controversy (Huntington et al., 1994). They point out that obstacles to investment that would otherwise be cost-effective (i.e. market barriers) are widespread and exist in all markets, including energy. Some of these market barriers (which may or may not be market failures) cause resources to be misallocated and justify government intervention, other barriers do not. Information problems taking different forms are identified as the principal source of market barriers and / or market failures that account for the postulated gap in energy efficiency investments.

4.2.2 The general relationship between energy efficiency and economic efficiency

Although energy efficiency is at the forefront of the debate on sustainability issues, according to Patterson (1996) it is surrounded by a number of critical methodological problems. According to Sutherland (1996), conservationists claim that if an energy efficiency investment is cost-effective, it necessarily contributes to economic efficiency. He criticises this point of view and states that there is a conceptual difference between economic and energy efficiency and gives the example of implementation of time of use rates. This is a DSM measure and may contribute to economic efficiency by matching retail prices and marginal costs, but there is the possibility that energy use increases. Similarly, in cases of fuel substitution leading to reduced energy costs, energy consumption might increase or decrease, thus indicating, that improvements in economic efficiency can have ambiguous effects on energy efficiency. Generally, the figures brought forward by proponents of the energy efficiency gap hypothesis are based on engineering economic analyses that estimate the net benefits from energy efficiency improvements as the difference between the net present value of energy saved and the initial investment costs whereas the appropriate measure of benefits from the point of economic efficiency would be

consumer surplus or net willingness to pay as used in traditional economic analysis (Sutherland, 1996). Therefore it is claimed that if performance or appliance standards, as well as utility DSM programmes are to pass the test of economic efficiency, they have to equate the marginal costs and benefits of reducing the level of energy intensity.

On a middle ground, it is argued that although a perfectly competitive equilibrium attains Pareto efficiency, idealised conditions required for efficient outcomes are rarely fully satisfied and under such circumstances competitive resource allocation will not yield efficient outcomes (Sanstad and Howarth, 1994). Huntington (1994) states that most researchers agree that inefficiency is widespread, but also points to the necessity to identify the causes of such inefficiency before policy implications are formulated and the appropriate policies can be designed to treat the root causes of inefficiency. He stresses the need for empirical tests for the extent of technological and allocative inefficiencies.

4.2.3 Identification and measurement of technical inefficiency in energy use

The aim of empirical tests of technological inefficiency should be to identify if and to what extent specific market failures do actually influence energy-efficiency decisions. Researchers have found some degree of technical inefficiency in various industries, but according to Huntington (1994) there is no agreement on how much inefficiency really is too much. He therefore formulates three steps to identify technical inefficiency. As a first step it has to be clarified if significant departures from best practice technology (i.e. technical inefficiency) can be identified and measured meaningfully. Secondly, it needs to be addressed if energy-using inefficiency that is more wasteful of energy than of other inputs can be distinguished from neutral or even energy saving inefficiency. Finally as a third step the question needs to be answered if ex ante tests of inefficient behaviour can be developed prior to observation rather than relying solely upon ex post explanations of apparent anomalies already observed. Huntington (1994) thus points out that in order to decide these issues, it is important to identify the best practice frontier, although a firm that operates with the best practice technology can still be economically inefficient if not simultaneously its allocative efficiency is ensured.

4.2.4 The degree of market inefficiency and possible market failure in energy markets

To answer the questions surrounding the energy efficiency gap hypothesis, the general relationship between energy efficiency and economic efficiency and the identification and measurement of technical inefficiency in energy use is a necessary precondition to decide upon the degree of market inefficiency and possible market failure in energy markets.

Opponents to the concept of market barriers claim that such barriers (e.g. uncertainty in future fuel prices, limited access to capital or low energy prices) are typically not market failures and are therefore not producing economically inefficient market outcomes (Sutherland, 1996). Consequently, regulatory policies that attempt to encourage energy efficiency investments can rarely be based on failure of private markets to make efficient decisions. Even if market failures are identified, the benefits of the government

intervention should exceed the costs and intervention therefore has to achieve both, reducing a market failure and passing a benefit-cost test (Sutherland, 1996).

The response of conservationists to this criticism is that although the concept of market barriers has rarely been developed in terms of well established economic concepts or using standard economic techniques, analyses that are sceptical to the idea of 'market barriers' tend to be based on the simple proposition that 'normal' markets are efficient and that the intuitions expressed by the market barries concept may be closer to the theoretical mainstream than sceptical views (Sanstad and Howarth, 1994). Levine et al. (1994) for example assert that market imperfections (i.e. market barriers) preclude private decisions from attaining a level of energy efficiency consistent with economic efficiency. In a step further, it is claimed that the view that competitive markets produce optimal outcomes follows from libertarian political theory and that hence the most conservative 'economic' case can be seen as primarily political in origin (Sanstad and Howarth, 1994).

Huntington (1994) takes a middle ground in this respect, making the point that minor modifications in market institutions might be preferable to widespread end-use (performance or appliance) standards or utility demand-side management programmes using rebates or subsidies. He further remarks that the conservationists' faith in widespread government intervention in the markets for energy and energy-efficient equipment may be unjustified as government failure can create economic distortion just as market failures do. These considerations are of particular relevance for the role of the Porter Hypothesis, since they indicate that demand and supply side measures to increase energy efficiency are actually substitutes.

To understand and assess better the nature, extent and severity of 'market barriers' the main arguments with regard to discount rate divergences and hidden costs, bounded rationality and investment theory issues, and information economics and transaction costs previously identified as the main source of possible market barriers shall be examined in more detail in the following two chapters.

4.3 Economic approaches to explain the 'energy efficiency gap' hypothesis

4.3.1 Discount rate effects and hidden costs of efficiency investments

The discount rate issue and the question of omitted (but real) costs are important aspects of the debate over the energy efficiency gap especially in relation to the question of informational imperfections. According to Huntington et al. (1994), cautious advocates of energy conservation activities think that information problems are restricted to specific situations and argue that analyses indicating large energy efficiency potential are too dependent upon unjustifiably low discount rates and the omission of important hidden costs.[69]

Firstly, it is argued that omitted but real costs prevent consumers from investing in energy efficiency, a criticism often raised against the empirical

[69] More pronounced advocates of the existence of an 'energy efficiency gap' who perceive information as a systemic problem found in 'normal' markets see high inferred discount rates as direct evidence of improperly working markets.

studies of technologies. According to Sanstad and Howarth (1994), hidden costs refer to the indivisible private costs associated with energy-efficiency improvements such as the hassle associated with implementing such improvements. Hidden costs are a subset of the total costs arising in undertaking efficiency improvements. Koomey and Sanstad (1994) have developed a framework for cost analysis that minimises this problem and have applied it to a series of such empirical examples. They were able to show, that some anomalies cannot be explained away by hidden costs as technologies only differ in their energy efficiency and hence conclude that their examples provide evidence of market failures attending energy-efficiency investments.

Nichols (1994) attempts to explain the efficiency gap from a 'willingness to pay' analysis of actual decisions made under a rebate programme and finds that omitted costs are highly sensitive to the participants' discount rate used for evaluating future energy savings.[70] He demonstrates by this, that the efficiency gap is highly sensitive to discount rate assumptions.

Secondly, it is argued that there exists a divergence between the social and the private discount rate with the private discount rate being higher than the social.[71] It is further argued, that in some cases this divergence between private and social discount rates signals market imperfections. According to Scheraga (1994), although considerable work has been done to estimate private discount rates from market data, economists are less able to explain the underlying consumer preferences that are manifested in the market behaviour characterised by these rates.[72] If the private discount rate diverges from the social discount rate, then the key question is why it does so. It is not clear that such a divergence is due to market imperfections (such as inefficient energy services or inefficient markets for information) as other explanations exist (e.g. that consumer behaviour may be constrained by institutional barriers or regulatory structures). He concludes that (as all of the attributes affecting an individual's consumption decisions contribute to economic welfare) it is critical that a better understanding is gained of the determinants of consumer behaviour because only then it can be said whether or not there are market imperfections (Scheraga, 1994). This points to the relevance of possible bounded rationality of consumers when making decisions about energy use.

4.3.2 Inefficient behaviour and bounded rationality of consumers in energy decision making

According to Sanstad and Howarth (1994), traditional economic theory assumes fully rational agents (i.e. utility maximising consumers and profit maximising firms) to solve the highly complex problems of optimisation associated with the least cost provision of energy services. In contrast to this notion, they argue that consumers often face incomplete information about their energy decisions and also lack knowledge in applying and processing

[70] For example, at a discount rate of 5.5%, omitted cost would have to be 117% of the initial cost to fully account for the efficiency gap, whereas these additional costs need to be only 15% at a discount rate of 20%.

[71] The concept of the private discount rate is simply a way of characterising the behaviour of consumers.

[72] A paradox often quoted to illustrate this is why consumers are willing to borrow at high interest rates when using their credit cards and at the same time are willing to lend to banks at low interest rates by keeping positive balances in their savings accounts.

the available information resulting in systematic deviations from rational, cost minimising behaviour. They further explain that, even if consumers have technically correct information through appliance labelling or performance standards, they do not necessarily process such information rationally what points to the relations between economic models of behaviour and the models of other social sciences (e.g. psychology or sociology) thus raising the question if economic models are generally insufficient for explaining and predicting consumer energy decision making and generally behaviour related to energy. However another notion of the issue of bounded rationality is that this is an imperfection of markets that are considered to function normally otherwise and this does not necessary constitute a market failure.

For example, Thaler (1994) finds that in laboratory experiments participants require higher prices to relinquish goods they own than the costs of obtaining new ones what is explained by theorists as an endowments effect produced by an aversion to loss. As well he finds a strong preference for the status quo which has been sought to explain by an experience factor that emphasises the need for a more dynamic approach to consumer choice theory. Thaler also finds that actors in economic laboratory experiments that eliminated transaction costs and risks require higher rates of return for shorter payback periods and for smaller investment amounts.[73] According to Huntington (1994), these phenomena indicate that the high rates of return and the very short payback periods required for energy efficient appliances are embedded in more general patterns of economic behaviour and do not necessarily imply overuse of energy and hence would not alone justify government intervention (e.g. in terms of more stringent regulation) to achieve higher energy efficiency.

According to Huntington (1994) as economic agents probably often achieve economically efficient outcomes with limited information in laboratory experiments, the important question would be how the anomalies mentioned influence all markets, not simply markets for energy-efficient appliances and equipment i.e. how large and widespread such apparently inefficient behaviour is and just how bounded consumer rationality is.

4.3.3 Information asymmetries and transaction costs

Imperfect and asymmetric information are often seen as major barriers to energy efficiency investments which represent market failures and require government intervention, such as regulation towards more sustainable production and consumption. However, Sutherland (1996) states that the information limitations consumers face (i.e. lack of information on the cost savings of energy efficiency investments or the inability to evaluate such information) characterise numerous consumer goods (e.g. effective interest rates on credit card purchases) so that the question for purposes of market intervention is whether state intervention would enhance welfare. Jaffe and Stavins (1994a, 1994b) provide a broader framework for this discussion in distinguishing between information possessing a public good characteristic

[73] Transaction costs are likely to represent a bigger proportion of the total costs for smaller investments and have a more negative effect on shorter investment periods according to Huntington (1994) who also raises the issue that the risks for investments with shorter time horizons tend to be higher.

and a private good characteristic. According to economic theory, information has a public good characteristic when it is supplied and consumed at zero marginal cost and does not affect the amount available for others. If information expresses this public good characteristic then, according to the theory, supply by private markets will be insufficient relative to the social optimum. In such a case, the absence of perfect information would not be a market failure but if the information provided by appliance labelling would have this public good characteristic then state intervention that mandates labelling could in principle contribute to economic efficiency as it would reduce a market failure (Sutherland, 1996). However, Sanstad and Howarth (1994) state that appliance labelling programmes that aim to provide information to customers can have ambiguous effects on consumers' subjective beliefs as they may not be particularly informative if a consumer's informational background is limited. They conclude that simple presentation of factual information, although technically accurate, may be insufficient to induce consumers to make substantively rational decisions.

The observation that appliance labelling did not appreciably affect consumer choices can be seen as one of the initial rationales for performance standards. Sutherland (1996) acknowledges that customers who prefer energy efficient appliances may have positive search and information costs that would be reduced if all other appliances would be eliminated from the market. However he states that such appliance standards would not eliminate a market failure, but instead impose barriers to certain customers and therefore would not contribute to economic efficiency (although they likely would save energy). Similarly, Schwartz and Wilde (1979) argue that imposing contractual terms like performance standards does not produce economic efficiency and consider efforts to reduce information costs superior to legislative determination of contract terms. This would also be an argument against the efficiency of the mechanisms behind the Porter Hypothesis.

Asymmetric information problems arise, when parties involved in a transaction have access to different levels of information, as it is the case when consumers attempt to evaluate the post-purchase performance of equipment prior to sale. According to Sanstad and Howarth (1994), asymmetric information is extremely common in real world markets and consequently inefficient resource allocation may be a rule, rather than the exception. In this view, energy inefficiencies would probably not be considered a market failure.

Another argument made by Sanstad and Howarth (1994) is that the net gains achievable through improved energy efficiency might be outweighted by the associated transaction costs ie. costsresulting from gathering assessing and applying information on the characteristics and performance of energy using equipments.[74] They conclude that the argument that transaction costs are normal and have no implications for economic efficiency is a fallacy and suggest considering possible interventions or alternative institutional arrangements by means of which such costs can be overcome. In this view high transaction costs (mainly information costs) would represent a market failure if they could be overcome by appliance labelling, performance standards for appliances and utility subsidy or rebate programmes. This argument is challenged by Sutherland (1994) who argues that energy

[74] These should not be confused with the hidden or omitted costs mentioned in section 4.3.1.

efficiency is one characteristic of an energy using device and consequently the transaction cost associated with energy efficiency would be the incremental cost associated with purchasing the energy efficient component of that device. He therefore concludes that economic efficiency would be increased only if the policies implemented would reduce transaction costs and achieve net benefits.

4.3.4 Market mechanism shortcomings in achieving optimal diffusion of energy efficient technology

In the current process of deregulation of energy markets in Europe, important long-term decisions on regulation concerning energy efficiency, demand side measures and energy services, but also regarding renewable energy sources have been and are being taken. In order to avoid welfare losses from removing or adjusting such regulations, once they are established, it is advisable to establish the effect of deregulation on demand side and supply side energy efficiency and here especially on demand side measures and energy services. Academic research in the field of energy efficiency in deregulated markets was mainly undertaken in the US and therefore predominately focussed on US energy markets and the regulation of energy efficiency there. In Europe research mainly concentrated on the effects of deregulation on renewable energy sources. As explained in the previous sections, the two most influential models in the discussion about energy efficiency are the 'technologist' and the 'economist' perspectives. The first one (also known as the 'engineering' approach) essentially claims that a large proportion of the cost-effective demand-side energy efficiency investments are not carried out under current market conditions. The 'economist' perspective holds the view that, although energy markets express imperfections these are caused by general anomalies in the behaviour of economic agents and do not justify the notion of market failure. Thus, from this latter perspective utilities in deregulated markets should only follow market signals in deciding which customers to provide with which energy-efficiency investments, demand side measures and energy services. One of the main reasons for the dominance of these two views is probably that they match very well the different political opinions that were in search of justification for their policy prescriptions.

5 The role of the Porter hypothesis for energy efficiency improvements

The starting point of the investigation was the issue how the role of innovation and market structure in the mechanisms proposed in the Porter Hypothesis can achieve more sustainable consumption and production processes. In order to assess this, the theoretical and empirical knowledge we have to date on the Porter hypothesis was linked and the role of innovation and market structure in it (as well as their interaction) was elaborated upon. Following this, the issue of energy efficiency in industry, commerce and households was discussed from various angles in order to evaluate the relative influence of market barriers, market failure and general anomalies in the behaviour of economic agents in bringing about the levels of energy efficiency that can be observed empirically.

An important conclusion from the review of these two lines of thinking and debate is that in many ways enabling the mechanisms of the Porter

hypothesis means that the issue of market failure with regard to energy efficiency becomes much less relevant. The reason for this is that without the mechanisms of the Porter hypothesis (i.e. innovation as a result of stringent, yet efficient regulations that produces social as well as private benefits), government intervention would only be efficient from the point of social welfare, if energy inefficiencies are in fact a market failure. However, if strict regulation leads to innovatory activities with the effects proposed in the Porter hypothesis (i.e. increased competitiveness of firms and improved environmental quality, in this case especially improved energy efficiency) then even in the absence of market failure government intervention in terms of stringent, yet efficient regulation may be justified. However, as argued in section 2, in the absence of market failure, the Porter hypothesis is most likely to hold if the market structure of the industry in which the firm operates is conducive in terms of supply side aspects (such as capital structure characteristics of the industry or the firm) or a favourable demand side and if reward structures, organisational inertia or inefficiency in firms' routines (Gabel and Sinclair-Desgangé, 1999) are such that the result is organisational failure.

Green consumerism on electricity market is a possibility that is explicity mentioned in theoretical modelling of product differentiation under price competition(Conrad, 2005).[75] Such a favourable characteristic of the demand side would enable the Porter hypothesis as it leads to a more favourable demand side and thus essentially to a more conducive market structure. However the evidence for green consumerism to work in energy markets is limited in the EU where e.g. the energy markets in the United Kingdom and Germany have been fully deregulated, but demand of household customers for „green" electricity remained low. For Canada, based on a survey of intentions a somewhat more positive assessment emerges (Rowlands et al., 2003). Labels guaranteeing specific energy sources or standards for energy efficiency are in this respect an important device to signal the environmental quality of a differentiated product to environmentally conscious customers.

Etablishing the possibility that the basic mechanisms behind the Porter hypothesis can work in energy markets does not imply that the type of innovatory activity proposed in it actually takes place. Therefore in the following one specific aspect of energy efficiency-increasing activities shall be analysed with regard to whether the Porter hypothesis actually holds for it. This is the case of demand side management (DSM). DSM has been defined as „measures taken by an electricity supplier or other party (apart from the electricity consumer) to reduce a consumer's demand for electricity through improvements in the efficiency with which electricity is used (LE Energy Limited and SRC International ApS, 1992) and as planning and implementation of activities aimed at influencing the use of electricity by customers in ways that result in changes of the utility's load shape that are desired by the utility (Gellings, 1996). Tables 2 and 3 provides an overview of possible DSM activities.

The argument has been made that deregulation itself triggers increased DSM levels, resting on the argument that the concept of energy services is based on the notion that customers want to buy services that energy provides (e.g. heat, light and power) rather than electricity or gas itself. As a result,

[75] Energy markets are mainly characterised by price competition because a high quality of energy supply is usually expected by customers.

the lowest-cost solution for light, power or heat is in the customers' interest (in line with the concept of least cost planning (LCP) that has been pursued by at least some municipalities. Assuming this customer preference holds, the provision of demand side energy efficiency services would be an important part of product offerings of firms in a less regulated energy market. Chamberlin and Herman (1996) use precisely this argument when they claim that a large market for energy efficiency services exists in a more competitive environment.

Table 2: Energy-specific DSM programmes

DSM programme approach	**Examples**	**Approriate/best application**
Load management	Direct load control, energy management systems; peak control rates	Demand reduction at peak load times; matching of marginal cost with prices; utilities concerned with RIM test
Energy audits	Household surveys, commercial and industrial energy audits	Identification of most viable energy efficiency investments; complement to incentive programmes
Appliance labels	Refrigerators, washing machines	Better information provision; new construction areas/markets where existing practices are inefficient
Subsidies and rebates	Energy efficient appliances, equipment, lighting, etc.	Provision of incentives for energy saving investments
Leasing and loans	Insulation e.g. in new construction markets and other retrofits	Customers with limited capital availability; markets where long lead times are acceptable
Performance contracting	Building controls, mechanical contracting, Self-generation equipment: installation, operation and maintenance	Overcoming investment barriers due to long pay back periods
Direct installation	Air-conditioning equipment; well-insulating windows	Low income customers, when DSM savings are needed quickly
Market transformation	Equipment replacement and new construction measures	Areas, where DSM savings are needed in the longer term
Bidding	Utilities request proposals from outside parties to supply demand side resources	Transfer of performance and implementation risks from utilities to third parties; inexperienced utilities

Source: adapted from Nadel and Geller (1996)

In terms of new business models although some of the programmes will likely be the same and done by the same firms in deregulated energy markets, future DSM opens up opportunities for innovative energy services and new delivery mechanisms provided by specialised energy service providers since these will only succeed if it offers more benefits to customers than competing products by traditional utilities.

In addition to that, LCP or contracting by firms or municipal utilities would lead to higher energy efficiency and is essentially a supply-side activity that positively affects market structure (Results Center, 1993a; Stadtwerke Hannover, 1998). There is some evidence of this approach t obe successful, but it depends also on other aspects such as changes in the regulation of energy markets. Here, an important role exists for energy agencies, which have been successfully set up in yet another new business

model e.g. in Hannover or Leicester (Results Center, 1993; Stadtwerke Hannover, 1998).

Table 3: Non-specific DSM services

DSM service	**Examples**	**New marketing methods**
Energy solutions	Selection of contractors, equipment installation	Financing, shared savings (performance contracting), contract energy services, packaged with other services, third party financing
Equipment contracting	Owning or maintaining of generation plants or energy management systems	Contract energy services, packaged with other services (e.g. power marketing and brokering)
Building maintenance	Power quality, reliability, backup services; equipment rental, maintenance and repair	Project management, technical/engineering/design assistance, warranties and building commissioning
Cable/communications systems; entertainment services	Internet access, telephone lines	Packaged with other services (e.g. bundling with electricity supply)
Other services	Billing and information services, security systems, risk management products/services	Packaged with other services

Source: adapted from Chamberlin and Herman (1996)

Changes in the regulation of energy markets can enable the mechanisms behind the Porter hypothesis also in a more indirect way. However, rather than deregulation of energy markets, this would probably require specific regulations aimed at fostering energy efficiency. Opposed to this, the objective of the liberalisation activities carried out over the last decade on the national energy markets of EU member states were mainly aimed at improving the workings of price competition by decreasing the level of vertical integration present in these markets. By reducing vertical integration natural monopolies were intended to be limited to the distribution network, whilst competition would be increased in in energy production and distribution. Whilst the current process of deregulation of energy markets in the EU is having exactly the opposite intention, there are nevertheless country-specific examples of regulation that aims for higher energy efficiency. For example, in Germany specific regulation to increase energy efficiency has been enacted (Wenzel, 2006).

However deregulation (i.e. regulation that does not introduce more stringent environmental quality requirements but is largely unrelated) seems to also have enable new decentralised energy technologies (such as fuel cells, microturbines, internal combustion engines, combined-cycle gas turbine (CCGT), wind turbines or photovoltaic cells). The “dash for gas” in the early deregulation of energy markets in the United Kingdom is well-documented (Watson, 1997). Similar effects have also been found in the energy generation equipment manufacturing industry which can be considered an earlier stage of the production chain of the energy supply industry (Magnusson et al., 2005). Magnusson et al. (2005) state that fuel cell and internal combustion engines technology were not successfully developed by large power plant producers because this was an

organisationally less well-fitting innovation that could be done with same easeby small entrants. A similar situation may also apply to the case of wind turbines or photovoltaics systems.[76] This points to the need to distinguish for the Porter hypothesis the possibility that the win-win benefits from stringent, yet efficient regulation may not always accrue to one firm, but that the Porter Hypothesis still holds, if the net benefits across a sector or even an economy from implementing stringent, yet efficient regulation are positive. This means that there can be winners or loosers from the enactment of a regulation, but that overall, the economy or a specific industry (in this case the energy supply industry) becomes overall more competitive. The most important question that arises from this is then of course how likely it is for the Porter hypothesis to hold in energy markets, especially in the EU.

In a similar line of argument as the one for decentralised energy technologies it seems also to be possible that deregulation has a positive effect on (energy-specific and non-energy specific) DSM acitivities. Assuming inefficiency in highly regulated energy markets profits should decrease after deregulation. However, energy suppliers may be able to counter this by incorporating additional services and activities that bring value to their customers and enable firms to charge a premium price. In this case, after deregulation and incorporation of such services which act as a means to compensate a profit erosion from deregulation by moving into higher value segments, also energy efficiency should have improved (based e.g. on the services reported in Tables 2 and 3 above). In this situation, DSM would be an activity that simultaneously increases private and social benefits on a deregulated market, and deregulation could be perceived as the type of regulation that is proposed in the Porter hypothesis. In addition to that, other regulation that introduces stringent environmental targets (such as the "Wärmeschutzverordnung" (heat saving ordiance) in Germany) may additionally motivate loan schemes which can increase the profits of energy suppliers in case DSM activities targeted at meeting stringent targets avoides costly investment in new generation capacity which is more costly in deregulated markets. In such a case, DSM can also be linked with LCP as e.g. promoted by municipal utilities or specialised energy service providers. The overall market potential for energy services is likely critical for how profits change as a result of increased DSM activities after deregulation.

6 Discussion and conclusion

This section attempts to summarize the insights on the issues raised. The starting point of the analysis was how the Porter hypothesis may be applicable for fostering on sustainable consumption and production, especially with regard to energy efficiency. Based on a brief review of theoretical reasoning about and evidence for the Porter hypothesis the role of innovatory activities by firms and of market structure are discussed in detail and are linked to sustainable consumption and production. Following this, the general issues surrounding the energy efficiency debate are introduced and discussed.

[76] Magnusson et al. (2005) show however, that large electricity generation equipment manufacturers became very active in CCGT and microturbine technologies and argue that this is largely due to the possibility for coherent diversification into these technologies, partly because they are not competence destroying and organisationally radical.

This addressed the 'energy efficiency gap' hypothesis and the issue of market barriers to energy efficiency. It also evaluated the different economic models and approaches concerning the behaviour of economic agents in energy markets with special regard for demand-side energy efficiency and addressed one of the most important questions namely to what degree firms and customers are only partially energy-inefficient in their behaviour. Answering this also answers ot what extent market failure accounts for inefficiency and thus if market failure is the dominant source for inefficiency on energy markets. If market failure proves not to be the main cause, other explanations would have to be explored such as whether the energy efficiency gap is mainly caused by general anomalies in the behaviour of economic agents, for example regarding their investment behaviour.

An attempt was then made to link the insights from the debate about energy efficiency to the Porter hypothesis and to opportunities for firms with regard to new (and more sustainable) business models and additional potential for innovation with regard to energy efficiency. This analysis indicates, that deregulation *per se* is not the type of regulation proposed in the Porter hypothesis, since it does not explicitly tighten standards with regard to environmental quality, and here especially energy efficiency. It is also pointed out, that demand side effects with regard to environmental product differentiation may not be strong and thus not favourably influence the market structure in the energy supply industry with regard to sustainable production and consumption.

However, for the special case of demand side management, a more in-depth analysis reveals, that it may well benefit directly from deregulation and bring about exactly the effects proposed in the Porter hypothesis. Even more so, deregulation may trigger the development and expansion of new business models (such as e.g. energy agencies, energy service provides or LCP activities by municipal utilities) that are more likely to bring about more sustainable production and consumption.

In addition to that, the analysis also points to an additional effect along the lines of the Porter hypothesis which is however is more indirect and also not fully in line with Porter's reasoning. This is the positive demand effect that deregulation had on decentralised energy technologies and especially CCGT, microturbines and internal combustion engines.One important issue behind this last effect is that the Porter hypothesis can be evaluated at different levels, e.g. the level of the individual firm, that of one industry sector, hat of a complete national economy or that of an economic trading area like the EU or the NAFTA (Wagner (2006) discusses this in more detail). The separation of benefiting and disbenefiting firms in the mechanisms behind the Porter hypothesis also opens up possibilities for new business models and for product differentiation, especially when environmentally conscious customers exist (Conrad, 2005).[77]

It is important to point out that energy efficiency is only one important aspect of energy policy with regard to sustainability. The other one is the use of renewable energy sources, which is an equally important issue with regard

[77] Nevertheless it needs to be stated that electricity (but not the underlying energy sources) are a relatively homogenous product and that therefore vertical product differentiation is very difficult and horizontal product differentiation at least dfficult as is witnessed e.g. by the challenges in Germany to brand electricity with regard to specific features (green, yellow and other electricity) which focuses on the heterogeneity of the underlying energy sources.

to the question underlying this paper, especially since environmental regulation and market deregulation simultaneously influences both, energy efficiency as well as the level of use of renewable energy sources for electricity generation in particular and energy provision in general.

In general, one would expect that the mechanisms of the Porter hypothesis work better for renewable energy sources than for energy efficiency, given that regulation in the former area is usually much more aligned to the basic idea behind the hypothesis, and in fact this seems to be the main reason for positive effects on wind turbines and photovoltaic cells. There are various examples of government intervention in terms of stringent regulation that resulted in an increased level of innovation for renewable energy systems.

One important example is the EEG (a renewable energy levy) in Germany, which forces large energy generators to buy decentrally generated electricity (e.g. from water, biomass, wind or solar photovoltaic sources) at prices that make investments in such renewable energy sources viable (basically by setting a price to be reimbursed to decentralised producers that is higher than that for fossil fuel or nuclear power-based electricity). Effectively of course this is some form of subsidy that puts the burden on large energy generators whilst the benefits of this will accrue to small and innovative firms focussing on renewable energy technologies (such as e.g. Vestas, Enercon, Solarworld).

Whilst in a narrow sense this result would not be consistent with the Porter hypothesis, it may still be consistent with it if the sum of the benefits accruing to the smaller firms and the social benefits from an increased use of renewable energies that result from a reduction of environmental externalities is larger than the disbenefit to large electricity generators. Certainly it is the stringent regulation that was introduced that resulted in the increase in innovatory activities in the smaller firms and in this sense supports the Porter hypothesis. Here again, the issue of the level at which the Porter hypothesis is addressed becomes pivotal.

As concerns future research foci, three aspects seem to be particularly relevant.

Firstly, although several countries have pursued different policies of re-regulation and liberalisation, there seems to be a certain degree of convergence in regard to the environmental effects of these policies, for example their effect on energy efficiency activities. It might be worthwhile to further explore the implications of this in the context of the Porter hypothesis.

Secondly, case studies on sustainable production and consumption in with a focus on energy efficiency in different firms and industries could provide insights into when the Porter hypothesis is actually applicable, not only in the energy supply industry, but also in other sectors of the economy as concerns cost-efficient energy efficiency improvements. Arguably in all industries, in which energy efficiency can be improved through investments with a positive rate of return, this would represent a situation in which the Porter hypothesis holds, as long as these investments are triggered by regulation aimed at improved energy efficiency (or carbon efficiency fort hat matter). Examples for such regulations that have been discussed here were the „Wärmeschutzverordnung“ (heat saving ordiance) and EEG in Germany, but can also be other regulation such as the recent EU directive for energy

use in buildings or stringent regulation for stand-by performance of consumer electronics devices as planned e.g. by the German govrenment.

Thirdly, a formal analysis focussing on environmentally differentiated products as well as willingness to py for environmental quality (possibly incorporating reciprocal behaviour of customers and firms) could provide insights in the factors which affect the validity of Porter hypothesis under different assumptions. This could also help to derive further insights on the likely behaviour of firms (e.g. in the energy supply industry) with regard to innovatory activities within the structure-conduct-performance paradigm or the concept of the active firm incorporating e.g. strategy aspects or linkages to sustainable production and consumption as possible guiding principles fort he governance of firms.

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Chapter 27 Alternative business models for a sustainable automotive industry

Bridging the gap between production and consumption

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1 Introduction

In respect to many consumer goods, more efficient production or a more efficient product would not in themselves constitute the attainment of sustainability because such improvements are still embedded within essentially linear value chains, and are articulated by business models that emphasise 'fire and forget' production. Taking the case of the automotive industry, this paper seeks to demonstrate that alternative business models have the potential to redefine the terms of competition, and in so doing realign business with society at the local level while finding a solution to the wastefulness that is characteristic of the profusion society. The paper draws on many years of research, but specifically a five-year programme conducted within BRASS at Cardiff University investigating the concept of Micro Factory Retailing. It is concluded that there are many, but not necessarily insurmountable, structural barriers to the creation of sustainable patterns of production and consumption with respect to complex engineered products like cars.

In so doing, this paper draws together two lines of discussion. On the one hand it is argued that sustainable technology of the characteristics to achieve 'factor x' scale improvements needs a pathway in which to develop. Given that in contemporary society technologies are generally delivered by companies, acting in markets to reach customers, it is therefore pertinent that this pathway needs to be competitive with the prevailing market offerings and viable at low volumes – because the market will initially be small compared with that for established products. While much has been done in terms of understanding the ways in which strategic niches may form the stepping stones along the pathway to successful market penetration, there has been rather less consideration of the ways in which business may have to change in order to challenge the prevailing orthodoxy.

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On the other hand, it is also argued that contemporary patterns of production and consumption are essentially unsustainable whatever the technologies or materials involved. This is perhaps a more difficult case to make, but in the case explored here (that of the automotive industry) the explanation rests primarily on the structural conditions evident in the industry that result in a distinctive business model. This approach to business is by no means confined to the automotive industry, and is characterised by high capital intensity leading to over-production and thence over-consumption. The symptoms of this trajectory include continued downward pressure on the price of new cars, high rates of product depreciation, baroque innovation, and the arrival of economic obsolescence before technical obsolescence. Despite the widespread evidence for the lack of economic, social or environmental sustainability in the automotive industry, it remains characterised by high barriers to entry and exit with considerable resilience to disruptive technological change.

The paper begins with an introductory section that seeks to locate the case presented here within the wider debate on sustainable production and consumption, making the basic case that the assumption that the 'market' will allow the emergence of appropriate business models is somewhat optimistic. This is followed by a definition of what is meant by the term 'business model' in the context of this paper, and how that concept can be related to the ways in which value is created by a company.

Thereafter, the discussion is more closely aligned to the specifics of the automotive industry, not least on the premise that the transition from generic understanding to specific solution requires embedded knowledge. Put simply, the solutions appropriate to the automotive industry may not necessarily be those appropriate to other aspects of sustainable production and consumption. Note also that the approach adopted here is not determinist, in that new ways of making things (production technology) and new things themselves (product technology) are envisaged as enabling changes in, for example, the organisation of capital or modes of consumption but not necessarily requiring them. This theme is expanded upon later, particularly in the context of the discussion of barriers to change at the conclusion of the paper.

2 Sustainable Consumption and Production: the Issue of Business Models

The need for sustainable consumption and production (SCP) is broadly understood. That is, with expected world population levels, existing patterns of material consumption are beyond the capacity of the planet if the majority of the world population were to achieve the patterns currently exhibited by the industrialised nations of North America, Europe and Japan (von Weizsacker et al, 1997). In essence, there are two related problems here: to reduce the already unsustainable patterns of production and consumption evident in those industrialised nations; and to allow a level of material and quality of life prosperity to develop in the economically emergent nations in a manner that does not further undermine the carrying capacity of the planet for existing and future generations. Food consumption, domestic energy requirements and, significantly in this case, mobility are seen as the three

major dimensions of modern life that account for the majority of the ecological impact of contemporary consumption patterns (Tukker et al, 2005).

The extant SCP literature is testimony to the scale of the problem, but also to the potential availability of solutions. Enormous effort has gone into understanding how ameliorative technologies might develop, most notably by the 'Industrial Transformation' school of thought. As Tucker et al (2005) rather dejectedly note, von Weizsacher et al (1997) actually listed some 50 examples of innovations that would substantially reduce environmental impact for a given 'service unit' made available to consumers, yet ten years on such items are confined to niche markets. The explanation pursued in this paper is that, at least in part, it is because there has been insufficient consideration given to the need to have viable business models to deliver SCP. While attention has been given, deservedly, to significant social and cultural forces that underpin and reinforce contemporary patterns of consumption, the proponent of SCP have to date largely given their insights to the required changes in regulatory frameworks and other government interventions that might provide the conditions for change towards SCP. Studies of innovation, particularly those grounded in ecological economics, tend to focus on the socio-technical landscape – and the creation of niches within which innovations might form an initial presence – and on the socio-technical regime that might be thought of as the ecosystem within which such niches can be nurtured (Geels, 2002).

In the context of sustainable mobility, the approach adopted by Geels (2002) is illustrative both of the systemic coverage of the SCP concept, but also of the gap in analysis with respect to business models. While Geels admits of the importance of industrial structure as one determinant of the socio-technical regime, there seems to be scant translation of this to an understanding of the dynamics of competition and change by businesses within the mobility sector. Obviously, vehicle manufacturers and their suppliers are major actors for change or non-change in terms of how mobility aspirations are defined and met. There appears to be an implicit faith in the invisible hand of the market, indeed in the essential power of capitalism, to respond with appropriate new businesses as required.

Transition management as a school of thought employs a broad definition of 'technology' that extends well beyond either the artefact or the process, such that particular technological configurations are seen as formed within and deeply embedded in socio-economic, cultural and institutional systems and structures (Berkhout et al, 2003), while also serving to change those structures and systems. In the language of these theorists (Geels, 2002; Schot, 1998; Rip and Kemp, 1998) the automotive industry can be understood as a regime with characteristic ways of both defining the problem and arriving at the solution (of mobility). This regime comprises accepted ways of working, of engineering practices, of product and process definitions, and of related institutional practices, infrastructures, policy, and industrial structure. The transition to SCP is thereby entailed as a meso-level problem, whereby the (unsustainable) aspects of the regime must be changed. At this relatively abstract level, then, there is clearly a 'space' within which business per se is located. However, in practice the major thrust of the analysis to date has been on creating the policy environment

within which, for example, strategic niche management (Kemp, Schot and Hoogma, 1998) might nurture the seedlings of regime shift.

Meanwhile, and from a rather different perspective, in the context of emerging economies there are quite different macro-economic and social conditions within which demands for mobility are emerging. For example, as a crude characterisation these economies are notable for a relative paucity of capital and surfeit of labour (often somewhat unskilled in terms of modern industrial requirements), and have large but dispersed rural populations with governments having a strong incentive to reduce the rural-urban drift that is powering the growth of new cities. In these conditions, the simple replication of business models from the established industrial nations may be inappropriate (Wells, 2001) or inadequate to the task (Hart, 2005).

To summarise then, the proposal here is that one reason for the inability to achieve the transition to SCP is the failure to achieve innovative business models. Innovation forms a central feature of the SCP analysis, and again the concept is very broad to include social, cultural and political dimensions of innovation. Once again, however, the analysis seems to stop at this point. While not seeking to discredit the overall project that is SCP, this paper therefore seeks to establish both the significance of business for achieving SCP and to put some proposals forward as a means of recognising sustainable business when we see it.

In the first instance, the starting assumption is that business is the main vector of innovation, it bridges the gap between production and consumption. The second basic assumption is that if these vector businesses are not competitive, they will go out of business and the regime will once again lapse back to the default position of the present incumbents: that is, the status quo will not change substantially. It is recognised that both assumptions could be questioned, and obviously there are many other sources of change or indeed non-change in society. The value of socio-technical experimentation (Vergragt and Brown, forthcoming) is not denied. Neither, also, is the contribution from government, or entities such as social enterprises that offer alternative discourses to the mainstream mantra of compete and survive (Bristow and Wells, 2005). Rather, this contribution can be seen as something of an antidote to the tendency of the transition management literature to treat business innovation as unproblematic and possibly trivial. Hence, the third basic assumption underpinning this paper is the proposition that business (in this case the automotive industry) as it is currently structured and practiced cannot produce sustainable mobility – but ironically in business terms at least it has proven itself to be remarkably sustainable.

3 Defining Business Models

A starting point for business models is to understand the relationship between the product as an artefact, the production processes needed to make it, and the structure of industry that emerges as a result. In this respect, the analysis is actually narrower than that adopted by the transition management school of thought, but in the search from breadth and comprehensiveness there is some danger that transition management has sacrificed important detail. In any case, it is partly about what element forms the centre for the

analysis. In the account presented here, business has been put at the centre, in particular the pivotal business that emerges as the most influential through the linear value system from supplier right through to customers. Hence, the business model undoubtedly influences how consumers think about the product, and the normative rules that shape expectations. This product, process, structure triumvirate is rarely entirely solid, but is equally highly influential in mediating between production and consumption. Of course, it is possible to have an innovative business model while utilising existing product and production technology (and an example is outlined in the case studies below). Equally, it is possible to attach innovative technologies to existing business models and indeed existing businesses. Innovation is more fluid and 'fuzzy' than such simple prescriptions would allow. Nonetheless, and especially in the face of entrenched business practices, it is also the case that novel technologies can be considered as enabling new business models thereby providing a new entrant with a survivable route to market expansion.

The concept of business models is rarely defined in the strategic literature, although recently greater attention has been given because of the attentions of leading scholars such as Hart (2005). Arguably, the concept came into popular use in the so-called dot.com era when many new businesses were searching for a profitable means of exploiting the possibilities of widespread Internet usage. As that era demonstrated, a great many such business models manifestly failed. What was interesting about the era, however, was the explicit recognition of two key features. First, that a significant technological change (the Internet) could create the conceptual space for new ways of intermediating between businesses and consumers; and second that by defining new business models those conceptual opportunities could be translated into competitive advantages against traditional companies or approaches to the market in question. Of course, it could also be argued that the dot.com era also illustrated an important third facet of relevance here: just how difficult it is to define and put into operation a genuinely successful new business model, whatever the sector under consideration.

Other areas of business activity have also attracted the re-definition of business models. One can consider privatisation as a case in point, with a transition from a social – governmental 'business' model, to one with at least some of the characteristics associated with openly competitive markets. In a related manner, trade liberalisation and the general policy of opening markets may at least in part be responsible for providing the conditions for new business models in some sectors, airlines being a potential case in point with the so-called 'low cost, no frills' airlines emerging in the 1990s.

The business model can be thought of as being intermediary between an overarching business concept, and the detail of a business plan. It is a combination of the structure of the business, the product-service offering, and the way in which added value is provided to customers. The business model furthermore is a statement of the terms of competition between businesses; entrenched business models become part of the accepted norms of behaviour – accepted by regulators, consumers and others as well as competitor businesses. In this respect business models can be extremely pervasive and enduring. More theoretically, the concept of the business model is about value creation frameworks. As Stabell and Fjeldstad (1998) have shown (deriving from earlier analysis from Porter, 1980; 1985), the

traditional (and especially manufacturing) value creation framework has been linear. That is to say, materials are created and then transformed into products, and then dispatched to customers with appropriate after-sales support until the product expires or is disposed of. Meanwhile, value passes back down this linear chain, along with other 'backflows', principally information. It can be readily appreciated that this linear framework lends itself to unsustainable business operations, although this was not the point of the analysis from Stabell and Fjeldstad. That is, the model closely approximates to the 'dig it up, use it, throw it away' approach to the satisfaction of material wants and needs that lies at the heart of many of the problems associated with the reconciliation of production and consumption. This concept is distinct from 'value capture', which has more to say about how distinct companies compete to capture value from each other – though it is equally true that the pattern of value creation and the strategies of value capture are often closely related. Indeed, the critical point discussed below is that innovative business models are one means to redefine the terms of competition, and hence both a new way of creating value and a new way of capturing that value.

In part, the interest in value creation patterns and the characteristics of the business model has been stimulated by another environmental debate: that concerned with recovering waste streams in production and post-consumer (Wells and Seitz, 2005). Closed-loop supply chains, embodying remanufacturing and reverse logistics, might be expected to an important means to enable businesses to meet the growing demands of corporate social responsibility, and to meet wider social goals to reduce the resource-intensity of contemporary economic life (Hart, 1997; Desai and Riddlestone, 2002; Steinhilper, 1998; Environmental Protection Agency, 1997; CEC, 2000). There is a clear resonance with the concepts of eco-efficiency (Schmidheiny, 1992) and eco-modernism (Ayres et al 1997): that closed loops offer opportunities to achieve the so-called 'triple bottom line' of social, business and environmental benefits (Hawken et al, 1999). Waste streams – including mechanical products that can be made serviceable again – can provide useful value-added business opportunities (Ferrer and Whybark, 2000). It becomes apparent in the case of reverse logistics and other features of closed-loop systems that in some respects the traditional linear value creation chain has been altered. On the other hand, one of the most significant impediments to the widespread adoption of closed-loop value systems is the empirical reality of the pre-existing linear value system. That is, in myriad hard engineering and soft attitudinal ways the primary linear value creation system is unable to accept returned products, components or materials. This suggests that SCP, that in itself would probably embody the concept of dematerialisation (or no new net consumption of raw materials), would perforce need non-linear value creation systems: alternative business models are fundamental to the achievement of sustainable production and consumption.

4 Disruptive Technologies: the Business Dimension and the Automotive Industry

This section presents a brief analysis of business models in the automotive industry as they pertain today, along with a consideration of why disruptive technologies have thus far failed to materialise in the industry.

Exactly what constitutes disruptive technology is of course somewhat elusive. There are perhaps two main categories of disruption: that which emanates from outside the sector (i.e. an alternative means of achieving the same or similar ends) or internally (i.e. a radical improvement of the existing means of achieving an end). In either case, the automotive industry appears to have been immune to such challenges. In this industry, it is the vehicle manufacturers that may be regarded as the pivotal businesses, orchestrating both component suppliers into the car production process, and the distribution and retailing system that presents those cars to consumers. The discussion on business models is therefore focussed on the vehicle manufacturers by virtue of their privileged position within the system. It is recognised that alternative business models may constitute a redefinition of these power relationships.

4.1 The traditional business model and the automotive industry

The traditional business model in the automotive industry has been remarkably enduring. In its basic form, it dates back to a series of innovations, both technical and managerial, in the early years of the 20th century. Henry Ford is often cited as the 'father' of mass production in the automotive industry, with the introduction of the moving assembly line, the standardised product design, the fragmentation of work, and the strategy of expanding the market through price reductions. In some important respects, this conceptualisation of the history of the industry is flawed, for it neglects the fact that Ford mass produced a 'pre-industrial' design that lacked a vital element of the product-process-structure equation: the all steel body developed by Budd (Nieuwenhuis and Wells, forthcoming). GM then introduced some equally important but non-technical innovations, including the GM Acceptance Corporation (GMAC) to provide credit facilities to buyers, the idea of the annual model change, and the idea of the multiple-brand group with a range of cars for 'every purse and every purpose'.

Many years of refinement then followed, leading to the characteristic business model of the automotive industry. Under this model the key determinant of the scale and scope of production is the requirement for economies of scale in manufacturing, a consideration shaped by the capital intensity of the production process including tooling for that process. This has resulted in a pattern of centralised manufacturing facilities, linked to the market via long logistics lines and extensively distributed franchised dealerships. Under this framework, the widespread adoption of the Toyota Production System from the 1990s onward represented a further refinement of the business model, but not the radical change presented at the time (Womak et al, 1990). Vehicle manufacturers earn their revenues primarily through the sale of new vehicles and associated finance packages, not from vehicles in use (apart from the lucrative spare parts business). The main measure of competitive status is market share for new car sales. Given the very high fixed costs of production, the achievement of low per unit prices can only be obtained by high volumes of unit production. In other words, economies of scale are a classic 'double edged sword' in that with this business model the vehicle manufacturers absolutely have to achieve high outputs, or suffer financial loss. It is hardly surprising then that the industry

as a whole suffers from endemic over-capacity, an ability to produce many more vehicles than the market can absorb, with consequential impacts on over-production and over-supply, leading to prevalent discounting of new cars in the market. Returns to capital are low, typically below 5% and often negative with periodic crises enmeshing the vehicle manufacturers. The vehicle manufacturers do not capture most of the profit streams generated by cars in use, these go to franchised dealerships, independent garages, insurance companies, fuel companies, and many other parties (see Wells and Nieuwenhuis, 2001 for a fuller account of the prevailing business model).

The high costs of production and of new model development leads to a concern for risk reduction, thereby embedding a conservative culture. With respect to existing technologies in vehicle production, given the very long experience, they are extremely stable and predictable, all the performance parameters are understood. All alternatives are judged against the standards of the prevailing regime, and almost inevitably found wanting. This is particularly relevant for the introduction of disruptive technologies, which almost by definition would need to begin at low volumes and hence high per-unit prices. Note that these observations do not just apply to what the industry terms 'powertrain' items, but also to the basic design of vehicles, to the architecture of the body structure, and to the materials used.

Now, this overall business model has perhaps three variants that are worthy of consideration. These are:

a. High volume producers
b. Premium producers
c. Specialist producers

The high volume producers adopt the business model outlined above. The so-called premium producers have historically occupied a sort of middle ground, offering a degree of exclusivity and performance or specification not provided by the mainstream, high-volume producers. The specialist producers that occupy niche markets tend to be characterised by products with extreme performance or luxury. This pattern has rather broken down in recent years, as mass-market high volume producers have sought to capture some of the premium market, and as premium producers have expanded into offering a fuller range of products at higher volume. Specialist producers are often now owned by larger groups. Still, in broad terms all three categories adopted the same basic approach of deriving revenues from the sale of new cars.

Despite these observations, the automotive industry has not and is not entirely bereft of innovations with respect to the business model and the introduction of disruptive technologies. The following section discusses the extent to which the constituents of a radical business model might be observed within existing practices, particularly with respect to low-volume specialist producers.

4.2 The traditional niche business model and the automotive industry

As noted above, there has been an enduring niche business in the automotive industry, particularly that in Europe. It is interesting to speculate why Europe is such a fertile place in terms of nurturing these specialist

producers, when they were squeezed out of existence in the USA, and never really appeared at all in Japan or South Korea. Whatever the reasons, these niche businesses exhibit some features that are worthy of attention with respect to the development of alternative business models and the achievement of SCP.

In the traditional niche business model the following characteristics are often present, though not necessarily all in one business at one time. It is useful to consider that in some cases the businesses concerned have demonstrated remarkable levels of sustainability in an economic and social sense, even if the products themselves have not shown particular environmental merit. For example, the UK niche vehicle manufacturer Morgan has the distinction of having made a profit every year of existence, and of never having made any employees redundant. Very few businesses can make this claim. These niche manufacturers could be said to include Rolls Royce, Bentley, TVR, Lotus, Bugatti, Ferrari and Maybach – all with production volumes under 10,000 units per annum. The characteristics of note include:

- Production capacity is pitched to meet the lowest point in the demand cycle, with excess demand managed by greater or lesser waiting times for products (often measured in years);
- The product is retained in production for a long time, with many minor iterations rather than radical redesigns;
- The product usually serves a distinct niche demand, and is therefore specifically designed for this purpose rather than being a 'general purpose' machine;
- The product has a high value does not depreciate rapidly with time, as is the case for mainstream products. As a consequence, there is impressive product longevity;
- Production itself is limited, in general these are more accurately termed assemblers with all major components bought in (especially engines and gearboxes);
- Actual production is often confined to the vehicle body, with alternatives to the all-steel Budd system adopted offering low-volume viability and often performance advantages such as lower weight;
- The assembly process is conducted without automation, and allows a high degree of variety thereby offering high levels of customisation;
- Cars are built to order, not in anticipation of demand;
- There is often high engagement with customers in an iterative process whereby product specification is refined. The engagement continues into the vehicle use phase;
- The factory often serves as the point of vehicle service, especially for major product overhauls;
- The business derives a high proportion of income from non-manufacturing activities including 'heritage' parts businesses, and motor racing.

It is certainly the case that the vehicles produced are expensive relative to mainstream products. Therein lies a conundrum. From an environmental perspective, the high economic value is a useful attribute, because it provides

the rationale for product longevity: these vehicles are worth keeping. Product longevity is an attribute of debateable merit in the context of contemporary cars, but would certainly be a feature of sustainable mobility in the future. On the other hand, high unit prices obviously preclude many from the purchase of such cars: we cannot all drive a Rolls Royce! Therefore, it might be reasonably proposed that these business models and their products are essentially irrelevant to the challenge of mass sustainable mobility. This is clearly the case, unless changes can be made to the business model that bring the advantages of niche manufacturing together with technological innovation and affordability.

4.3 Innovative business models and the automotive industry

It is interesting to speculate on the degree to which the prevailing business model is historically and spatially specific, bounded to time and place. Put another way, has the prevailing business model had its day? The prevailing business model is best suited to conditions of market expansion, and indeed contributes significantly to such expansion through the reduction in (quality adjusted) prices. In the stagnant and fragmenting markets evident through much of the industrialised world today, it becomes much more difficult to reconcile the demands of the production system (for standardisation) with the demands of the market (for variety). In other words, regardless of any sustainability considerations, the structural conditions of the regime are such that the prevailing business model is under pressure. These pressures are manifest in the economic performance of the business model, with many major vehicle manufacturers and suppliers struggling to attain profitability. Of course, the vehicle manufacturers and the industry is responding with a range of strategies including globalisation (finding new, expanding markets), platform designs, modular supply, outsourcing to low-cost production regions, outsourcing of manufacturing to third parties, and attempts to drive up the per-unit value of vehicles sold through the integration of many new features.

Still, the economic pressures are being compounded by growing concerns over sustainability. To date, the main interests have been with respect to emissions of toxic gases. More recently, for both environmental and strategic reasons, the issue of fuel consumption (and of CO2 emissions) has come to the fore, while in Europe at least specific demands are now made in terms of recycling so-called End of Life Vehicles. Other aspects of unsustainability remain neglected, principally the extraction and use of raw materials by the automotive industry. Nonetheless, with these sustainability concerns comes an imperative for radical technological change in the powertrain and, probably, the body architecture.

Taken together then, there is scope now for the introduction of new business models that can embrace both the economic and the environmental challenges faced by the industry. This leaves two basic questions: how can new business models emerge? And what happens to the existing businesses? The social cost of structural readjustment is already high, counted in terms of plant closures and redundancies, and is indicative of an industry with both high barriers to entry but also, crucially, high barriers to exit. In turn, this raises a third issue: will the impetus for change come from within the industry, or from outsiders with no vested interest in the contemporary status

quo? Evidently, vehicle manufacturers for all their difficulties are in many respects the most able to institute change. They have the technical, financial and human resources, the experience and knowledge, to produce something as complex and safety-critical as a car and then bring it to market. They also have the strength of existing brands, an issue that should not be dismissed lightly.

Alternatively, outsiders (perhaps from the industry but no longer 'of' the industry) may see the potential for a business model redesign that existing vehicle manufacturers dismiss as unworkable. Moreover, with new technologies come new competencies, new suppliers, and sometimes an opportunity to change the rules. Lacking in historical baggage or the sunk costs of previous investments, unconstrained by considerations like protecting the existing brand character, new entrants may offer innovative business models that find an echo in the need to change the way in which value is created and captured. In recent years there have been several attempts to do just that. Some have been documented elsewhere (see Wells and Orsato, 2005 for example), however the following section provides some thumbnail sketches of examples to illustrate the main points.

5 Case Studies

This section provides four brief case studies of innovative business models from a range of actors. The list is neither exhaustive nor particularly detailed, but is intended to provide a 'flavour' of these alternative models. In part, the point is to illustrate that there is not one definitive alternative available and that the degree of deviation from the existing business model may be more or less marked. None of the alternatives discussed has come to pass, again an important consideration in the context of understanding why and how transitions may fail to emerge. Table 1 provides a summary.

5.1 MDI Air Car

This particular business model provides a good illustration of an attempt to combine in one innovative package a new approach to vehicle design, vehicle production, and exploitation of the market. Motor Development International (MDI) is the company formed to bring to market the ideas of the inventor of the compressed air engine, Guy Negre (Wells, 2002). The technical concept and the business plan have generated much controversy in the automotive industry, and doubts over both remain.

In this vehicle, compressed air is held in a suitable canister and is then fed into a cylinder and allowed to expand, and in so doing the expansion provides the motive force to push a piston and hence turn the engine. There is no combustion, so there are no emissions at the point of use other than air. A useful attribute of the technology is that any sort of dedicated infrastructure would not be technically difficult or expensive to install – air refilling points could easily be added to existing petrol stations for example. Simple air compressors could be run from domestic electricity and re-charge the cylinders overnight.

Table 1: Alternative business models in the automotive industry: an outline of the main features using four examples.

	MDI Air Car	Th!nk	PetrolCo	Autonomy
Feature				
Source	Ex-Formula 1 engineer	Industry outsiders; plastic injection moulding	Petroleum company	GM, established vehicle manufacturer
Technology	Compressed air engine; steel frame plus plastic panels	Battery electric vehicle; PSA 205 running gear; plastic panels	Either normal new cars or bespoke design, standard technology	Fuel cell and drive-by-wire in skateboard chassis
Component Supply	Bought in via central purchasing operation	Large modules for all key items	Not known	Large modules made in-house. Rest purchased via central operation
Manufacturing	Franchised plant @ 2,000 units per annum; in-house production of panels	In-house production of panels; 5,000 units per annum.	Not known	Large scale production of chassis; localised assembly of body
Retail / Service	Production and retail combined	Localised manufacturing; no dealerships; use of Internet	Pay per use concept with regular 'refresh'	Not known, but acknowledged to allow different approach
ELV	Not within business model	Not within business model (except battery replacement)	Continued reuse of vehicles	Not known

The car was positioned in the market and performs rather like a battery electric vehicle without the weight and cost penalty of high performance batteries. Compared with contemporary petrol and diesel cars the range, top speed and acceleration are limited. An interesting by-product of the technology is that the exhaust air is at minus 15 Celcius, so air conditioning for the cabin is easy to obtain.

Of equal interest is the business plan developed by MDI. With many innovators, the core problem is usually lack of investment resources allied to the need to break the hold of the existing market leaders. MDI is no exception, but rather than seek to persuade an existing vehicle manufacturer to take up the technology, MDI have tried a quite different approach. The core of the MDI approach is to grant licences to third parties that in effect take on an MDI franchise for a defined territory in return for the investment needed to create the factory to serve that territory. MDI has designed a standardised or modular factory, and claims that 50 factories have already been allocated in various locations around the world. In addition, the standardised factory includes office space and a showroom, because in the MDI concept the point of manufacturing is also the point of retail and service / maintenance delivery. A prototype factory is claimed to exist in Nice. The factory therefore includes 4,200 m^2 of workshop space; 500 m^2 of

offices; and 300 m^2 of showroom space. On a single shift, with 70 workers, the factory is expected to produce about 2,000 vehicles per annum. In terms of operations, the factory would manufacture and assemble engines, car parts, the chassis, and undertake final assembly. The large plastic body panels would be manufactured at the factory as well. Of course, in addition the factory would undertake promotion and sales, and distribution, sale of spare parts, repairs and service within the zone allocated to them.

Despite initial interest, this project does not appear to have come to market – though it is difficult to know precisely why the concept failed. Certainly the designs themselves, and their styling, were controversial, while the inability to offer demonstration vehicles undermined confidence in the concept.

5.2 Th!nk

One version or approach was the TH!NK. The basic design concept was a two-seat city battery electric vehicle with a thermoplastic body for urban commuters and utilities (Wells and Nieuwenhuis, 1999). The TH!NK employed a lower frame constructed from 90% high strength steel cut, folded and welded rather than pressed into shape – the design for which was developed in co-operation with British Steel Automotive Engineering Group. Normal steel pressings would have required large investments in tooling. Mounted onto the lower frame was an upper frame constructed from aluminium extrusions, seam welded at the joints - this time Norsk Hydro provided useful expertise. The thermoplastic body was moulded in one operation, with separate mouldings for the doors, roof and a few smaller parts, and was non-structural. The factory in Norway had a design capacity of 5,000 units per annum and was characterised by a highly modular assembly process: the production line was only ten stations long. The wider business model included the use of Internet sales and mobile service delivery to obviate the need for dealerships. Furthermore, the intention was to supply potential new markets such as California by locating a 'cloned' factory in the market.

Having initially been rescued from bankruptcy by Ford, and placed into a 'green' portfolio of vehicles, Th!nk was sold off after the ousting of CEO Jak Nasser from Ford. Th!nk officially went into bankruptcy in January 2006, having failed to find sufficient markets for the products.

5.3 PetrolCo

This example derives from a consultancy project undertaken on behalf of a major petroleum company, for reasons of confidentiality this company cannot be named. The project explored two variants of the same basic scheme. The concept in principle was simple: consumers would pay a deposit to have a vehicle on their driveway for a contract period of three years. Thereafter, consumers would pay a per-mile fee, possibly with other items such as insurance bundled into the package in the same way. The vehicles would then be returned to the company, and would be put through a 'refresh' process including replacement interiors before being returned to the consumer.

The business model was proposed for both existing new cars, purchased for the business from an established vehicle manufacturer, or for a purpose-

designed new car. Indeed, some designs were commissioned from some leading designers. Interestingly, if the target price for the cars could be met, the business plan worked on the basis of the deposits alone, with significant profitability coming if the consumer travelled more than 5,000 miles per annum.

From an SCP perspective, this business model has some affinity with other Product Service System concepts. The consumer is faced with a more accurate reflection of the marginal cost of motoring, and may therefore be expected to adjust their travel behaviour accordingly. The refresh process keeps cars in circulation for much longer, reducing the need to build new ones, while the business model enables the company to earn revenues from managing the fleet of cars in use rather than from production per se.

The proposal was not pursued in the end, mainly because it was felt to be too far away from the existing core business of the petroleum company and would potentially bring the company into competition with their (vehicle manufacturer) customers.

5.4 GM Autonomy

Even the vehicle manufacturers have shown potentially radical ideas – an example being the GM AUTOnomy. Designed by a small team within GM, the brief was essentially to reinvent the automobile in the light of the fuel cell and drive by wire. The vehicle is split, with a running chassis upon which a separate body can be mounted. The chassis contains the fuel cell and all related powertrain components, as well as the physical and electronic docking points for the body. With drive-by-wire there is scope for the redesign as demonstrated by the Hy-wire concept vehicle (GM, 2003).

The interesting feature of this car is the manufacturing and market strategy potential it contains. In interviews, GM outlined the idea that the skateboard chassis could be manufactured in very high volumes in a centralised facility, and then distributed out to localised assembly points where the rest of the car could be assembled, quite possibly by third parties. The ability to swap the upper body elements, including for example the seats, instruments and steering wheel means that the vehicle could be changed in configuration during its useful working life.

Given the financial difficulties besetting GM, and the technical challenges of developing viable fuel cell vehicles, it is perhaps unsurprising that this concept has yet to reach the market. On the other hand, ideas like this may be adopted in part in the future, and in any case illustrate how new technologies can offer the potential to redesign the product itself and the manufacturing system.

6 Overall conclusion

If nothing else, the above examples illustrate the point that the emergence of new businesses and new business models to usher in the era of SCP is far from unproblematic. At the same time, the pervasive contemporary business model in the automotive industry is itself a significant impediment to change and hence a significant reason why innovative technologies in the broadest sense have not yet emerged. There is no absolute reason why the current automotive industry cannot itself generate both the novel technologies

themselves, and the novel approaches to the market that could presage the end of over-production and over-consumption. The GM Autonomy case is at least illustrative that even the largest vehicle manufacturers can arrive at imaginative solutions.

The examples have also been selected to illustrate the diverse character of business model and new technology combinations that are possible. Indeed, perhaps the future is one in which there is no one single dominant business model but several coexisting. Hence the examples show different sorts of company seeking to redefine the automotive mobility 'space', ranging from entrepreneurial new entrants (MDI; Th!nk), a mainstream incumbent (GM), and a large company with a major interest in contemporary patterns of mobility (Petrolco). The examples show varying degrees of technological innovation, and indeed quite different solutions to the problem of sustainability in this sense, with fuel cell vehicles (GM), battery electric (Th!nk), and compressed air (MDI) while one (Petrolco) shows no change in motive power technology at all. Again, three of the examples (GM, Th!nk, and MDI) show various solutions to body engineering that are more suited to low-volume production. The examples also illustrate to varying degrees an attempt to redefine the nature of the value creation process, taking the 'vehicle manufacturer' beyond mere manufacturing and into product service systems in which the car becomes a corporate asset to be supported through many years of use and several iterations of customer. These dimensions are important because the they represent ways of breaking the over-production problem.

The paper has not greatly discussed the question of value capture, and the extent to which alternative business models may enable the terms of competition to be changed. At one level, the evidence so far is that none of these alternatives have made it to the market, and therefore the logical conclusion is that they are not competitive. This is perhaps unfair on the alternative models discussed here, or of others that could have been raised in the paper but were not. It is however suggestive of the two critical problems blocking the introduction of alternative business models: finance, and customer acceptance. The first problem is probably amenable to solution, providing the business can be structured correctly. The second is more challenging, because consumers have for years been 'told' to define motoring in the terms offered by the mainstream automotive industry. Expectations in this sense can be very powerful, and can over-ride the logical analysis of the merits of the product or the product – service offering.

As ever, more research is needed.

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Chapter 28 Marketing in the Age of Sustainable Development

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1 Marketing: Part of the Problem or Part of the Solution?

Marketing in the twenty-first century will look different from marketing in the past century (Belz 2006). The natural environment will shape future marketing – aside from globalisation as well as information and communication technologies. The overall impact of human activities on the natural environment is the result of three factors: population, consumption per person and technology. This can be expressed through the *IPAT-formula* (Ehrlich and Holdren 1971, p. 1212-1216): Impact = Population x Affluence x Technology.

Population is the total number of people living on earth. The world population grew from 2.5 billion in 1950 to 6.5 billion in 2005 and is projected to grow to 9 billion by 2050 (United Nations 2005, p. 1).

Affluence relates to the amount each person consumes. Based on the consumption per capita three classes can be distinguished on a global scale: the poor, the middle, and the consumers (Durning 1992, p. 26-36). The consumer class includes all households whose income per family member is more than $7,500. They live in climate-controlled, heated buildings, equipped with refrigerators, clothes washers, dish washers, and many other electric-powered gadgets. They dine on meat and processed, packaged food, and imbibe soft drinks and other beverages from disposable containers. The dominant modes of transportation in the consumer class are automobiles, and increasingly airplanes. The members of the consumer class enjoy a kind of material lifestyle never ever experienced before in the history of mankind. The "democratisation of consumption" started in North America and expanded to Western Europe and Japan in the past half century. Since the 1990s the consumer culture has been spreading over the world. According to the latest estimations 1.7 billion people belong to the global consumer class, which is about a quarter of the present world population. Although most consumption spending still occurs in more developed regions, the number of consumers increases in less developed regions. Almost half of the global

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consumer class lives in developing countries (Gardner et al 2004, p. 4-8). If the same levels of consumption that several hundred million of the most affluent people enjoy today were replicated across the world tomorrow, the impact on water supply, air quality, climate, biodiversity, and human health would be severe. Thus, the ecological question is also a social question of resource equity in a global world with limited resources (Wuppertal Institut für Energie Klima Umwelt 2005). As resource scarcity increases due to world population growth and the rise of the global consumer class, equitable distribution of natural capital, goods and services becomes more difficult and makes conflicts over oil, natural gas, water, and arable land more likely.

Technology determines the amount of resources used to produce each unit of consumption (input side), and the amount of waste or pollution generated by each unit of consumption (output side). A shift from non-renewable resources to renewable resources and an increase in resource productivity and energy efficiency by "Factor 4" (von Weizsäcker et al. 1998) to "Factor 10" (Weaver and Schmidt-Bleek 2000) are contributions to reduce environment impact. This requires process, product and service innovations as well as system innovations (Elzen et al 2000). Higher resource productivity and energy efficiency in developed countries due to new technologies may enable less developed countries to get their fair share of resources, fulfil basic human needs and lead a life of dignity. Therefore, an increase in resource productivity and energy efficiency is also an essential contribution to equity, security and peace in the world.

What are the links between marketing and the IPAT-formula? Which role does marketing play, when it comes to population, affluence and technology? Marketing has relatively little direct effect on population. However, marketing does have an influence on both the level of affluence and the technology which creates it (Peattie 1995, p. 49). In this respect marketing plays an ambivalent role: On the one hand it promotes a consumer society and materialistic lifestyles, which impose problems on the social and natural environments. On the other hand marketing helps developing and diffusing sustainability innovations to make the revolution of resource productivity and energy efficiency come true. Furthermore, sustainability marketing can facilitate new lifestyles, which are less materialistic and more sustainable. Insofar, marketing is not just a problem, but it may be part of the solution as well.

2 Definition of Sustainability Marketing

Marketing is generally defined as building lasting and profitable customer relationships (Kotler and Armstrong 2004, p. 5). Far from "telling and selling", modern marketing analyses customer needs and wants, develops products that provide superior value, and prices, distributes and promotes them effectively to selected target groups. Two core marketing activities are attracting new customers by promising superior value and keeping current customers by delivering satisfaction. Since many consumer goods markets in developed countries are stagnating, there has been a shift from attracting new customers and generating sales to retaining current customers and building long-lasting relationships, i.e. from transaction marketing to relationship marketing (Christopher et al 1991).

Sustainable development is a kind of development that meets the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987, p. 24-25). Meeting the needs of the present means intra-generational equity, i.e. equality between North and South, the more affluent and the less affluent. Considering the needs of future generations implies inter-generational equity, i.e. equality between one generation and another. Sustainable development requires meeting basic human needs of all: clean water, enough to eat, shelter, sanitation, schools and transportation. Meeting basic human needs may lead to a new era of economic growth for nations in which the majority is poor. Global sustainable development implies that those who are poor get a fair share of resources and that those who are more affluent adopt lifestyles which need less resources and energy. Sustainable development is a process while sustainability is the possible outcome and ultimate aim. Sustainable development is a process of change, which is neither easy nor straightforward. Sustainable development deals with trade-offs, continuously balancing economic, environmental and social goals in a responsible way. In marketing, these kinds of conflicts and trade-offs become more obvious than in any other business function.

Sustainability marketing goes beyond conventional marketing thinking. If marketing is about satisfying customer needs and building profitable relationships with customers, sustainability marketing may be defined as building and maintaining sustainable relationships with customers, the social environment and the natural environment. By creating social and environmental value, sustainability marketing tries to deliver and increase customer value. Sustainability marketing aims at creating customer value, social value and environmental value. Similar to the modern marketing concept, sustainability marketing analyses customer needs and wants, develops sustainable solutions that provide superior customer value, and prices, distributes and promotes them effectively to selected target groups. Throughout the whole process sustainability marketing integrates social and ecological aspects.

Sustainable marketing is *not synonymous* to sustainability marketing. In everyday language the term “sustainable” means durable, long-lasting, or ever-lasting. Hence, sustainable marketing is often interpreted as a kind of marketing, which builds long-lasting customer relationships effectively – without any particular reference to sustainable development or consideration of sustainability issues. That is why the term sustainable marketing might be misleading and is not used here.

Green marketing (Charter and Polonsky 1999; Ottman 1998; Peattie 1992), *eco-marketing* (Belz 2001; Meffert and Kirchgeorg 1998) and *environmental marketing* (Coddington 1993; Peattie 1995; Polonsky and Mintu-Wimsatt 1995) are concepts closely related to sustainability marketing. Developed during the 1990s, these concepts mainly focus on the natural environment. They deal with the integration of ecological aspects into conventional marketing thinking. Sustainability marketing goes beyond eco-marketing insofar, as it also considers the social dimensions – besides ecological and economic aspects.

3 Conception of Sustainability Marketing

The managerial approach of sustainability marketing differentiates six steps as depicted in figure 1 (Belz 2005 and 2006). The first two steps begin with an analysis of the company's situation. In sustainability marketing it is crucial not just to know consumer needs and wants, but also to find out about the ecological and social problems of products along their whole life cycle from cradle to grave. The intersection of socio-ecological problems and consumer wants sets the ground for sustainability marketing. It indicates new market opportunities for innovative companies. Steps three to five describe the implementation of sustainability marketing. Social and ecological criteria are fully integrated into the mission statement, strategies and marketing-mix. Hence, sustainability marketing moves from analysis to action. Step six is one of the special characteristics of sustainability marketing. It is about the commitment of companies to sustainable development and their active participation in public and political processes in order to change the existing framework in favour of sustainability. In the following the six steps of sustainability marketing are presented and discussed in some more detail.

Figure 1: Conception of Sustainability Marketing (Belz 2005, p. 3)

3.1 Socio-Ecological Problems

The point of departure in sustainability marketing is the thorough analysis of social and ecological problems, generally and specifically regarding products, which satisfy customer needs and wants. Here the whole *product life "from cradle to grave"* has to be taken into account, i.e. the extraction of raw materials, transportation, production, distribution, use, recycling, and disposal. *Qualitative* and *quantitative life cycle assessments* are complementary methodologies to analyse the impact of products on the

social and natural environments (Fuller 1999, p. 56-72). Life Cycle Assessment (LCA) is a quantitative method for calculating the impact of a product on the natural environment and human health (SETAC 1991). The socio-ecological impact matrix is a qualitative instrument of life cycle assessment (Belz and Hugenschmidt 1995). It identifies and categories the main social and environmental problems of a product along the whole life cycle on the basis of ABC analysis.

The relevance and importance of social and ecological issues vary from one product category to the other. Take, for instance, houses, which fulfil human needs for shelter and living and which are one of the most important elements in the environmental load of private consumption (Nijdam et al 2005, p. 147-168). The main product life cycle phases of houses are planning, resource extraction, transportations, construction, use and final demolition. The relevant environmental and social dimensions include resources, energy, air, water, soil, waste, ecosystems, health and equity. The planning and design of the house has little direct impact on the environmental and social environments. However, indirectly it does have a great impact. In this phase of the product life cycle architects and planners decide in co-operation with builders, how large houses are, which materials are used, how well-insulated the walls and ceilings are, and which kind of equipment is employed to control the climate of the building. The decisions in the first phase influence the impact of the following phases to a large extent, especially in the usage phase, which is of special importance. Living houses have a comparatively long lifetime. The energy consumption for controlling the climate of the house is ten to twenty times higher than the "grey energy", i.e. the energy used to produce the materials and build the house. A large amount of the energy consumption is spent on heating and cooling the house (OECD 2002, p. 46). The rest of energy consumption is for water heating, lighting and cooking. The larger a house is the more resources it needs – both in construction and during operation. Since the 1970s the energy efficiency of living houses has been improved due to better insulation of walls, ceilings and windows. However, increasing living space per capita and rising comfort needs partly compensate the energy efficiency gains (Wilson/Boehland 2005, p. 277-287). Another environmental problem is the high use of fresh water in private households, especially in OECD countries, ranging from 100 to 300 litres per capita per day (OECD 2002, p. 48-52). From a health point of view, pollutants in building materials may influence the air quality inside and have toxic-allergic effects on inhabitants. From a social point of view, the lack of affordable apartments in urban areas is important, especially in European cities. Families with children and less income are often forced to live in suburban areas. If the family members work in the urban area, they are forced to commute each day, leading to social stress and causing ecological problems. Here it becomes clear, that living and moving are closely linked to each other. The main problems in the end of the product life cycle are the vast amounts of demolition wastes, which partly contain toxic substances. If dumps leak, there is the long-term danger of soil and ground water pollution, causing health problems.

Such life cycle assessments become increasingly important for marketing decision makers. These approaches and instruments become valuable sources of insights into the impacts of products and provide relevant information for marketing decisions. Neglecting the impact of products on the social and ecological environments is risky for business and brands;

knowing the impact of products opens up new perspectives and market opportunities.

3.2 Consumer Behaviour

Consumer behaviour includes the purchase, use and post-use of products. The main body of marketing literature is primarily concerned with the first stage, the process and act of purchasing (Kotler and Armstrong 2004, p. 178-205). In the context of sustainability, all three stages of consumer behaviour are important. Many significant contributions that consumers can make towards environmental and social quality come in product use, maintenance and disposal, or in delaying a purchase, or avoiding it altogether (Peattie 1999, p. 66). *Sustainable consumption* considers ecological and social criteria during all three stages, i.e. the purchase, use and post-use of products. It responsibly balances ecological, social and economic criteria, which is neither an easy nor straightforward task for consumers.

When a customer has a choice between two or more product alternatives, he or she will take the offer, which promises the highest perceived value – a customer's evaluation of the difference between all the benefits and all the costs of a marketing offer relative to those of competing offers. Customers do not judge product benefits and costs accurately on an objective basis. They act on perceived value, which may differ largely from one customer to the other (Kotler and Armstrong 2004, p. 17).

As shown in figure 3 there are four different kinds of product *benefits*: The basic benefit is the function of the product. Additional benefits are self-esteem, recognition, and edification from doing-it-yourself. Take, for example, a sports car: Such a car is far more than a mode of transportation (use benefits). It is prestigious and stylish, thus filling the owner with pride (self-esteem) and raising his popularity (recognition). Tuning the car is great fun for fanatics uplifting their spirits (satisfaction). The evaluation is not complete without considering the *costs*, which go beyond the price of a product. Purchase costs, usage costs, and post-usage costs have to be taken into account as well. Purchase costs include the costs for searching a product (search costs), gathering information on prices, specific features and comparing it to alternative marketing offers (information costs), and finally getting the product (transportation costs). Usage costs are often underestimated and not taken into account at the moment of purchase. In the case of long-lasting products such as houses, cars, washing machines, and refrigerators, a considerable amount of money is paid for energy during the usage stage. Life cycle costs are often underestimated by consumers. However, in times of rising resource and energy prices life cycle costs become increasingly important (Belz 2001).

The individual perception and evaluation of benefits and costs is based on a number of personal and situational factors such as socio-ecological awareness, socio-ecological knowledge, disposable income, peer group, and purchasing situation. Based on individually perceived benefits and costs three different groups can be differentiated: Socio-ecological actives; those that can be socio-ecologically activated; and socio-ecological passives (Belz 2001, p. 79). The first group has a very high level of socio-ecological consciousness (*"socio-ecological active"*). From their point of view, social

and environmental product features go along with a lot of self-esteem and recognition. That is why they are willing to make compromises with other product benefits and/or accept higher costs. Usually, this group is rather small and represents the innovators of sustainable products. The second group has a high level of socio-ecological consciousness ("*those, that can be socio-ecologically activated*"). They associate social and environmental product features with some self-esteem and recognition. The members of this group are often willing to pay a higher price for the perceived value added, but they are reluctant to make any compromise when it comes to the quality of the product. To a certain extent, this group is open for sustainability innovations. They represent the adopters. The third group is not particularly conscious about social and ecological issues (*"socio-ecological passive"*). Socio-ecological product features are not perceived as value added. Thus, this group is not willing to make any compromises with respect to performance or price. They represent the average consumer and the laggards of sustainability innovations. This kind of differentiation is rather general, but gives a good first insight into the target groups of sustainability products and markets.

Consumer behaviour is not necessarily consistent with respect to social and environmental issues. It is rather product and context specific. One and the same consumer may pay a lot of attention to socio-ecological criteria in one area (e.g. food), whereas in another he or she does not care about it at all (e.g. automobiles, leisure). If social and ecological aspects are entangled with individual benefits such as taste, health etc., they have a good chance of being marketed successfully.

In sum, marketing sustainable products successfully means taking all benefits and costs from the customer's point of view into account. If sustainable products have a higher perceived value than conventional products, they will be bought and used.

3.3 Normative Sustainability Marketing

In the beginning of the twenty-first century many companies claim to be committed to sustainable development, assuming economic, ecological and social responsibility. Multinational corporations as well as small- and medium-sized companies explicitly express their commitment towards sustainability. As one critic sarcastically says: "It would be a challenge to find a recent annual report of any big international company that justifies the firm's existence merely in terms of profit, rather than 'service to the community'. Such reports often talk proudly of efforts to improve society and safeguard the environment – by restricting emissions of greenhouse gases from the staff kitchen, say, or recycling office stationary – before turning hesitantly to less important matters, such as profits (Crook 2004, p. 3)". No doubt, there is a grain of truth in this critical remark. Nevertheless, *corporate sustainability statements*, *guidelines*, and *principles* are vital normative foundations for sustainability marketing, if the company and its employees live up to it. It is signalling to build up reputation and trust, both internally and externally: On the one hand sustainability statements and guidelines may help marketing management and employees in strategic and operational decision making. On the other hand they send signals to society

and market partners along the whole product chain to strive for sustainability.

Well-intended corporate sustainability statements and codices are of little use, if they are not integrated in the goal-setting process. Sometimes ecological, social and economic *objectives* are complementary. The win-win-win rhetoric is based on this assumption and presents some anecdotal evidence for such instances. However, in many cases there are trade-offs between ecological, social and economic objectives, which have to be carefully and responsibly solved by decision makers. Finding the right balance between ecological, social and economic goals is a demanding challenge and a continuous process. It also depends on institutions: The more institutions are in favour of sustainability and the more external effects are internalised, the easier it is for decision-makers in marketing to balance the triple bottom line. The socio-ecological objectives in sustainability marketing can be qualitative (e.g. the enhancement of renewable energies) or quantitative (e.g. 20% of the total revenue with renewable energies in 2020). It is problematic if these aims are counterbalanced by evaluation and income systems based on short-term profits.

3.4 Strategic Sustainability Marketing

On the strategic level of sustainability marketing there are a number of issues to consider for marketing managers: innovation, segmentation, targeting, positioning, and timing. *Sustainability innovations* are a condition sine qua non in successful sustainability marketing. Examples of sustainability product and service innovations are passive houses, solar cells, organic food products, fair trade products, hybrid cars, and car sharing. If these kinds of sustainability innovations are developed, which are the main target groups? Which role do social and environmental aspects play in positioning? What is the unique sustainable selling proposition (USSP)? When is the right moment in time to enter the market with sustainable innovations?

There are at least three possibilities in the *positioning* of sustainable products and services. Firstly, the socio-ecological dimension plays quite an important role and is communicated as the primary benefit of the product or service, whereas performance and price are secondary. Secondly, the socio-ecological dimension plays a significant role, but it is not predominant. It is treated equally to performance and price. Thirdly, the socio-ecological dimension is an integral part of quality and performance. The sustainable positioning depends on a number of influencing factors such as consumer preferences, competitive offers, brand assortment, and company size. The first positioning may be suitable for smaller sustainability pioneers following a niche strategy and aiming at the socio-ecological active customer group. Since the sustainable niche is rather limited, it is seldom a viable option for medium-sized or large companies. The second positioning aims at those that can be socio-ecologically activated. If companies manage to combine the socio-ecological dimension with classical buying criteria such as taste, freshness, design, durability and so on to “motive alliances”, this customer group is open for sustainability innovations. In many markets they represent an important, growing segment. The third positioning is appropriate for companies, which aim at the mass market. The social and environmental

performance of a product is taken for granted and is not necessarily communicated to the consumer.

Many consumer goods markets are characterized by polarization, i.e. the lower price segment and the upper quality segment gain significance and market shares, whereas the middle segment erodes. Customers either demand low-priced products with good value *or* they ask for high quality products and premium brands, which promise a high value added. Which consequences does the market polarisation have for positioning of sustainable products? An obvious opportunity is to position socio-ecological innovations in the quality segment. Take for example, organic and natural reform stores, which put a lot of emphasis on socio-ecological aspects targeting at the socio-ecological active customer group. Large organic retail chains like Whole Foods Markets in the USA and Basic in Germany try to appeal to a broader customer group. Their stores are located in urban areas and offer a wide assortment of organic and natural food products. They mainly appeal to those that can be socio-ecologically activated. The two retail chains grow in stagnant food markets, which are characterised by fierce price competition and substitution competition. Another viable positioning strategy for medium-sized and large companies is multi-segment-marketing with a clear multi-brand-concept. Take, for example, Migros, the largest food retailer in Switzerland, which offers two different retail brands: "M-Bio" is positioned in the premium segment and fulfils the high quality standards of controlled, certified organic farming, whereas "M-Budget" is clearly positioned in the price segment. For non governmental organisations (NGOs) it is important to attach importance to the quality as well as to the price segment to upgrade socio-ecological product standards. Due to the public pressure, the Swedish furniture retailer IKEA was made to pay attention to sustainability issues in purchasing and pre-production (IKEA 2004). Similarly, the Swedish textile retailer H&M assumes social and ecological responsibility along the whole textile chain (H&M 2004). Both companies are positioned in the price segment and aim at price-sensitive consumers. These are the socio-ecological passives, which are hardly willing to pay a higher price for socio-ecological benefits. By means of the public pressure the customers of IKEA and H&M get a socio-ecological value "for free". From the viewpoint of companies under scrutiny, the main aim is keeping brand image and corporate reputation, not so much socio-ecological differentiation.

Sustainability marketing is usually targeted at the global consumer class in developed countries. However, sustainability marketing may be applied to the less affluent and fortunate, too. *Sustainability marketing for the poorest of the poor* (Kirchgeorg/Winn 2006) is based on the "Bottom of the Pyramid" approach (Prahalad 2005) and re-conceptualises global poverty as an attractive opportunity for growth, which helps satisfying basic human needs and leading a life in dignity. These new business models and marketing concepts aim at the poor, which live on less than $700 a year per family member, i.e. less than $2 a day. The focus in this type of sustainability marketing is not so much the environmental dimension, but the social dimension.

Besides targeting and positioning, the question of *timing* is important: When is the right moment to introduce sustainable innovations to the market? Is it worth entering the market at an early stage and leading the

market? Or is it better to wait and follow at a later stage depending on the growth and market development? If companies enter the market at an early stage and the technological innovations are not yet perfected or the consumers are not sensitive to the sustainability issues at hand, the main challenges consist in continuous product improvements and consumer education (= primary market entry barriers). If companies enter at a later stage and the leading company has already established the reputation of a socio-ecological pioneer and gained significant market shares, the main challenge is rather about fighting the competitor, not so much about informing the consumer (= secondary market entry barriers). A good example for an early entry and a successful pioneer strategy is Toyota and its hybrid car "Prius", which literally means "to go before". The Toyota Prius is a hybrid car combining the power of a gasoline engine with the efficiency of an electric battery. The electric motor starts the car and operates at low speed. At higher speed the Prius automatically switches to the gasoline engine. Under normal driving conditions, the hybrid runs at 4.3 litres per 100 kilometres and emits 104 grams CO_2 per kilometre – much less than most petrol and diesel cars. The Prius looks stylish and comfortably seats five. It combines environmental performance with power, convenience, and safety. Between 2003 and 2005 the annual sales of Toyota hybrid cars quadrupled from 53,000 to more than 210,000 units, partly due to the rise of gasoline prices.

3.5 Operational Sustainability Marketing

Once a company has decided on its overall sustainability marketing strategies, it is ready to begin planning the details of putting it into practice. To implement the sustainability marketing strategies, a comprehensive marketing mix has to be developed. The marketing mix first proposed by McCarthy (1960) consists of "four Ps", namely product, place, price, and promotion. The classical concept of the four Ps takes the seller's point of view. In the age of customer relationships the four Ps might be better described as the "*four Cs*" consisting of customer solutions, convenience, customer cost and communication (Lauterborn 1990, p. 26; Kotler and Armstrong 2004, p. 58). This concept takes the buyer's instead of the seller's viewpoint and is well suited for the idea of sustainability. "Products" tend to put an emphasis on tangible goods, whereas "customer solutions" include products as well as services, i.e. intangible goods, which satisfy customer needs, substitute tangible goods and reduce environmental impact. "Place" stresses the physical distribution of goods, whereas "convenience" makes marketers aware, that customers want to get products or services as conveniently as possible. "Price" only takes the amount of money into account the buyer has to pay to obtain a product or service, whereas "customer cost" considers the whole life cycle cost (price, transaction cost, usage cost, and disposal cost), which is important in times of rising resource and energy prices. "Promotion" means one-way communication from the seller to the buyer, whereas "communication" is both ways, which is essential to build trust and credibility.

Customer Solutions: In the heart of the sustainability marketing mix are sustainable products and services, which may be defined as products and services that satisfy customer needs and that significantly improve the social and environmental performance along the whole life cycle in comparison to

conventional or competing offers (see for a similar definition Peattie 1995, p. 181). This definition has the following characteristics.

- Customer satisfaction: If sustainable products do not satisfy customer needs, they will neither survive nor thrive in the market economy.
- Dual focus: Unlike "green" products, sustainable products have a dual focus on social and/or environmental performance.
- Life cycle orientation: Sustainable products have to take the whole life cycle from cradle to grave into account, i.e. extraction of raw materials, transportation, manufacturing, distribution, use, and disposal.
- Significant improvements: Sustainable products have to make significant contribution to the main environmental and social problems analysed and identified with instruments of life cycle assessment.
- Continuous improvement: Sustainable products are not absolute measures, but relative in dependence of the status of knowledge, latest technologies and societal aspirations, which change over time. A product that meets customer needs and that has an extraordinary social and environmental performance today, may be considered standard tomorrow. Thus, sustainable products have to be continuously improved regarding customer, social and environmental performances.
- Competing offers: A product that satisfies customer needs and that proposes environmental and social improvements may still lag behind competing offers. Thus, the offerings by competitors are yardsticks for improvements with regard to customer, social and environmental performances.

Often a sharp distinction is made between tangible products and intangible services. However, all products include some kind of services and all services require some tangible elements (Heiskanen and Jalas 2003; Halme et al. 2005, p. 4). Basically, there are three kinds of sustainable services: Product-oriented services, use-oriented services and result-oriented services (Hockerts 1999; Halme et al 2005, p. 6-9). Product-oriented services are usually after sales services like repair, maintenance, upgrading, or take-back of the product. Such offerings might be interpreted as extended producer responsibility, i.e. the company takes responsibility for the product beyond sales in the downstream phases of use, reuse, recycling and disposal. Use-oriented services are services that sell the use of a product. The product itself remains in the property of the producer or provider of the use-oriented services. Examples for this kind of service are car sharing or launderettes. Result-oriented services deliver the result of a performance. Take, for example, taxi rides, public transportation, and textile care centres. In these instances the customer neither owns nor uses the product. He or she receives the "fruits" of product-service combinations.

Convenience: Many sustainable products and services are not distributed widely, which is one of the reasons why they remain in niches. They are only available in special shops or via mail, which is highly inconvenient for the majority of potential customers. If sustainable products and services are aimed at larger market segments or mass markets, they have to be made widely available by "multi-channel marketing", i.e. direct distribution, online shops, speciality shops, retailers, and so on. In the context of sustainability marketing for the poorest of the poor, new ways of distribution

networks have to be invented and implemented. The mode of transportation is important from an environmental point of view. Generally spoken, ships and trains are more environmentally benign than planes, trucks and lorries. The question of convenience is also crucial for "retro-distribution", i.e. the collection of packaging and products at the end of life. To make consumers bring back the used packaging and products, it has to be as convenient and cost-efficient as possible. Often retailers are good points of return.

Customer Costs: In many advertisements the price is used as a key argument to entice consumers buying the product. However, in addition to benefits, total customer costs have to be taken into account by companies offering sustainable products and services. This includes costs of purchase, use and post-use. Some customers, for instance, may be willing to pay a premium price for organic food products, but they may not be willing to "walk the extra mile" and visit the alternative shop in the other end of the city instead of the super market around the corner. Most customers are responsive to consumer goods prices, but few are aware of the total life cycle costs, especially costs during the usage phase (e.g. water and energy consumption costs in the case of washing machines). In times of rising resource and energy prices, these kinds of costs become increasingly important. In addition to that it is the task of marketers to make consumers conscious of total life cycle costs by comparing sustainable products and services versus conventional ones. Take, for example, Mobility CarSharing as the world's largest car sharing organisation: It makes customers aware of the total costs of private car ownership and uses it as an argument in advertising (Belz 2000).

Communication: Social and environmental qualities are often credence qualities, which cannot be inspected prior to the purchase or experienced after the purchase (e.g. organic farming or fair trade). Thus, the consumer has to trust the information provided by the producer or a third party. That is why credibility and trust are of special importance in the markets for sustainable products and services. Possible ways to inform the consumer and overcome scepticism are: personal declarations by the owner, voluntary self-bindings, the use of third-party labels and partnerships with governmental as well as non-governmental organisations (Karstens and Belz 2006). On the one hand companies have to inform consumers in a simple and credible way about the sustainability issues at stake. On the other hand companies have to animate consumers to get their attention. This describes the "communication paradox" of sustainable products and services between information and animation, which have to be balanced continuously.

3.6 Transformational Sustainability Marketing

Transformational sustainability marketing is about the active participation of companies in public and political processes to change institutions in favour of sustainability (Belz 2001, p. 91-99). First of all, there is a *normative rationale* for such an endeavour. Many owners of family businesses and some managers feel obliged to society and want to be good citizens. Besides, there is also a *strategic rationale*: Within the present institutional framework the successful marketing of sustainable products or services is possible, but limited in width and depth. The institutional design fails to set positive incentives for sustainable behaviour, both for producers

and consumers. On the contrary, it allows – and often even enhances – unsustainable behaviour. That is why changes in institutions are necessary to expand the intersection between socio-ecological problems and consumer behaviour, and to set up the conditions for the successful marketing of sustainable products beyond niches. Sustainability pioneers and leaders can participate in *enlightened self-interest* changing the public and political institutions and thus enhancing sustainable development (Bendell and Kearins 2005, p. 376-378). They can help developing the free market system towards a socio-ecological market system on the global level. The more social and political institutions favour sustainable consumption, the easier it is for companies to market sustainable products beyond niches.

The *objectives* of transformational sustainability marketing are to initiate institutional changes, which either set positive incentives for the purchase and use of sustainable products, or which set negative incentives for the purchase and use of conventional products. *Examples* of transformational sustainability marketing are: voluntary agreements of socio-ecological industry minimum standards, development of sustainability labels in co-operation with non governmental organisations (NGOs), public support of companies for the ratification and implementation of the Kyoto protocol, etc. Here it is important to note, that transformational sustainability marketing is not simply another form of lobbying enforcing corporate and business interests. It is about the true commitment of companies to sustainable development and their active participation in public and political processes. It is a discourse with stakeholders to realize institutional frameworks for a market system that is stable, fair, and just, serving the vital purposes of human beings and good life (Ulrich/Maak 1997, p. 33-35). It remains to be seen and analysed, which companies truly support such an endeavour and to which extent it is possible in a global market system and fierce competition.

4 Special Characteristics of Sustainability Marketing

If we compare sustainability marketing to classical approaches of marketing, in which respect does one differ from the other? What is distinctive about sustainability marketing? There are at least six characteristics of sustainability marketing as compared to conventional marketing (Belz, 2005, p. 21-22):

- *Socio-ecological problems:* The analysis and identification of ecological and social problems are points of departure in sustainability marketing. Social and ecological aspects are integrated throughout the whole process of sustainability marketing.
- *Intersection:* Social activists with big hearts put a strong emphasis on the solution of socio-ecological problems, but widely neglect consumer wants and demand. They follow a kind of anti-marketing or alternative marketing approach. Mainstream marketing mainly focuses on consumer demand overlooking the social and ecological environments. Sustainability marketing tries to find solutions to the socio-ecological problems and at the same time meet customers demand.
- *Normative aspects:* Sustainability marketing aims at sustainable and profitable relationships with customers, the natural environment and the social environment. Besides common marketing goals like sales, market

shares and profits, ecological and social objectives are taken into consideration and balanced in a responsible way.

- *Information asymmetries:* Social and ecological qualities of products are often credence qualities. That is why signalling, credibility and trust are essential in sustainability marketing.
- *Transformational aspects:* Within the existing framework, there are few economic incentives to behave in a sustainable way, both for producers and consumers. By engaging in public and political discourses and changing the institutional design in favour of sustainability, companies set the conditions for the successful marketing of sustainable products beyond niches.
- *Time aspects:* Classical marketing is focussed on sales and transactions. It is rather short-term oriented and has a bias towards the present. Modern marketing represents a paradigm shift from transactions towards relations. That is why it is called "relationship marketing". It aims at building lasting customer relationships in order to produce high customer equity. Sustainability marketing goes much further. It aims at building lasting relationships with customers, the social environment and the natural environment. Thus, long-term thinking and futurity are fundamental components of sustainability marketing (Peattie 1999, p. 58).

5 Conclusions

Marketing in the age of sustainable development is ambivalent: On the one hand marketing promotes a consumer society and materialistic lifestyles, which impose serious social and environmental problems. On the other hand marketing helps developing and diffusing sustainability innovations, which create customer satisfaction, while considering social and environmental aspects. The main *potential* of sustainability marketing lies in the promotion of sustainable products and services. Thus, sustainability marketing is mainly concerned with the technology part of the IPAT-formula and – to a lesser extent – with affluence. Sustainability marketing for the poorest of the poor focuses on the less developed countries. It is a marketing model to target new customers groups, which have been widely neglected by companies so far. It may enable the poor to lead a life of dignity and alleviate poverty. Having said that it is important to acknowledge the *limitations* of sustainability marketing: It is hardly suitable to solve the problems of world population, over-consumption and sufficiency. Furthermore, it is doubtful that sustainability marketing will bring about system innovations necessary to make a resource and energy revolution come true. Besides, the theory and practice of sustainability marketing tends to focus on sustainable products and services which are successful ("win-win-win rhetoric"). Seldom does sustainability marketing deal with failures of sustainable products and services. There are important lessons to be learnt as well. Despite these and probably other limitations sustainability marketing is a dynamic and fascinating field of research worth to be studied.

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Chapter 29 Integrated Product and Service Engineering – the IPSE project

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1 Background

In their search for business-differentiating strategies, manufacturing firms create value for customers by offering integrated products and services. As a result, several business concepts have emerged, such as Functional Sales (Lindahl and Ölundh 2001; Sundin *et al.* 2005b), Product-Service Systems (Goedkoop *et al.* 1999; Tischner *et al.* 2002; McAloone and Andreasen 2004; Tukker 2004) and Functional Products (Alonso-Rasgado *et al.* 2004). A common ingredient is that services are integrated into customer offerings, and that the service aspect is considered already in the design phase. Because of this, manufacturing companies, which have traditionally focused on their physical products, need to change their working procedures in the development phase. For manufacturing firms, it is a question of finding fruitful combinations of traditional product offerings with services that customers ask for. In this work, therefore, the term Integrated Product and Service Engineering (IPSE) will be used[78].

In fact, integrated product and service offerings are promoted from several perspectives, i.e. *economically*, *socially*, and *environmentally*, since sustainability is a key factor in all future development. One benefit of IPSE is that it promotes dematerialization and changed consumer behaviour in society. Integrated offerings in manufacturing firms tend to have a lifecycle perspective, from concept development and product realisation to service, maintenance and finally recycling. This generates opportunities for affecting consumption patterns, as well as product and service design exploited in close collaboration between buyers (users) and suppliers in the complete supply chain.

The aim with functional sales and IPSE is, from a lifecycle perspective, to offer and optimise a solution with a combination of products and services that satisfies an identified customer need (Lindahl and Ölundh 2001; Lindahl

[78] This term is meant to be used interchangeably with the term “Service Engineering”, used previously by the authors.

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and Sundin 2005; Sundin *et al.* 2005a), and at the same time increases the suppliers' competitiveness. Examples of companies that have developed functional sales include large organizations such as BT Products, Volvo Aero and ITT Flygt (Sundin *et al.* 2005a), as well as a number of small and medium-sized ones (Lagerholm and Öhrwall Rönnbäck 2003).

Despite this phenomenon being highly promoted in the environmental literature, there have been few research attempts made investigating just how to support manufacturing companies in realizing integrated offerings. Firms need support for developing services taking customer behaviour, economic aspects, organisational aspects as well as environmental aspects into consideration. This is crucial early in the development of a new concept. In our research project, "*IPSE – Integrated Product and Service Engineering*", we elaborate on a methodology and a software application to support firms in developing and visualising different aspects of integrated products and service offerings.

1.1 The environmental potential

An important aspect of the integrated product and service offerings is the potential of affecting and changing consumption patterns. The possibility increases for companies to improve the environmental performance of the use phase of products. When offering integrated products and services, the responsibilities for the supplier increase for the products during use and end-of-life handling. This creates economic incentives for suppliers to develop products in more economically and often environmentally beneficial ways. For manufacturing companies, this concerns saving resources, and if possible dematerialising solutions for customers and having a lifecycle perspective when developing offerings and solutions.

The supplier's focus on offering integrated products and services can be a driving force for developing new and innovative technical solutions. Offering integrated products and services has proven to be an important market channel for companies aiming to spread new technology to their customers. When developing new technology, however, it is important that companies consider environmental aspects from the beginning in order to be able to realise the potential environmental benefits. Our aim is that the IPSE methodology will offer support for companies to better consider market as well as environmental benefits.

1.2 Customer value creation and economic aspects

In the traditional sale of products, the income from sales is strongly connected to the customers' costs for the physical product and for maintenance and spare parts. Earlier research shows that when offering integrated product and services, a new mindset for how to secure the economic growth of companies needs to be developed (Ölundh 2003). When the suppliers maintain ownership and responsibility for the product during its lifecycle, income from for example maintenance costs become internalised at the supplier. In other words, instead of contributing to the profit, it burdens it. Different business logic is also needed with the formation of profit centres. A basic assumption is that the profit of the supplier is based on the value that the offerings create for the customer. By transitioning into offering more services, and by selling knowledge and performance for satisfying customer needs and thereby increasing the profit of the customer, the suppliers can increase their profit as well.

An important aspect to consider is that both the customer and the supplier will benefit economically from the solutions, making it a "win-win" situation. It also means that the terms of the contract between supplier and customer becomes increasingly important.

Specifically, the contracts must include more than the parts directly connected to the products such as services and performance.

Earlier research within the research team has pointed towards several driving forces for developing integrated product and service offerings. These include: forward integration in the value chain, creating value for the customer by offering services, creating closer and longer lasting relationships with customers, spreading new technology, and differentiating products with services.

1.3 Innovation potential

Integrated product and service offerings increase economic incentives for companies to change the design of the physical product used in offerings. When offering integrated products and services, there are two principal and important changes in the business logic: *(1) the costs for use and end-of-life handling are internalised for the supplier* and *(2) the products have economic value at end-of-life*.

Integrated products and services are often considered to be organisational innovations, and are not focused on changing the physical product. This means that the innovation potential is often focused on changes for the user and the system surrounding the product such as delivery, logistics, take-back systems and business logic.

Co-operation among actors within companies is a key factor for successful service development, product development, production and logistics. The actors need to have a close relationship in order to be able to realise the innovation possibilities when offering integrated product-services.

The view of the research team is that when offering integrated product-services the whole product system needs to be in focus, something which entails great changes for suppliers, customers and users. In Figure 2, four parts are presented whose innovation potential is important for suppliers to explore when developing integrated product and service offerings: *the physical product*, *the service*, *customer and user behaviour*, and *delivery and take-back systems* for products and services.

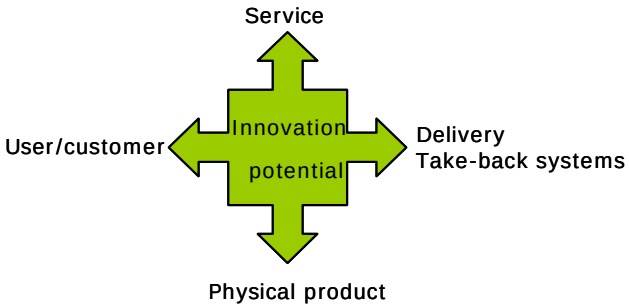

Figure 1. Areas of innovation potential important to explore when developing integrated products and services (Ölundh 2006).

2 Vision, aim and objectives of the IPSE project

2.1 Vision

In order to be able to develop products and services that lead to added value for customers, there is a need for companies to visualise and verify customer needs. Integrated product service offerings are context-dependent and specific for each company; even so, a generic methodology can support the work in the company as well.

Our vision is that offering integrated products and services can contribute to increased profitability for suppliers and increased economic profit for customers, together with more efficient and sustainable resource utilisation.

2.2 Aim

The aim of the IPSE project is to develop an IPSE methodology for efficient development and production of integrated product and service offerings.

2.3 Objectives

IPSE is based on a lifecycle perspective, meaning that a large part of the value chain is considered when optimising a solution, and that the focus on creating closed material loops is increased. There is a shift in focus from fulfilling customer needs by selling a physical product to satisfying customer needs by offering functions, services and performance.

The IPSE methodology aims *to create better prerequisites for firms to develop integrated product and service offerings that are gainful for the supplier firm, the customer, and for the society in large.*

This can be expressed as the following objectives:

- supporting innovative thinking when developing offerings,
- supporting internal and external communication,
- supporting development of technical solutions in offerings, and
- increasing the environmental performance of firms.

Identifying customer needs, performing concept generation and verifying demands with customers is part of both the development process and the IPSE methodology. Realisation of integrated products and services are related to the production phase. The aim is that the ISPE methodology will by actively used in the participating companies, and that an increased level of competitiveness will be reached.

3 The IPSE methodology

Kim and Mabourgne (1997) have shown that companies that are repeatedly successful as innovators with the ability to create value for their customers take their innovative potential from several perspectives, such as logistics and delivery of offers, products and services. Companies need to be open for whatever components in a solution need to change, and begin with the customer's requirements in mind. Understanding the customer's needs and values are crucial for companies to deliver satisfying solutions (Edvardsson *et al.* 2000).

The transition to functional sales places changing requirements on product and service development, production and on the suppliers' way of dealing with their customers. It is becoming increasingly important for companies to be able to combine different variants of products and services

that together provide a desired function. For a company with warehouse management, for example, it is not the individual forklifts that are of interest but rather how they work within a material handling system, and how one with the help of service and maintenance can guarantee accessibility.

For a company to be able to deliver effective functional sales, a requirement is that its value-creating processes and personnel competence are continuously developed (Brännström and Elfström 2002; Söderström 2004). This also applies partly to the organization of the company and partly to the development of the company's logistics as well as delivery of solutions such as reclamation of physical components for maintenance, repair or reconditioning. Our investigations (some of them financed by the Swedish Governmental Agency for Innovation Systems) show that the functional sales concept that exists today, in most cases, is taken from the company's marketing department and based on products optimized for traditional sales (Ölundh 2003; Sundin *et al.* 2005a).

Products and services must be developed and integrated in a good way to ensure a successful result. Today, a well-developed method for developing the functional sales concept is missing, that is to say one that considers and manages the development of business offers involving a combination of products and services in an integrated way (Hara *et al.* 2004; Sundin *et al.* 2005b). Brännström and Elfström (2002) have developed a product development model that shows that a well-developed service organization is needed. Shephard and Ahmed (2000) specifically point out that companies need secure and effective internal communication, and that they should be organized so that the solution for the customer can be delivered in a satisfactory way. This is opening up an entirely new research area, namely IPSE.

Traditionally, engineers have for the most part focused on improving the function of physical products. Within IPSE, however, the focus is not simply on the physical product's function, but rather on the entire customer offering. IPSE aims, through the addition of services, to increase the relative value of the physical products at the same time as the relative environmental impact decreases (Tomiyama 2001; Arai and Shimomura 2004), and to intensify, improve and automate the supply company's generation and delivery of services and service use. This means beginning with the customer's needs in mind, and thinking holistically in order to create effective business offers such as described in Normann and Ramírez (1993) "value constellation" concept.

The research is based on the research group's earlier work with Service Engineering and the Functional Sales concept, and has its origins in a lifecycle-based interactive design model for IPSE (see Figure 2). The model, which has been developed through discussions with companies in the project, illustrates areas that are critical in order to be able to create good functional sales concepts. We have concluded that these areas therefore should be considered in an IPSE methodology.

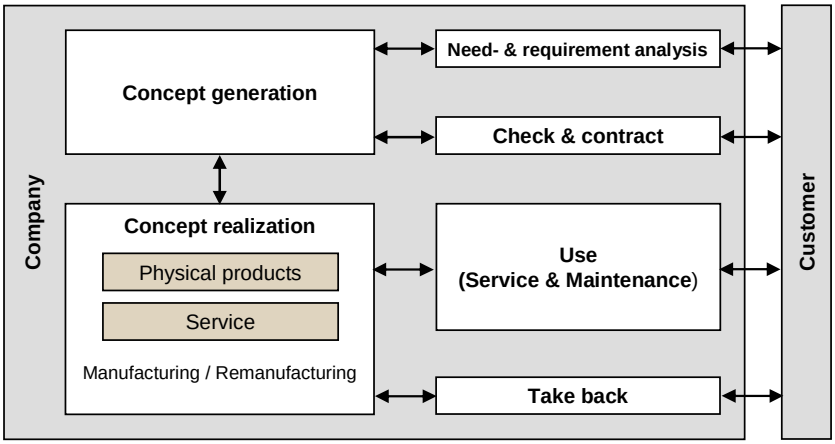

Figure 2. A lifecycle-based interactive design model for IPSE. The two-way arrows symbolize the important communication that must occur between the different activities and their actors (Lindahl *et al.* 2006).

The proposed IPSE method aims to increase the customer's perceived value (degree of satisfied need) of the offer (a combination of product and service) in relationship to the total lifecycle cost. At the same time, the method also aims to provide a reduced environmental impact.

The method consists of both analytical and synthesized sub-methods. Thus far, three sub-methods have been developed, as well as the software application Service Explorer (Arai and Shimomura 2004; Sakao *et al.* 2006b). The three sub-methods are modelling, evaluation (Arai and Shimomura 2005) and design (Sakao and Shimomura 2004; Shimomura *et al.* 2006) of service. These sub-methods have been developed and evaluated in several industrial cases (together with companies in Japan, Italy, Sweden and Germany), for example at a company that manufacturers forklift trucks (Lindahl *et al.* 2005) and at a hotel company (Sakao *et al.* 2006a).

Some of the sub-methods have the potential to be included in the current version of Service Explorer. The IPSE method can therefore become a powerful tool and thus support for companies that wish to design a functional sales concept. Through the implementation of carefully chosen parts of the method in a computer tool, advantages can be gained such as effective data and document management, risk management and probability calculations as well as improved decision support for service development (Roozenburg and Eekels 1995; Coyne 1998).

4 The IPSE software application

Suitable parts of the methodology will be embedded in a software application called Service Explorer. This software has been developed by our Japanese partner, the Shimomura Laboratory at Tokyo Metropolitan University (Hara *et al.* 2004).

The Service Explorer application for the IPSE methodology can be viewed as a prototype system of a computer-aided modelling tool for service design. Using this tool, designers can describe services and register them in a database. They can operate the service in the following ways:

- express a product and service model;
- edit the models, such as rerouting arcs among function units, changing attributes of function units, and so forth;

- evaluate the total service by means of assigning values to each of the components; and
- search for suitable product and service components in the database such as analogous services and partly-related services.

The current version of Service Explorer was developed using Java (Java2 SDK, Standard Edition 1.4.1) and XML version 1.0 in the Microsoft Windows XP Home Edition environment.

5 Research methodology

The study described in this paper is part of a two-and-a-half-year project. The study is based on an IPSE model that is described in Figure 2.

The study was designed as a double loop consisting of six steps. The first loop consists mainly of companies that have experience of working with integrated product and service solutions and which are interested in developing these further. This enables build-up of knowledge concerning the methodology. The first loop encompasses the three steps: (1) current state analysis and identification of needs and demands of the more experienced companies; (2) development of the IPSE methodology; and (3) application of the methodology in more experienced companies.

From the fourth step, the second loop begins. In this loop, small and medium-sized enterprises will be included. These companies lack experience and do not have an integrated product and service solution, but see this as an interesting possibility for development of the company in the direction towards integrated product and service offerings. The purpose of this loop is to test, adapt and verify that the methodology is useful and that it could support companies that are new to integrated product and service offerings. In Step (4), progress is made regarding the use of the methodology in more experienced companies, as well as a further development of the IPSE Methodology. In Step (4), a current state analysis is also made for the smaller and less experienced companies that are a part of the study. In Step (5), an implementation and test of the methodology is made, and in Step (6) an evaluation and verification of the methodology is made regarding the smaller and less experienced companies.

Based on the experiences at companies that already have started to develop integrated product and service offerings, knowledge can be generated. By also involving companies that are currently not working with integrated product and service offerings, a possibility arises to generate knowledge about the problems that they might encounter. Overall, the knowledge from these two groups of companies can be useful for the development of an IPSE methodology.

A major part of the data collection will be made by interviews. During the project, a series of seminars will be conducted with the companies. This series of workshops can be considered as a network for the exchange of experiences between the companies, and where they will have the possibility to learn from each other. The seminars are also an opportunity for reporting research results.

6 Discussion

The ambition is that the IPSE methodology will be integrated into the working processes in the participating companies. The methodology will be adjusted to fit the needs of each company.

The IPSE study can contribute to current research on integrated products and services by taking a more active part in the companies' work and actually provide a support methodology for realizing the shift to a more service-based society. This is an important step, since earlier research shows that companies have difficulties in managing the transition of their business rationales into including services. The IPSE methodology can in these cases be a support tool for visualizing what services and integrated offers to develop and, importantly, support the organization in analyzing the economic, environmental and organizational aspects. The methodology also supports companies in how to realize new offerings. As mentioned earlier, the objectives with the IPSE methodology are:

- to support innovative thinking when developing offerings;
- to support internal and external communication;
- to support the development of technical solutions used in offerings; and
- to increase the environmental performance of firms.

The project is expected to result in a methodology and a software application that supports companies in developing and realizing integrated product and service offerings. The methodology is expected to support the process of transforming customer requirements to the development of the physical product. The method shall also support requirements such as short time-to-market, as well as help visualize and simulate different concepts and support the cooperation between different actors in the company such as for example the design and sales departments.

Based on the above, the project also expects to result in an implemented and actively used IT-tool for the work of developing and realizing products used in integrated product and service offerings.

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Chapter 30 Product Service Systems as a Holistic Cure for Obese Consumption and Production

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1 Introduction

From the consumers point of view most of the problems regarding our consumption and production patterns belong to one of three categories, or a combination of them: 1) excessively consuming, 2) product-owning, and 3) throw-away culture. Firstly this paper identifies underlying causes of those behaviourally obese patterns from a social and cultural point of view. Interestingly, from the observation of the picture of consumption and production, several common factors between a physical obesity and the consumption patterns were recognized as listed below:

1. Substantial needs of consumption have been developed to be undesirable habits of immoderate and irrational consumption.
2. The habit is undermining the stability of health (environmental) system while not conceived.
3. Multi-dimensional treatment is recommended for a radical change.
4. Success stories and enabling strategies can motivate the participants of the cure programme.
5. Alternatives to the behaviour pattern need to be discovered and perceived attractive.
6. Feeders (providers) can be good curers and trainers, and they need to find good reasons to do so.
7. A long-term monitoring is necessary to prevent 'yo-yo' phenomenon.

In the context of these similarities we may be able to refer to the method of physical obesity treatment to learn about effective ways of shaping lean consumption and production figures. In this paper we suggest the need of multidisciplinary approaches enabling to achieve a higher level of sustainability. Among the multiple strategies, the potential of product service systems (PSS) is highlighted because of their holistic lifespan thinking and flexible way of addressing the underlying demands. PSS solutions which are

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tailor-made to meet individual demands will enable autonomous consumer decisions to head towards 1) moderately and rationally consuming, 2) use- and result-oriented culture and 3) resource circulating society. A few examples of PSS models and environmentally friendly products are introduced to demonstrate how those systematic solutions change the mindset of consumers and producers.

Due to the uncertainty of 'rebound effects' of PSS strategies, a careful and systematic planning is required as well as a long-term attention. Nevertheless, as the number of sustainable PSS grows and a better infrastructure is established, the rebound effect can be regarded as a minor factor which can be overcome. For widespread recognition and use of PSS, companies are expected to integrate the PSS point of view into their business routine. The new perspective interwoven in companies will facilitate corporate social responsibility (CSR) management and increase independence from resource prices and investments.

2 Diagnosis: our current production and consumption patterns

Food consumption is essential to sustain everyday life. In many cases of physical obesity, however, the need for food is developed into a wrong eating habit or eating disorder. Not very differently, product and material uses to support our basic needs became a demand of consuming and owning more and more things and settled down as our current obese consumption and production habit. Obesity does not immediately stop someone's life but it is a major contributing cause of diabetes and heart disease, and also increases the likelihood of developing cancer. Although often feeling uncomfortable and knowing it is a wrong direction, due to a lack of recognised alternatives, people continue their habit.

While the result of an undesirable eating habit and lifestyle is limited to the person, that of an unconscious consumption and production habit threatens not only the person but also other citizens and even future generations by causing irreversible environmental damage in a long term. Therefore we need to make a precise diagnosis from the already-evident and shaping-out symptoms, and find pertinent methods for the cure.

2.1 Excessive consumption

An excessive consumption pattern may be originated from the current underestimation of the value of natural resources. For a long time people have seen the nature as a target of exploitation, out of which all kinds of materials are provided without paying equivalent price for them. The concept of *economy of scale* combined with mass production is dominating modern economic organisations whereas use of raw materials is often perceived as cheap investment to accomplish higher level of profitable production scale. This linear correlation between profit and resource consumption has subsequently shaped the consumer mindset, that is, *too much* is always appreciated to be better than *too little* or even *just enough*. People who tend to pay little attention to energy efficiency and

environmental impact of products are more likely to consume and waste more energy and materials than others who are conscious about the ecological influence of what they buy and use.

2.2 Product owning culture

There were some eras in the past when materials and products were so precious that there was no way but to share one product either with family members or, even with neighbours. For example, clothes for little children used to be handed over and over to younger ones, especially because children grow so fast that their clothes are only used for relatively short period, thus still wearable. However, nowadays the custom is perceived to far less extent than before, because new clothes are easily affordable, people are keen on fashion, and they want to have their own things without having been used by others.

In Korea until few decades ago, as another example, there used to be local communities called 'Doorai'. Members of the agriculture-based group shared farming animals and tools to cultivate crops because the farmers could barely afford to own equipment. This community also shared manpower to manage the difficult farming work such as rice planting, irrigation, weeding and harvesting, which strengthened the relationship among the members as well. After farming seasons, they divided the output according to agreed rules and had a celebration together. Now, unfortunately, the old custom has almost disappeared and individual farmers own their own machines and tools.

One of the characteristics of modern consumers is the strongly rooted belief that *I am what I own*. People define themselves and others in terms of the things they possess. Indeed, many people describe possessions as aspects of the self, and their loss is experienced as a personal violation and a lessening of the self.

> 'In Western materialistic societies… an individual's identity is influenced by the symbolic meanings of his or her own material possessions, and the way in which s/he relates to those possessions… Material possessions provide people with information about other people's identities.' (Dittmar, 1992)

This socio-economic belief also coined a term of 'retail therapy' which has been used as a dignified excuse for binge shopping for the last decades. In modern economy people are manipulated to buy things. Advertisements, marketing promotions cleverly utilise psychological factors to seduce people to spend more money on purchasing products. People regarded shopping process as a salvation from the stress of modern living and emotional cure. Unhappy people were most likely to be trying to push out their bad mood through purchasing. More recent research, however, suggests shopping process only offers short-term emotions and it cannot always fulfil psychological need for status and reassurance. Consumption can make consumers feel worse rather than offer real welfare. (Summerskill, 2001) Clayton and Radcliff already stated in their psychological research that the emotional reassurance derived from a particular pattern or act of material consumption is transient. They interpreted this is probably because psychological and emotional needs can only be adequately addressed and satisfied at a psychological and emotional level. (Clayton and Radcliff,

1996) The displacement of psychological and emotional needs into product owing habit will undoubtedly generate considerable economic activity, and a consequent energy and resource cost, but cannot properly satisfy consumers' needs.

2.3 Throw-away society

In the past, if a part of a product is broken or worn out, people repaired or replaced the part so as to keep the product in use. Even when the product became completely out of order, people used it for another purpose or, at least, tried to recover as much material as they can, which could be used for making other products. As products were handed down through generations, durability was one of the most prioritised requirements for a product. Here, *durability* implied highly reliable quality of products that could last for centuries. Now those old products have different values only as 'antiques'. The advantage of durability is less appreciated than the convenience and fanciful design of new products. Though some products are still appealing their durability, they seem to be just less fragile. Most of the commonly used products in modern consumer societies are designed to be thrown away within few years or even months.

As for some digital products such as computers and mobile phones rapid technology development also has been contributed to shortening product life time, and ever-increasing functions on a product boosted the frequency of product disorder. Regarding other product groups which are less affected by the speed of technological development such as furniture and clothes, the market still forces consumers to ride on seasonal trends and sales.

From consumers' point of view, in the case of disorder of products including occurrences of broken or worn-out parts and functioning troubles, they easily decide to throw away the product instead of getting it repaired. It is partly because getting things repaired costs more than simply buying new ones, and some service uses are quite tiresome. Proper process of waste treatment also has not been widely understood by users, and the ecological efficiency of each of waste management services is not clearly reported.

3 Prescription: PSS as effective diet solutions

Strategies to shape lean consumption and production patterns may be suggested by a good model of physical diet programme. In general eating healthy foods in moderate amount and doing proper exercise is more recommended to sustain a health body and to avoid risks and stresses than an abrupt change or one-sided nutrition diet. Less food consumption but the higher quality of food would promote ecological and fair production methods. This change will not only reduce the environmental load in agriculture, but also create income and stabilise socio-cultural structure of the producing unit.

Eco-products such as energy efficient and toxic-substance-free products will be used as organic foods in a physical diet program. To achieve a higher level of sustainability, however, multi-dimensional and tailor-made solutions should be accompanied with the dietary treatment. Needless to say, a combination of various methods has bigger possibility to bring a radical

change than a single manner. Depending on how many solutions are adopted and how well coordinated, there also can be synergies gained.

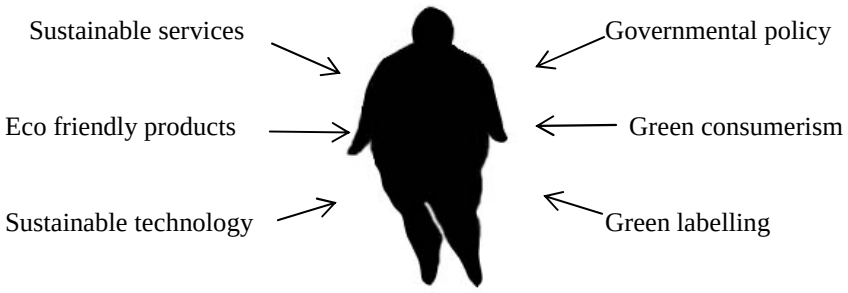

Figure 1: Multi-dimensional approaches for sustainable consumption and production

The sustainability of PSS strategies were vigorously discussed in the last few years. Though there are doubts to be investigated further in terms of their ecological side effects and economic feasibility, in general PSS are recognised to be a breakthrough from the present state of industrial sustainability. The potential of PSS as a cure programme lies in its basic idea. In other words, through PSS solutions, consumers can experience that their needs are satisfied by sustainable alternatives in a convenient and comfortable manner.

Tackling current consumption pattern will mean changing people's lifestyles - encouraging them to consume less material and to pay attention to the hidden environmental impact behind products they buy, use and dispose of. Important mission of the PSS is, therefore, to support clients to be aware of environmental, economic and social benefits of the systems by means of providing them with functional reliability as well as mitigating risks of buying products and concerns about maintenance. The new opportunities will change the society slowly, but a clear and constant message of the systems will be certainly appreciated by the mass.

3.1 Moderate and rational consumption

The key solution is to provide consumers with more chances to raise a sense of moderation and rationality. For this, producers and public organisations can play a role as a good motivator, adviser and regulator. Researchers say retailers should tailor their marketing more carefully so shoppers do not feel they are being tricked into unnecessary purchases. (Summerskill, 2001)

Following examples are from Japan and Korea, both known for their short innovation cycle and rapid technological development.

The example of a housing company in Sekisui Chemical Co., Ltd implies the influence of a producer on the change of consumers' mindset. The company contributed to changing users' living habits by developing "Zero-utility-cost houses" based on renewable-energy generation systems using large-capacity photovoltaic method. Those houses only emit 18% of the CO2 that is emitted from conventional houses. According to their survey, 98% of

their customers who have bought the Zero-utility-cost houses have become more conscious of energy savings by recognizing the decrease in energy consumption, and 57% have changed their lifestyle in order to enjoy the full benefit of the houses and to help the environment. (Shio and Suzuki, 2005) Better performances both in economic and ecological dimensions of products and services are the key factors to complete a real success.

The second example shows that smart PSS solutions can bring bigger satisfaction of consumers while using up less resource. It also indicates the power of green consumers as well as necessity of institutional support to maximize the efficiency of a systematic solution. Consumer Protection Board in Korea surveyed that customers regard it unnecessary to buy a new charger when they already possess one. In 2002 a governmental organisation, TTA (Telecommunications Technology Association), combined several types of mobile charger into one standard format (24-pin). Now due to availability of sharing one charger among family members and colleagues or in the public, it is expected that we can reduce the resource consumption and environmental pollution as well as the purchasing cost. In companies, cost for production, packaging and distribution will be saved. The new charging interface is being considered to be applied to broader scope of digital equipment including digital cameras and mp3 players. Also public battery charging kiosks have been installed across the country to help users use the convenient service. (TTA, 2003)

Figure 2: the standard type of mobile charger and an express-charging deck in a subway train (TTA, 2003)

This example suggests environmental policies should be enhanced to encompass the criteria of efficient use of materials in the use phase, so as to make a real difference and to spur industries and consumers to move towards sustainability.

3.2 Use- and result-oriented system

Through PSS, people can rent, lease, share and pool products to *use* instead of buying them. In these services users would be still able to *own* a product, nevertheless the ownership is rather temporary. An important premise of those use- and result-oriented systems is that clients should be able to use the systems with as freely as possible. Washing machine sharing system usually faces some problems such as the difficulty of carrying heavy laundry from home to the shop, inconvenience of waiting for a machine to be emptied by previous user and so on. Service providers are required to improve the quality of service enough to be competitive against the cheap

products which are made in countries with low labour cost. Increased convenience of use- and result- oriented systems will appeal to its users.

Users do not need to be concerned about maintenance, repair and end-of-life treatment of a product they use. What they only have to do will be to use the products and services provided at the best quality and finally 'throw away' the used product to the service provider.

Additionally, in the process of provision of the services companies will have more chances to listen to their customers' opinion on the product and this will be led to more user friendly products and improvement of services. Once clients recognize that the alternative services are far more economical and efficient than owning products, the culture product ownership may be rapidly replaced with membership and, further, with product stewardship.

3.3 Product longevity and resource circulating system

Firstly product longevity should be re-valued by both companies and users. Although it is clear that durability is one of the features to complete a high quality product, it is often considered to be a critical component to raise the production cost and, consequently, the retail price of the product. Also durability is believed to postpone the occurrence of next income. These are the very reason for many companies to persist in producing short-lasting goods. However, these ideas which are resulted by short-sighted and only profit-line focused view of companies need to be eradicated. Planned obsolescence should no longer be used as a means of revenue generation. Industry will realize that product longevity can be achieved in a profitable manner by a more innovative and systematic way. The type of PSS will be determined by traits of a target product and capacity of each company. For example, a system related to digital products which are associated with the fast change of technology development would be better focusing on ease of 'upgrade' to enable longer use phase possibility. The higher production cost may be returned through different ways such as periodical rent and pay-per-use.

In addition to the basic durability of a product, which secures less event of disorder and ease of repair, services for upgrade and maintenance are highly recommended to expand the lifetime of the product, especially for those products which have short technological development cycle such as computers and ICT equipment.

Service platform for exchange, buy and sell products such as a flea-market also can be one type of PSS solution. Recently traditional flea-markets and auction houses have been transformed into online services (e.g. ebay.com) which are free from space and time limits.

At a disposal level, according to McDonough and Braungart, as far as products and services were designed and disposed of in an ecologically responsible manner we could enjoy the ritual of throwing things away. (McDonough and Brangart, 2002) The question is how to inform consumers of the appropriate ways because majority of consumers have little knowledge of the materials in their product, thus they do not know how to dispose of them. Education and better labelling policy could be means of delivering the information. Paralleling with those endeavours, however, take-back and recovering services for resource circulation or safe disposal treatment should be provided by governmental or industrial organisations.

Kodak's one-time-use camera is one of the most successful redesign stories of a consumer product in the last couple of decades. At first glance the product looks the same as before and people just keep throwing it away to photofinishers after a single use. In fact, however, the new product is completely different. 77% to 90% (by weight) of the camera is remanufactured and all components are reused or recycled elsewhere at least. This statement of the company, "you take the picture we do the rest", seems to be truly descriptive of their firm attitude towards environmental responsibility. (Kodak, 2006)

Figure 3: Kodak's one-time-use camera (Kodak, 2006)

The 'resource-recycling housing system' of the housing company in Sekisui Chemical in Japan shows the effective use of materials that normally used to be demolished when an old house is disassembled. Old houses are disassembled into units, which are returned to the plants, inspected, repaired as necessary, and sold to new customers to be built on new sites. Through this system, more than 85% in weight of the original house is reused, which results in a great reduction of building waste. Such houses can be purchased at 60 to 70% of new-house prices. For the last two and a half years of the 'reused system house' marketing, the company achieved a better return of investment and an expansion of new sales areas. In addition, surveys conducted discovered that owners of the original houses feel satisfied as their houses are rebuilt into new houses instead of being demolished and disposed of. (Iwahara and Suzuki, 2005)

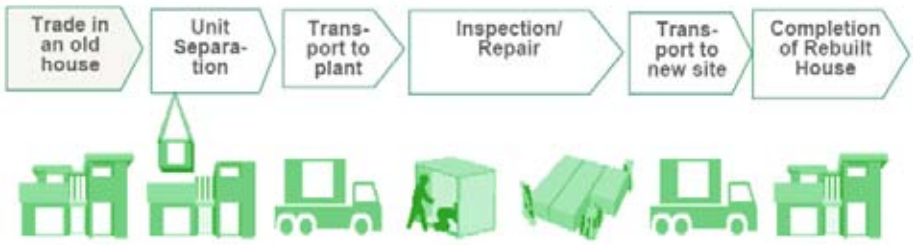

Figure 4: flow or reused system house (Iwahara and Suzuki, 2005)

To develop the PSS solution to be more sophisticated, with the help of the methodology for PSS (MEPSS) (Halen, Vezzoli and Wimmer, 2005) the company is currently improving and optimising the system.

4 Cautions: rebound effect and long term attention

While scientists have already done detailed research about various diet programmes, environmental load of each product and service has not been clearly proven yet. Therefore, we should apply PSS programmes in practice in a highly prudential manner. The delivery method should be carefully designed not to force people to adapt themselves to the system provided, but to be attractive enough to make clients willing to participate in the system. As such a diet plan, tools like MEPSS can guide producers to build a good system.

One of the important instructions regarding the use of PSS treatment is the necessity of a long-term monitoring to prevent the so-called 'yo-yo' phenomenon. There is a risk to return to its original patterns after some economic, environmental and social benefits have been recognized (especially on the side of producers).

The rebound effect of PSS strategies is often pointed out as an obstacle to apply PSS strategies in market. Energy consumption and CO2 emissions caused from transportation, which is accompanied with service provision, are among the main targets of concerns. Sometimes a dematerialized service solution can bring an unexpected consumption of other materials. For example mp3 files, which reduced CD and CD player production volume, newly created mp3 player market. Online telecommunication programmes which replaced traditional phones increased the chance of headset purchase instead.

In spite of these rebound effects, PSS are still believed to lower the entire amount of environmental load as far as industry tries to develop them in a more sustainable way. If planned accordingly, the environmentally conscious message of PSS can motivate users to live in more sustainable lifestyle. This influence will contribute to the massive change of consumption pattern not only regarding the product included in the system, but also inspirationally across other products. Presumably, by the time when the number of PSS arrives at a certain point, better infrastructure of service provision may shorten travel distance as well.

The last point of within the debates of sustainable consumption and production is the possibility of deterioration of the quality of life. To eliminate this dubious view on the sustainable lifestyle, it should be clarified that sustainable way of life does not aim at going back to the primitive age. Fighting against the stream of technological and economic development alone cannot bring a radical change in massive scale. More than anything, fulfilment of people's demands and wishes should be prioritised. Indeed, power is with people and market chasing continuous development. Smart companies will read the stream carefully and utilise its power to find more sustainable answers to the environmental problems and gain competitiveness in the market at the same time.

5 Overall conclusion

The idea of ethical consumerism was already introduced into market and consumers started to exert their power on markets. Though the movement seems to occur slowly, it is certainly changing the market and requiring new business models and strategies. The enormous amount of knowledge and experience accumulated in conventional marketing and branding strategies

can be applied to promotion of new PSS models in the same way. One of the positive influences of big companies leading PSS development lies in the utilisation of their well-established brand value, reputation and infrastructure. The realm of the credit which has been obtained from the high quality of products of the companies can be easily expanded to the PSS solutions offered by the company. It is necessary to give consumers more opportunities to discover how beneficial the products and services are they use. For this, the PSS view should be incorporated into everyday business sales goals likewise eco-design should be aligned and integrated throughout entire production processes. Each of sustainable solutions alone will have less beneficial effect when compared with a system in which all the solutions are combined for optimised environmental, economic and social performances.

In a post-industrial world the focusing point should be put on the more sophisticated coordination of products to fulfil consumers' needs rather than the number or volume of products to be sold. Along the value chain of PSS everyone can win benefits. Users will be provided with a combination of products and services perfectly matching their needs. Companies will broaden the scope of their market and gain better reputation while reducing production cost. For the environment, aggregated energy consumption and material use will be reduced.

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Parallel Session IV: System Innovation and Policy

Leader: Maj Munch Andersen
Rapporteur: Sophie Emmert

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Chapter 31 System Innovation versus Innovation Systems - Challenges for the SCP agenda

A DISCUSSION DOCUMENT

Session: System Innovation and Policy

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1 Introduction

The session on "system innovation and policy" seeks to highlight systemic aspects of sustainable consumption and production (SCP). That is, to set focus on eco-innovations which are so radical and systemic in character that they involve complementary changes in production and consumption patterns, often involving considerable institutional change.

The "system innovation" concept is by now a well-established concept at the core of the SCP literature seeking to encapsulate such radical change.

This introductory chapter seeks shortly to draw up some main points of discussion on the concept of "system innovation" related to SCP particularly by mirroring it to the concept of innovation system. The chapter seeks to raise critical questions on how the concept of system innovation is understood and used, noticeably in relation to policymaking. The arguments pursued here should not be seen as final answers but as explorative attempts to raise important discussions, many of which are in need of further investigation.

1.1 The SCP agenda and system innovation

The environmental agenda has changed considerably over the last 40 years since it evolved. The environmental policy focus has shifted from neighbour regulation and end of pipe solutions towards process, products, functions and lately the broader system innovation closely related to the all encompassing sustainable consumption and production frame (SCP).

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Generally, emphasis has shifted from the supply-side towards the demand-side and towards a still more systemic scope. Despite a strong emphasis on product oriented environmental policy (Integrated Product Policy (IPP)) the last ten years mainly based on information instruments, effects are limited and we are far from a take-off of a green market development. Policies directed towards consumption, not only as procurement but also as consumption patterns are in a development stage within SCP. These increasingly focus on the need for a shift from resource to service intensive societies.

The SCP agenda is developing very much at the international level with the United Nations Environment Programme (UNEP) as a central player. This means that global development issues (rather than a narrow Western European approach) are in focus. The Marrakech process widened the SCP agenda into: industrial development; waste management; SCP training and capacity building; sustainable trade and resource consumption; and sustainable energy and mobility.

At the SCP meeting in Costa Rica in 2005 four working groups were established where different countries have taken the lead in developing respectively: sustainable lifestyles, advertising and youth (Sweden); co-operation with Africa (Germany); sustainable product policies (UK); and sustainable procurement (Switzerland).

Recently the concept of eco-innovation is gaining policy attention, in seeking to forward greater synergy between environmental and innovation policy as explored by the ETAP process (Andersen, 2004, Foxon, 2004). Eco-innovation was highlighted and endorsed during the Dutch presidency of the European Union (EU) in 2004 (Kemp and Andersen, 2004, Kemp, Andersen and Butter, 2004). Recently EU innovation policies are continuing this work in establishing (March 2006) an eco-innovation sector panel to explore innovation policies directed specifically at eco-innovation (as one among a serios of sector panels)- the SYSTEMATIC project of DG Enterprise. These sector panels will run from March 2006 and two years ahead.

So far the SCP and hence the UNEP agenda has only weak linkages towards this emerging eco-innovation agenda. Eco-innovation could potentially bridge between sustainable consumption ad production, as the innovation concept per defition covers the entire innovation chain from idea generation to value creation on the market. Eco-innovation, as a contrast to sustainable innovation, is not normative. It merely represents innovations which are able to attract green rents on the market. It makes no claims on the "greenness" of varies innovations. It can hence say nothing about the sustainability of single innovations, but it can say something about *the direction* – the degree of greening - of technological change and the role of market mechanisms in this (Andersen, 1999).

The system innovation concept feeds into many of the SCP themes.in emhpasizing the need for simultaneous innovations in technology, infrastructure and wider institutions. System innovation research is not undertaken by one research community but by a mixture of policy analysts (emphasising the policy regime), sociologists (emphasising the socio-institutional frame) and evolutionary (innovation) economists (emphasising the innovation processes). However, in order to gain theoretical rigour there

is a need for greater theoretical coherence. Or at least for recognizing the important differences in approaches.

Interestingly despite the use of the innovation term the system innovation concept is not applied within general innovation economic research. The system innovation concept is only developed and used within environmental research and urban planning. And the innovation system concept, which today is a well-established frame for innovation analysis and policy making particularly at the national level, has so far been very little used in environmental analysis and policymaking. The beginning use of the innovation system concept does give rise to unclarity and confusion concerning how the concepts of respectively ”system innovations” and ”innovation systems” relate to each other.

The lacking bridging between these two concepts illustrates the very weak connection between innovation research and environmental research. But it also raises two interesting questions:

1. Could innovation economic theory inform SCP research on radical systemic eco-innovation/change? (What kind of insights and concepts are used here which are currently not applied in SCP research? Are these compatible, complementary or contradictory to the current system innovation research?) What are the policy implications of possible differences in approach?

2. Could the concept of system innovation inform innovation economic theory on systemic change and guide innovation policy making?

3. How could the concepts of system innovation and innovation systems be aligned?

This chapter takes seeks to shed light on the relation ship between these two concepts. The main argument of the chapter is the possible need for a shift in perspective in policymaking (and noticeably in analysis) from system innovation to innovation systems. Some of the ideas presented here were raised in the strategy paper for the EU informal council on strategies for eco-efficient innovation (Kemp and Andersen, 2004).

In section two the system innovation concept and research hitherto practiced is critically assessed through a series of very short statements and questions. In section three 11 policy recommendations for radical systemic eco-innovations are made inspired by an innovation systems thinking. Hence the chapter’s emphasis lies on the illustration in (policy) practice of the possibly novelty of the innovation system approach forwarded here, rather than a detailed account for and critique of the use of the system innovation concept. A more thorough review will follow in the upcoming edited SCORE book on SCP.

2 Points of discussion

Bearing in mind that the system innovation concept is used by a variety of research communities, and therefore does not represent á stringent

concept, it is still possible to come up with some fundamental questions as to its adequacy. This will be done in the form of short statements/questions on key issues.

- **System innovation is a policy concept.**

The system innovation concept is a planning/policy concept rather than an analytical concept. It seeks to call out for institutional change as an integrated element of radical innovations. The claim is that system innovation is what is needed rather than other (earlier) types of innovations for environmental sustainability. The problem is that (any) system innovations per definition is good and is seen as thé (only/main) solution to environmental problems.

- **Understanding systemic change**

The system innovation concept implies a model of radical "saltationist" change as the only way to obtain systemic change. This is not in accordance with existing general innovation research on systemic innovation which has a much more dialectic and interactive perspective on innovation (Nelson and Winther, 1982, Lundvall, 1985, 1992). But the SCP literature builds very little on this.

Within the innovation economic research there is focus on radical and systemic change, but without using the term system innovation. It is by now very well-recognized that radical innovations always are accompanied by institutional change, in fact institution formation is seen as an inherent part of innovation processes (Lundvall, 1992, Freeman and Perez 1988, Perez 2000, Perez 2002).

Concepts such as technological revolutions, techno-economic paradigm change, technological paradigms, technological or natural trajectories and innovation/business cycles are in use when analyzing systemic change (see Dosi, 1982, Nelson and Winther, 1982, Freeman and Perez 1988, Perez 2000, Perez 2002). This research emphasises a more cognitive or paradigmatic explanation of economic development. The basic argument is, inspired by Kuhn (1970) that technology development, parallel to scientific work, follows certain heuristics. Innovation is seen as inherently path dependent and cumulative. Departures, radical innovation, is a central means of economic growth and therefore an important part of the economic process. Path dependence is used as a core explanation for explaining innovation. The argument is that increasing returns on a number of issues (scale economies, learning effects, adaptive expectations and network economies), tend to favour existing technologies against newcomers (David, 1985, Arthur 1989, 1994). Several studies have sought to illustrate how inefficient innovations have emerged and become locked-in on the market. The friction to radical innovation is thus well-understood. Business cycles studies show how radical innovations are always accompanied by a series of incremental innovations, and that departure from existing trajectories may take place at any given time in the technology development process (Perez, 2000, 2002).

System innovation is not the only, nor necessarily the most important, road to overall radical eco-innovation. We should be careful in neglecting the importance of incremental change for eco-innovation - the potential is no

where exhaust – and we should pay more attention to the interdependies between different types (incremental and radical) of innovations. And fundamentally we should emphasize the need for fostering a variety of novel solutions (rather than early picking of environmental winners) to obtain radical innovations. The system innovation concept is not helpful here. But we do need to stress the importance of making extraordinary (policy) efforts to promote radical systemic change.

- **Systemic - absolute or degrees ?**

The system innovation concept implies that innovations are either systemic or not. But there is no dichotomy between systemic and inhouse/stand-alone innovations but rather a continuum. Most innovations are systemic to some degree, and call for complementary innovations in varies parts of the innovation system (other firms, knowledge institutions, infrastructure, planning practices, regulation, consumption patterns ect. (Teece, 1986, Langlois, 1992). Fundamentally the innovation process is interactive, and evolves from learning between multiple actors (Lundvall, 1992). There is a need of careful analysis of the systemic nature of each innovation, so that necessary complementary changes may be addressed.

- **Focus on innovations or innovation systems?**

No innovation, how systemic it may be, takes place in isolation. Policy should therefore focus on improving the general conditions for eco-innovation, rather than promoting specific innovations. (More on this in the policy section below).

The national system of innovation (NSI) perspective forms a part of evolutionary economic theory. The innovation system theory seeks to provide an analytical frame for the analysis of the co-evolution of technology, institutions and organizations (companies) (Lundvall, 1985, 1988, 1992 (ed.), 2001, 2005; Freeman 1987, 1995; Nelson, 1993; Metcalf, 1995; Edquist, 1996). Company innovation and competitiveness is at the center of analysis but seen in a larger institutional set-up. An innovation system is defined as "those elements and relations, which interact in the production, diffusion and use of new and economic useful knowledge" (Lundvall, 1992)[79]. Innovation policy seeks to foster the creation and use of new knowledge and generally build a high innovative capacity in national innovation systems. Framework conditions center on stimulating the innovation dynamo (knowledge creation in and between firms, between firms and knowledge institutions) (OECD, 2000, 2001a, 2001b, European Commission 2003).

3 Policy implications

3.1 An innovation system approach to radical eco-innovation

There are a great number of issues one could address in discussing policies for radical eco-innovation. The main argument pursued here is the possible need for a shift in perspective in SCP policymaking from system

[79] Innovation is generally understood in the innovation literature as a novelty leading to value creation on the market.

innovation towards innovation systems. The discussion will concentrate on these implications.

The overall argumentation for the suggested shift is threefold:

The first is analytical. The insufficiency in focusing on individual innovations (however systemic they may be). Innovations do not develop in isolation but in interconnection with other innovations and the surrounding economic, institutional and cultural set-up within national and supranational innovation systems.

The second is cognitive (analytic and strategic): The need to emphasize the evolutionary, market driven and context-specific nature of innovation, aspects which are conceptualized in the innovation system frame. You cannot plan innovation; for that it is too much of a decentralised venture. But you can facilitate and channel both the rate and direction of innovation. The shift suggested implies a change from a (primarily) planning approach to a (primarily) knowledge based approach, but dismisses the dichotomy between regulation and market.

The third is strategic: The need to situate the SCP agenda firmly within the general innovation agenda, analytically and politically. For eco-innovation really to take-off it must become an integrated part of research and innovation policy.

Eleven (preliminary) main policy recommendations can be pointed to, especially directed at the promotion of radical eco-innovations:

1. *Set up a greening of national (and supranational) innovation systems as a main overall goal.* This means rectifying the system failures towards eco-innovation specific to the given innovation system, so that search generally is moving in a green direction. There are three main general sub-goals connected to this:
    a. Facilitating *an efficient organisation of green knowledge production across firms and knowledge institutions*. We need to create an innovation system with a strong environmental knowledge base and strong clusters on core environmental competencies. Such a knowledge base will generally facilitate and encourage green search trajectories and attract more green knowledge.

    b. Related to this: *promote green organisational development in all companies. Widespread* proactive environmental strategies and capabilities among companies is a prerequisite for more systemic and radical innovations. The hitherto regulation driven uneven incentives for eco-innovation among companies means that many companies/industrial sectors today function as bottlenecks to eco-innovation, inhibiting systemic eco-innovation.

c. Promote *an integrative policy approach* so that policies, physical planning and technical standards consistently and continuously provide incentives for eco-innovation across varies policy domains. Lacking coherence in the policy framework conditions strongly inhibits radical eco-innovation. In practice such an integrative approach is very difficult to achieve.

2. *Strengthening incubator environments for eco-innovation.*
   New companies are central for radical innovations. Dynamic incubator environments, venture capital for eco-innovation and demonstrations of pre-commercial eco-innovations as a business opportunity are central elements here.

3. *Technology platforms and transition programmes for targeted eco-innovation action.*
   Technology platforms as proposed by ETAP, much inspired by the transition management methodology, could become a powerful instrument in fostering the development of visions and cooperation among different actors in the innovation system (e.g. companies along the value chain, investors, knowledge institutions ect.).
   There is a risk, though, that technology platforms may privilege certain solutions thereby restricting search processes rather than promoting the creation of variety. Also the dialogue may be dominated by big players participating in the platform. If used carefully they could become a means for improved strategic intelligence about future possibilities and risks of new or changing technologies.
   Technology platforms could gain more rigour by focusing on transition programmes as an effective means of identifying particularly the organisational, planning and socio-institutional barriers relevant to specific radical eco-innovations and suggesting means for organisational, infrastructural and institutional change. Since many of these changes are outside the domain of the market, this is a task where non-business actors need to step in. Such transition programmes should build on a thorough analysis of the innovation patterns, consumption patterns and institutional set-up of different innovation systems which vary widely across the globe. Dialogue on general conditions is not enough. Solutions need to be made specific and directed towards the dynamics of different innovation systems which we need to gain an understanding about.

4. *Research and development centres for explorative search in eco-innovation*
   Complementary to the above there is a need for new types of research and innovation programmes deliberately aimed at facilitating explorative (rather than focused) search for novel solutions to environmental (and other social) problems. This could be operationalized by establishing a series of thematic

research and development centres. In these funding should be given to extensive search phases to explore, test and demonstrate a variety of novel (radical, longterm, systemic) solutions. Such centres could also contain social scientific analyses to identify the processes and barriers of the radical innovations in question and suggest means for efficient radical eco-innovation.

5. *Sectoral innovation strategies for eco-innovation*

Sectoral innovation system studies and strategies for eco-innovation could focus on the dynamics related to specific (radical) eco-innovations in the different phases of technology evolution. These approaches also contain ideas of niche markets for pre-commercial innovations but go further. They differ from system innovation studies in emphasising the competition between different evolving and existing competing technologies, and the relations between the specific conditions in the sectoral innovation systems and the national and supranational innovation systems. Emphasis is placed on removing buffers and strengthening inducement mechanisms in the different stages of technology development from idea generation to market penetration.

6. *IPR and radical science based innovations*

There are increasing evidence that general purpose technologies such as ICT, biotech and nanotechnology may enable in direct and indirect ways very radical, systemic eco-innovations (which is not to say that these technologies will not also do environmental harm). The rise of these generic technologies which are likely to play a key role for innovation processes in the coming years may mean a greater role for science based eco-innovation in the coming years meaning that intellectual property rights policies will grow in importance.

7. *Visions and targets for eco-innovation*

Culture is governance on the cheap. Shared visions are the most powerful and decentralised means to guide human behaviour. Action should to be taken to make up with the old dominating, paradigm that the environment is a burden, inhibits competitiveness and is taken care of by environmental regulation only. This should by challenged by selling the message of a new positive overall vision of an eco-efficient society where production and consumption patterns are eco-efficient and resource productivity is a central means of competitiveness. Positive stories, scenarios and demonstrations are needed, seeking to make eco-efficiency mainstream and compatible with modern modes of production and lifestyles.

ETAP (and IPP) calls for targets for the performance of key eco-products and services. But more importantly we need targets, indicators and analyses measuring and benchmarking trends in the greening of varies economic actors (firms, industrial sectors, regions, nations, families). It is necessary for going beyond the myths and create solid knowledge on greening trends and the

different roles different players have in the innovation system on eco-innovation, i.e. who the green leaders and -laggards are, who is pushing who. Such targets and indicators would create much stronger incentives for eco-innovation.

8. *Getting the prices more right*
   Strong fiscal measures and the phase out of environmentally-harmful subsidies are important measures for backing up a resource productivity strategy/vision, creating incentives for continuous eco-innovation. These are crude measures though and the limitations (and political difficulty) in such a strategy should be realised. It is important but not sufficient to direct search in a green direction.

9. *Guiding research and innovation programmes*
   ETAP suggests more funding for eco-innovation. But it is important how this is managed. Fundings systems vary and influence greatly on who and what search gets funded, making up important elements in the dynamics of innovation systems. Generally, research and innovation policy take pride in not directing science and technology development but deliberately allow open creativity. The overall policy goal is a high innovative capacity rather than innovation for specific solutions. However, strategic research and innovation programmes do guide search funding to a considerable degree. Guidelines for funding these are often unclear or tacit. Explicit guidelines for eco-efficient (and other societal goals) science and innovation (compare the above vision) could guide (all) the strategic research and innovation programmes. Targeted funding for eco-innovation is, however, the most quick and efficient way of directing search in a green direction.

10. *Building well-functioning markets for eco-innovation*
    ETAP suggests encouraging procurement of eco-innovative products. But building well-functioning markets for eco-innovation is more than that. An effort should be made towards building environmental capacity and practices among retailers and wholesalers and towards building environmental knowledge among consumers – information (eco-labels) do not suffice. Business and public customers are far more important than consumers when it comes to creating markets for radical innovations and action should be targeted towards these. (Fiscal) measures should be taken to make it attractive to procure key radical eco-innovations and demonstrations and scenarios should create interests for new consumption patterns.

11. *Eco-innovation for short-cuts in developing countries*
    There are different opportunities for radical eco-innovations in many developing and transition economies as these are not locked-in to end-of pipe infrastructure investments and administrative procedures and wasteful consumption patterns to

nearly the same degree as the rich economies. There are therefore opportunities for a "short cut" to progress when it comes to eco-innovation. Developing countries could experiment with and achieve novel much more (resource)-efficient solutions when addressing their environmental problems.

On the other hand these countries have not gone down the green learning curve to the same extent as has happened in the richer economies so the green knowledge base is very weak or more or less absent. Also, these countries innovation systems are often ill-functioning where fundamental institutions and basic conditions are not in place.

In order to exploit the short-cut opportunities it is necessary to realize the open, fluid stage of development, to focus on strengthening the general innovation system, and (only) then seek to make targeted action for building novel eco-innovative capacities as well as (selective, critical) absorptive capabilities for eco-innovation. Such a radical strategy is difficult since environmental problems are urgent in these countries so that well-proven solutions are tempting. Partnerships between countries are a possible strategy for this.

4 Overall conclusion

This chapter has argued that there are some limitations in the "system innovation" concept that needs to be addressed, both analytically and politically. It is fundamentally difficult to align evolutionary thinking (though well represented in important part of system innovation research) with the system innovation concept. In furthering a stronger innovation perspective to sustainable production and consumption it is suggested to place greater emphasis on raising the innovative capacity of national and sectoral innovation systems towards eco-innovation rather than nurturing singly innovations.

The shift in attention from singly innovations, how systemic they may be, towards the innovation system is important because it reflects how we understand innovation. Much more complex representations of innovation processes (and its competitive, cooperative and interactive nature) are needed within SCP research than the one generally represented by the system innovation concept. To achieve this we need to situate SCP research firmly within, relate to and build on, the general innovation research.

SCP research and system innovation thinking has the potential to inspire the general innovation research and innovation policy by putting more emphasis on problem-driven innovation and policy measures and how we influence the direction (rather than the rate) of innovation.

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Chapter 32 The business enterprise & the sociotechnical regime - combining organizational innovation and system transition approaches

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1 Introduction

Research on innovation and sustainability tends to focus either on the organisational level of the business enterprise or on the systemic level of the sociotechnical regime. These different research strands tend to contrast 'innovation' concepts with those of 'transition', and sometimes implicitly juxtapose the concept of 'management' with that of 'governance'. In the policy arena these are reflected in the differing emphases on 'eco-innovation' and on 'sustainable consumption and production' . The paper argues that these strands need to be brought together more effectively in both theory and practice. It suggests that the interactional concepts of networks and discourse offer a framework to enable policy and management to span the boundary between these orientations.

2 Systems innovation & decoupling

It has been increasingly recognised that innovation which radically 'decouples' economic growth from environmental detriment needs to be explored at a system as well as an enterprise level. This is because of the problematic relationship of singular innovations which offer relative environmental benefit with their sometimes limited impact on decoupling at a wider system level. More fuel efficient vehicles may be accompanied by continued growth in carbon emissions in the transport sector. Energy saving devices in the home may still accompanied by growing domestic carbon emissions. The growth of digital technologies offering prospects for dematerialisation of communication have been accompanied by growing consumption of paper. These paradoxical consequences and rebound effects

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offer a major challenge for the pursuit of ecoinnovation and the achievement of significant decoupling.

Recent research on sociotechnical transitions drawing on historical case studies of radical innovation have led to some important insights. (Geels, 2004, Kemp 2003) Radical innovation involves a wider process of change than is expressed through the introduction of an individual product or a new business practice. It requires a transformation in a domain of societal activity which embraces both production and consumption and a host of individuals and organisations. It shows a complex pattern of change and interaction between a diversity of societal actors. The promotion of radical innovation for sustainability can be facilitated by the stimulation of new thinking and new stakeholder relationships through a purposive focus on key domains of social practice such as bathing/showering, cooking a meal, reading books & magazines, travelling to work etc. The contribution of technology is an important part, but only a part, of these wider changes in social practice.

Radical innovation, although conventionally contrasted as abrupt compared with slow incremental change, has actually been shown to often require a period of several decades to move from margin to mainstream. The process is a continuous one over a long time period that has been shown by retrospective studies to move through different phases with variations of tempo. These findings suggest the need for a major reorientation of ecoinnovation policy to include a sociotechnical system perspective. An innovation policy framework around social practices such as housing, food & travel (Spaargaren 2003) offers a way forward and represents a different perspective to the technology and industrial sector approach of much policy. It is very much in tune with the new orientation towards sustainable consumption and production, because central to sociotechnical systems and social practices is the involvement of social actors from both production and consumption. Another approach which has potential in this regard is the technology specific innovation systems approach of Jacobssen and his colleagues which focuses on the system characteristics needed promote innovation in certain technological domains. (Jacobsson & Lauber 2006)

A reorientation to sociotechnical transitions implies that ecoinnovation with strong decoupling potential will often comprise a hetereogeneous mixture of technological, organisational and social innovations. The economic and employment implications of such ecoinnovation are complicated to assess but it appears that the creation of new services and infrastructural activities which accompanies technological and product innovation offers positive scope for job growth. Community based waste management schemes and renewable energy initiatives are examples of this. The promotion of innovative approaches in sociotechnical systems and social practices and the systemic/network character of these innovations means that successful implementation draws strongly on situated knowledge and practice capabilities.

3 The role of specific organizational actors

The shift to a more systemic perspective is a realistic and positive one. Nevertheless it runs the risk of focusing attention solely on system wide policy concerns to the neglect of the critical role in system change of specific

organisational actors. Yet parallel with this shift to a systemic perspective is a renewed interest in the role of radical innovators, not only in introducing novelty into the system but also in orchestrating and constructing new networks for the future durability and pervasiveness of innovation. Transition theory recognises the role of 'niche' actors, (Geels 2005, Kemp 2004). Entrepreneurial research has identified the importance of 'path creation' in contrast with path dependence. (Garud & Karnoe 2000) Strategy research has addressed the role of 'disruptive innovators' (Christensen 1997) It is important to find a constructive way to combine these two approaches.

If business studies research has anything specific to offer then it should be in the provision of concepts to relate organisation specific capabilities to systemic change. Recent developments in the organisational strand of business research seems to point positively in this direction. Mintzberg's (1995) work on emergent strategy and Weick's (1996) concept of sensemaking offer important frameworks for an alternative to the simplistic rational actor without reversion to the random or charismatic. Recent research on the role of social capital and networks in business strategy (Burt) and the notion of communities of practice (Wenger) build on this tradition in offering approaches to explain the relative effectiveness of specific organisations which are alternatives to rationalism or heroism.

The management of innovation is a relatively new field in business studies which has contributed significantly to the understanding of organisational characteristics and choices which facilitate such an orientation. The origins and development of this field offer interesting territory for exploration.

4 Coupling or Interactive Models of the Innovation Process

The 'coupling' or 'interactive' model of innovation represents a shift away from the linearity of the push and pull models of innovation; Rothwell (2002) refers to this as the third-generation model of innovation; he argues that the key environmental factor encouraging the emergence of the interactive model was the severe resource constraints of the 1970s, and the consequent search for understanding the basis of successful innovation and reducing the incidence of failure. Rothwell and Zegveld (1985: 50) describe the basis of the model, as follows:

"The overall pattern of the innovation process can be thought of as a complex net of communication paths, both intra-organizational and extra-organizational, linking together the various inhouse functions and linking the firm to the broader scientific and technological community and to the marketplace. In other words the process of innovation represents the confluence of technological capabilities and market needs within the framework of the innovating firm".

Thus, at the heart of the 'interactive' model of innovation lies an implicit network perspective of the innovation process. However, as Rothwell (2002: 117) points out, it is "still essentially a sequential process…with feedback loops"

This conceptualisation of the innovation process embodies two fundamental developments on previous models; firstly, it stresses the need

for the coupling of emerging technological possibilities and market needs, rather than privileging 'signals' from either the science / technology-base or the market-place. Schmookler (1966) likened this coupling activity to the blades of a pair of scissors. For Rothwell and Zegveld (1985: 65) "The linkages between science, technology and the market-place are complex, interactive and multidirectional, the dominant driving force varying over time and between one branch of industry and the next"; and secondly, it stresses the importance of intra- and inter-organisational relationships and interaction. In bringing together these two factors, Freeman (1986: 31-33) argues that the "professionalization of industrial R&D represents an institutional response to the complex problem of organizing this 'matching'…The coupling process is not merely one of matching or associating ideas in the original first flash; it is far more a continuous creative dialogue during the whole of the experimental development work and introduction of the new product or process".

The coupling or interactive model of innovation has clear implications for both managers and policy-makers: managers must encourage the building and nurturing of formal and informal relationships and interaction across both internal and external organisational boundaries; policy-makers should develop policies that promote the forging of relationships within and between the science-base, innovative companies, and the market-place.

Rothwell (2002) introduces two subsequent generations of models of innovation. Whilst the fourth and fifth generation models embody increasingly more sophisticated responses by innovative firms – to an environment increasingly characterised by the emergence of key new communication technologies, shortening product development times and product-life-cycles, the strategic use of generic technologies, integration along the supply-chain, and extensive strategic alliancing and networking activity – they lack the clarity of the core themes introduced within the third generation model.

5 Two strands in innovation network theory

By the early 1990s, then, from a number of quite different directions the language of networks was permeating the field of innovation studies. It shared a new focus on the patterns of interaction between a diversity of actors in the innovation process rather than on the characteristics and behaviour of an individual actor, whether entrepreneur, business or government. However its usage was, and has continued to be, laden with two quite different approaches to the fundamental significance of the concept of 'network'

5.1 A 'new' mode of governance

One of these approaches places most emphasis on the network as a new particular mode of governance. Walter Powell (1990) in a well known paper presented it as an organisational form which was an alternative to the traditional 'hierarchy' or 'market' of organisational studies. Rod Rhodes used the concept of network to identify a new policy space as an alternative to the traditional categories of 'state' and 'society'. Much of the research on the industrial and regional networks in innovation has tended to express this

view of networks as something new. It has been associated with prescriptive approaches to the management of innovation which emphasise the importance of 'collaboration' and 'clusters'

5.2 A 'general' conceptual framework of social analysis

The other approach regards the notion of network not as something new and specific, but as a general theoretical approach to the analysis and explanation of social phenomena. This sociological tradition has its roots in the social interactionism of early sociologists such as Gabriel Tarde(1901) & Georg Simmel (1955) and the invention of the sociogram by Jacob Moreno (1928). In this approach a network is seen in much more general terms as 'a conceptualisation of the innovation process as a complex and pluralistic pattern of interactions, exchanges and relationships between actors participating in that process'. (Jones,Steward,and Conway 2001) This applies, not just to recent changes in innovation practices but to any case of innovation. It is this broad framework which informs the approach of this book.

6 Organisational networks & innovation

The 1990s saw a closer integration of the insights of technology studies with those from organisation studies. Network concepts have been increasingly employed from an organisational perspective to analyse the innovation process in the firm. These fields offer some rich resources for elaborating the theoretical framework further as a basis for empirical exploration.

6.1 Innovation networks

Freeman's (1991) review of innovation networks emphasises the pervasive and often informal nature of networks within the firm and their relationships externally. It essentially argues that the empirical tradition of innovation research from the early 1970s points to the importance of networks, even though the term is rarely used explicitly.

Conway and Steward (1996) have reviewed the literature which points to such an approach. Technological innovation should not be viewed as resulting from a single idea, but from a *bundle* or *ensemble* of ideas, information, technology, codified knowledge and know-how, which may or may not be embodied within the new product or process. Furthermore, new ideas seldom appear fully formed and articulated from a single source. This implies that innovation generally arises from a portfolio or network of actors and relationships. Studies of successful technological innovation have highlighted the importance of a number of key characteristics of these 'innovation networks': the key role of external sources and boundary-spanning activity; the diversity of internal and external actors involved in the development process; and the importance of informal or personal relationships in supplementing and 'breathing life' into formally prescribed relationships (the organisation chart) and linkages at the level of the organisation (*e.g.* joint ventures).

Studies have also indicated the importance of managing relationships across internal interfaces, such as between project groups, functional departments, and divisions. In particular, research has highlighted the importance of the internal marketing and R&D interface. A diverse range of external sources have been found to contribute to the development of successful innovation, including research organisations, suppliers, competitors, users, consumers and distributors

A number of other studies have indicated the importance of informal or personal *boundary-spanning* contact to the innovation process and particularly in relation to the transfer of *tacit* knowledge. (MacDonald & Williams 1993)The importance of network relationships in the innovation process, shown through these studies, is reflected in the growing number of investigations into particular types of these relationships, particularly external inter-firm collaboration. Studies which seek to reveal the relational diversity of the innovation process are far less common. (Tidd 1995) The reliance on the case study methodology in such studies poses problems for comparative work and this has let to interest in new approaches which can capture such diversity in a more systematic analytical fashion.

What is of particular interest is to explore whether certain theoretical propositions about network characteristics and associated behaviour can be tested in a new and more rigorous fashion. One set of such propositions is essentially concerned with the emergence of novelty in any such system and there are a variety of network characteristics such as 'openness' and 'weak ties' which suggest favourable conditions for new ideas to be identified and utilised. Another set of theoretical frameworks is more concerned with how choice is exercised between a variety of different technological possibilities and why a particular option is selected.

The actor network approach of Bruno Latour and Michel Callon (Callon & Latour 1981) argues that the process of innovation should itself be viewed as the formation of a network of human and non human actors through a process of enrolment, translation and closure. The emergence of a particular technological path is an expression of the capacity of an individual actor to construct such a stable network. This capacity is seen to rest on translation and enrolment abilities. The power of the actor network approach has been to reconceptualise the process of innovation in a completely relational fashion and refocuses the analysis of innovation toward the reconstruction of networks. These networks are no more or less than the expression of a set of discursive interactions.

A number of authors have located themselves on actor network foundations but have balked at the radical associationism of the Latourian approach and have sought to retain some notion of structural influences on power and outcomes Elzen et al (1996) employ the concept of sociotechnical networks which are defined as 'those interactions that have some relationship with the development of the artefact' and recast the issue of structural influences as those of 'preexisting networks' on the prospects for the 'development of new configurations of actors'.

7 From interaction to networks

The 'coupling' or 'interactive' models are relatively broad and abstract in nature, but they play an important role in aiding our conceptualisation of the

relationship between innovative organisations and their context, in particular with regard to their linkages with the market-place, and the science and technology-base. These models also provide us with an historical perspective of the way in which the practice of innovative organisations has evolved since the 1950s. The interactive model of innovation was important because it embodied two fundamental developments on previous models; firstly, it stressed the need for the coupling of emerging technological possibilities and market needs, rather than privileging 'signals' from either the science / technology-base or the market-place; and secondly, it stressed the importance of intra- and inter-organisational relationships and interaction. However the network perspective of the innovation process implicitly at the heart of the 'interactive' model of innovation has subsequently been developed much more fully drawing on a range of network theories. Although this has led to a new ubiquity in the use of network concepts in innovation studies it has been accompanied by a diversity which is often not sufficiently acknowledged by researchers within any one of the particular strands of research in this broad field. As well as the differences of approach recognition of the commonalities suggests the emergence of the network model of innovation as a new paradigm in innovation studies since the early 1990s

Innovations that offer a significant decoupling of economic growth from environmental detriment are of particular interest in terms of both sustainability and economic competitiveness. They are infrequent, but their significance can be very important While these cases often exploit a new market opportunity arising through regulatory change, what is also striking is that the innovation is often initiated long before the regulatory or market context is a favourable one. These innovation projects arise through an early anticipatory commitment by the businesses concerned. Another important feature of such cases is that they draw on a very diverse knowledge base ranging from reinvention of traditional technologies through to new developments in biological and molecular sciences. They draw on new technological opportunities but are not driven by science in any straightforward way. They cannot therefore be seen to arise simply from R&D investment.

What these successful cases of innovation illustrate along with studies of innovation in general (eg Freeman 1983) is that neither favourable market conditions nor suitable knowledge opportunities are sufficient in themselves for successful innovation. It requires managerial action to couple these together and it is the presence of this capability that enables some firms to out innovate others. These economically successful eco-innovations also express a particular type of business strategy. In strategic terms (Porter 1985) they represent 'differentiation' rather than cost leadership. Therefore although they offer economic and commercial benefits this is not of a simple cost saving nature. Another characteristic of successful innovations like this is that although they may be 'win-win' for the firms introducing them, they may also be 'lose-lose' for incumbent businesses whose market share they challenge. This is increasingly recognized as the 'disruptive' nature of significant innovation. (Christensen 1997)

In sum, when one is considering significant 'decoupling' eco-innovations, it should be recognized that the role of firm specific capabilities will play a critical role in which businesses succeed in making the

innovation a success and securing the rewards of early entry. A study conducted for the European Commission (Steward & Conway 1998) explored the role of these 'relational capabilities' in ecoinnovation through mapping the social networks involved and the communicative interactions of the actors involved in the innovation process. The business enterprise should not be viewed as a 'black box' responding to external signals. Neither can such significant innovation be explained simply in terms either of top management leadership or of implementation of environmental management systems. Instead it depends on individual managers, the links that they are involved in and the effectiveness of the strategic arguments that they deploy.

The challenge for policy is whether it can promote such relational capabilities and strategic choice in firms. There is often a view that such innovation capacity, since it is infrequent and dispersed, that it is therefore not amenable to policy intervention, the risk being of a heavy handed, counter productive picking winners style. In fact there has been an accumulation of understanding about innovation and entrepreneurship at the European level which acknowledges its human and idiosyncratic qualities while at the same time recognizes that there are explanatory patterns, which are open to softer instruments of encouragement. The communications on Innovation Policy (COM 2003 112) and the Green paper on Entrepreneurship in Europe (COM2003 27) both recognize the importance of the human managerial dimension and offer a framework of policy which include measures for skill and capacity building.

Nevertheless there remains a difference between the promotion of innovation capabilities in general and the encouragement of ecoinnovation in particular. Studies of ecoinnovation show that actors and arguments need to embrace sustainability as an important pursuit within the context of competitiveness. There are often competing options in the early stages of innovation with different agendas. There is therefore a critical domain of policy which facilitates innovation and entrepreneurship while encouraging a higher priority for sustainability as a goal. This needs to be pursued through models of network building and learning which promote new communities of practice (Hildreth & Kimble 2004) with shared commitments to ecoinnovation. Although these are 'soft' measures they need to be developed with sophistication and resources. They are quite different to low cost exercises based on existing business associations and professional bodies. They need to actively build on individuals and enterprises with specific ecoinnovation capabilities and enroll others in this mission.

As with the earlier discussion on the business enterprise – the recognition of the need for building focussed ecoinnovation capabilities for sociotechnical systems implies a softer network building type of policy agenda, not as an alternative to research/technology policies and regulation/market interventions but as a supplement to them. Again this type of agenda is not an easy and cheap option if it is to fulfil its purposes effectively. Instead it requires a serious commitment to policy innovation with the purpose of enabling new configurations of businesses and social actors to be facilitated and encouraged. This needs initiatives which: 1) have a more specific sustainability focus than general measures for facilitating knowledge flows between sectors and 2) give a key role to sustainability entrepreneurs seeking to promote new innovative paths of production and

consumption. Contestation and diversity need to be valued as inherent in such approaches.

The viewpoint of the management of innovation in the business organisation involves a significant change in perspective from the appropriation of novelty within the boundaries of one specific organisation to the capacity to act as a network builder and system transformer in the longer term. The review of management of innovation in this paper suggests that a cluster of concepts have been developed which can facilitate this. These include the recognition of organisational tensions, the significance of formal and informal networks, and the role of communicative action. These offer a 'relational' interpretation of the dynamic capabilities embedded in specific organisations which are a necessary element in the successful pursuit of system innovation toward broader societal goals of environmental sustainability

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Chapter 33 Transformations in consumption and production patterns from a regime perspective

Transformations within and between utility sectors

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1 Introduction

Network-bound infrastructure systems such as electricity, gas, water and telecommunications currently undergo transformations on multiple levels resulting from various sources of dynamics. These include changes of the regulatory framework - deregulation and liberalization -, changes of the institutional settings and corporate structures, e.g. as part of privatization and internationalization strategies, the introduction of new technologies and the emergence of new practices and cultures of use, for example in the context of mobile phones or the internet. Therefore, how these systems will look like in the future is dependent on developments within and across different action fields such as the provision of utility services, the consumption of these services and the political governance of both. Furthermore, these transformation processes do not take place in isolation in the different utility systems, but partly interrelate. Moreover, boundaries between these systems may shift or become blurred. The present paper proposes a conceptual approach for analyzing these ongoing transformations, which takes into account how transformation processes in production, consumption and governance patterns interrelate and how transformations within one infrastructure system interrelate with those of others. The paper[80] will

[80] The paper is developed in the context of the project "Integrated Microsystems of Supply", a participative foresight project that comprises the analysis of dynamics in the electricity, gas, water and telecommunications sectors, the construction of scenarios together with representatives from different stakeholder groups, an evaluation of the sustainability potential of the scenarios and the development of strategy options for and with different stakeholders (www.mikrosysteme.org). The project is funded within the Socio-ecological Research Programme at the German Federal Ministry for Education and Research (www.sozial-oekologische-forschung.org)

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predominantly focus on presenting the conceptual approach, but it will illustrate conceptual propositions by examples from utility systems. [81]

These transformations are of considerable importance for sustainable development because utility systems are closely intertwined with society and nature. Utility systems structure the relations between society and the natural environment. Therefore socio-technical transformations of these systems typically imply transformations of the relation patterns between society and nature, also referred to as social-ecological transformations (ISOE 2000). Utility systems are particularly important, because they enable and structure a large number of activities in firms and private households. Furthermore, utility systems themselves cause important environmental impacts by extracting and transforming natural resources, directing material flows, the production of toxic or radioactive waste, emissions, intervening in local ecosystems etc.

Given the high capital intensity and the coupling of technological, institutional and knowledge structures in these systems, socio-technical transformations tend to be relatively slow and strongly path dependent. There are few windows of opportunity for a departure from the established development paths. Radical changes in market rules, as the ones that have followed liberalization and resulting structural adaptations, open up windows of opportunity for developing more sustainable utility systems. On the other hand, this situation also exhibits the danger to lock-in new but not more sustainable structures for the decades to come. Thus, an encompassing conception of transformation processes is an important prerequisite to develop strategies on how to modulate transformation processes so as to exploit the potential for sustainable forms of the provision and consumption of utility services.

Transition theory has proposed a conceptual framework for analyzing system innovations, which considers the interrelation of provision-, consumption- and governance-related structures and, at the same time, considers transformation processes, which result from dynamics at different levels: a) dynamics located at the meso level of so-called socio-technical regimes, b) dynamics rising up from the micro level of specific innovation projects, c) dynamics resulting from processes at the macro level of broader societal, technological or ecological developments (Geels 2002a). Transition theory has been largely applied to analyze – either in a prospective or historical perspective - the dynamics involved in the transition from one regime to another. We propose that the concept of socio-technical regime and its interaction with processes at the micro and macro level may also be used more generally to analyze ongoing transformation processes in consumption and production patterns. Secondly, we sketch a conceptual framework, which allows to analyze how interactions between socio-technical regimes may contribute to transformation dynamics and how transformations may also lead to a shift of regime boundaries.

The paper is structured as follows: Chapter 2 gives a brief outline of the multi-level framework of transition theory and it elaborates, why we consider a specific understanding of a socio-technical regime as particularly appropriate to analyse transformation processes within and across consumption and production patterns, which may ultimately lead to system

[81] However, a thorough empirical analysis is beyond the scope of this paper. For a more encompassing analysis see Konrad et al. (2004).

innovations. Chapter 3 describes in more detail, how such an analysis may be conducted, illustrated by examples from utility systems. Chapter 4 then sketches the framework for analyzing multi-regime dynamics and presents potential dynamics in the utility systems resulting from these interactions. Finally, chapter 6 concludes by sketching a number of different overarching research questions and designs, within which the proposed approach may be fruitfully applied, and by deducing implications for policy.

2 Socio-technical regimes and the multi-level framework

In this chapter we will first give a very short overview of central building blocks and assumptions of transition theory: the concept of socio-technical regimes, the embeddedness of regimes in a multi-level framework and implications for socio-technical change to occur or to be brought about.[82] Then, we will explain in more detail, why we assume that the concept of socio-technical regimes may be specifically appropriate for analyzing transformation processes within and across consumption and production patterns, which may ultimately lead to system innovations.

According to Geels (2002b: 14) a *socio-technical regime* is defined as a socio-technical configuration, which fulfils a societal function, consisting of artefacts, user practices, markets and distribution networks, infrastructures, policy, laws, regulation, capital and finance. Socio-technical regimes are organized around the specific societal function, which is fulfilled by the socio-technical regime. Such a societal function may be transport, energy provision, housing etc. Elements of a socio-technical regime are co-ordinated, yet not necessarily perfectly aligned, so that tensions and frictions within the regime may emerge (Geels, 2002b: 106).[83] The interrelations of the elements of a regime provide on the one hand a stabilising function for the whole complex. Stabilisation does not exclude change, but it gives a direction to change which makes certain changes much more likely than others and incremental changes more likely than radical changes. On the other hand, if changes in parts of the regime occur, due to the interrelations further changes may be induced.

Technological *transitions* are conceptualized as a change from one more or less stable socio-technical configuration to another (Geels, 2002b: 15). Against the background of this conception we define *transformations* as major structural changes not necessarily of, but also *in* a socio-technical configuration, that is not necessarily a change *of* the socio-technical configuration as a whole. In the case of ongoing transformation processes, in contrast to an analysis of historical case studies, it is often impossible to predict in advance, whether such changes will ultimately be part of a larger transition process. Furthermore, they may not follow a dynamic pattern of a smooth s-curve from one stable state to another, but may include other macro dynamics, including steady incremental changes, cyclical movements or catastrophic changes. Moreover, it is not always possible to decide beforehand how sustainable a specific alternative scenario will be. Thus, we cannot presuppose that a regime shift is the only way to go for. Therefore, in

[82] For more detailed presentations of the approach see Kemp (1994), Schot (1998), Rip & Kemp (1998), Kemp et al. (1998), Rip (2000); Geels (2002a; b) and Hoogma et al. (2002).

[83] Therefore the concept of regimes refers to a less strictly coordinated entity as a narrow conception of a system would imply.

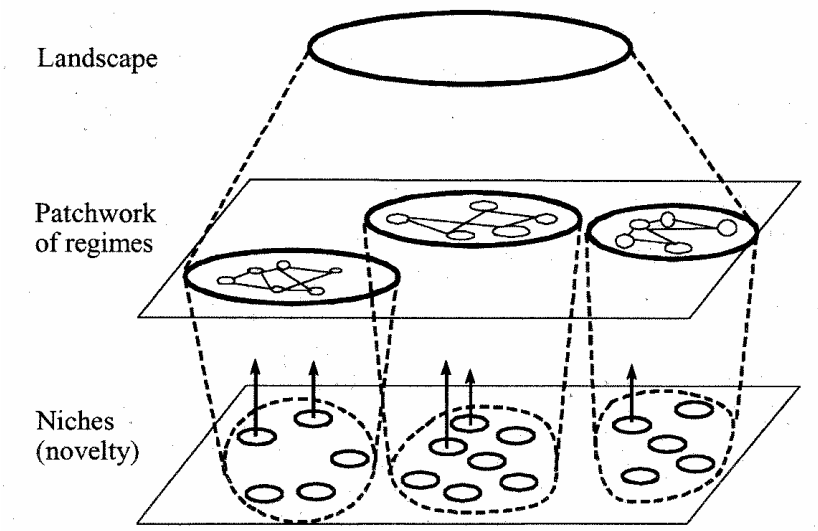
the following we will mainly refer to the broader conception of transformation processes.

The multi-level framework refers to a set of interrelated processes at three levels (see figure 1). Socio-technical regimes at the meso level correspond largely to the level of sectors. Both notions are not identical though. One sector may be dominated by one regime, e.g. the electricity sector so far, while another sector is rather characterized by two competing regimes as in the case of the transport sector with a private car-based and a public transportation regime (Hoogma et al., 2002). In contrast to incremental innovations, which may emerge within established regimes, radical innovations are typically generated in *niches* at the micro level. Niches are defined as socio-technical environments, for instance application domains, which are characterized by specific selection conditions diverging from the dominant regime (Hoogma, 2000: 80ff.).[84] Niches are important for socio-technical change, because they provide a space for learning about design specifications, possible ways of using and user requirements, new meanings, societal and environmental impacts, production and maintenance and the adequate regulatory framework (Hoogma et al., 2002: 28). Furthermore, niches allow for the build-up of supporting actor-networks. Major socio-technical changes as regime shifts typically start from niches and rely on a dynamic of niches: an expansion of niches, which eventually leads to the replacement of the old regime; a technology may also be implemented in a succession of different niches (niche branching or niche-cumulation) or the emergence of a new regime relies on the interaction of multiple niches (Schot, 1998; Geels, 2002a; 2002b: 121ff., 326f.). In the process of niche branching the technological design as well as the application domains may gradually depart from patterns that at the beginning had been rather similar to the respective regime (Hoogma, 2000: 341ff.).

Rather inflexible or slowly changing structures external to a socio-technical regime are defined as part of the socio-technical *landscape* at the macro level. These external structures consist for example of macro economic developments, demographic trends, cultural changes, broad political changes or environmental problems (Geels, 2002b: 109). They may have a considerable impact on the transformation dynamics of a regime, yet they cannot easily be influenced by the regime actors.

[84] Two types of niches are distinguished. The first type refers to so-called *technological niches*, which are explicitly built up to provide a protected space for innovations to be tested and to gain experience. A typical example would be experiments and pilot projects with new technologies, which do not have to be economically viable, which might still show technical problems, or which do not have to fully comply with the usual regulatory requirements. In evolutionary terms this is to say that selection criteria are suspended or weakened or that the innovation is only partly exposed to the selection criteria (Hoogma 2000: 81f.).[84] *Market niches* are also characterized by locally specific selection criteria. However, these are not the result of specific protection measures, but rather due to specific characteristics of an application domain and certain user groups, or they have been developed on the basis of a former technological niche (Kemp 1994; van den Ende/Kemp 1999; Geels 2002b: 100, 114).

Figure 1: The Multi-level framework (Geels, 2002a: 1261)



In addition to transformation dynamics rising up from the bottom of niches, transformation pressures may also result from dynamics at the level of regimes or dynamics at the landscape level. The interplay of these internal dynamics, e.g. concerning user practices, technology, policy or industry structure, may lead to tensions in the regime, which will open up windows of opportunities for novelties and thereby may also lead to broader changes (Geels, 2002b: 104).

To summarise, we consider the concept of a socio-technical regime as particularly appropriate to analyse transformation processes within and across consumption and production patterns, which may ultimately lead to system innovations, for the following reasons.

Firstly, it allows to identify a specific socio-technical configuration with respect to the societal function it fulfils. This is an appropriate demarcation, if we are interested in sustainable ways to fulfil these functions and not primarily in a specific technological system, which is rather the focus of concepts as socio-technical systems or technological regimes (Kemp et al. 1998). In a similar vein, the focus on a societal function stands in contrast to concepts of innovation systems, which either take a spatial focus for delimiting the system, as in the case of national or regional systems of innovation (Lundvall, 1992; Cooke 1997), or rather focus on the provision side (Malerba, 2002; Carlsson, 1991) and not so much on transformation processes based on various sources of dynamics in the spheres of provision, consumption and governance.

Secondly, because of the reference to a societal function it lends itself rather easily to the analysis of processes within the provision, the consumption and the governance of utility services or those related to another societal function as transport, housing etc. In the following, we will call these three fields action domains. It allows for a systematic analysis of the heterogeneous structural elements within these action domains and of the interactions and coupled dynamics between them. Usually different

conceptual approaches are used for analyzing processes in these domains, which makes it more difficult to take an integrative view. On the other hand, this implies that as such the concept of socio-technical regimes is not specifically attuned to the specific structures and rationales governing the three action domains, for example to account for the different rationales within firms, households and political administration. Therefore a more specific analysis of processes may be necessary in certain cases.

Thirdly, the multi-level concept allows to analyse transformation "pressures" from outside the regime and fourthly, as elaborated in the next chapter, it can also serve to consider interactions between different regimes.

It may be necessary to make more explicit, that we understand socio-technical regimes as a socio-technical configuration, which comprises heterogeneous structural elements such as technological structures, e.g. generation technologies and distribution networks, institutional structures, e.g. organisational structures of utility firms or regulation bodies, regulations and laws, established use practices, arrangements of ownership and use rights of technologies, knowledge structures, e.g. knowledge related to the provision and use of utility systems and qualification schemes, and also value structures as social norms concerning hygiene or guiding principles as the provision of a universal service. This understanding differs from more narrow conceptions of socio-technical regimes that subsume mainly institutional rule-sets as part of the regime, yet not technological elements (Kemp et al., 1998; Geels, 2004).

Furthermore, extending the socio-technical conception, ecological elements may be added. Utility systems are a central element structuring the relations between society and the natural environment (see chapter 1). This function is particularly prominent for the utilities, with its specific dependence on as well as specific relevance for ecological systems. To consider this function and, moreover, to describe possible transformations in the way how in a specific regime societal, technical and ecological elements are linked or in the way how material and energy flows are guided, ecological elements can be considered explicitly.[85] Finally, the actor groups involved in the provision, consumption and regulation of specific societal functions are also considered as part of the regime.

3 Transformation dynamics as an interplay between processes in the provision, consumption and governance of utility systems

3.1 Delimitation of regimes

When using the concept of regime in the field of utilities the question arises at which level this concept should be fruitfully applied. Does it refer to sector-specific regimes as a gas or water regime? Or rather to an overarching utility regime spreading multiple sectors? Or is it more reasonably applied below the level of sectors, e.g. to specific socio-technical configurations which have evolved around certain electricity generation technologies like nuclear or wind power? To answer this question we have to consider, how regime boundaries may be identified. We propose to identify regime

[85] For more detail see Konrad et al. (2004).

boundaries according to the density and strength of couplings between the elements of socio-technical configurations.

We differentiate between different kinds of couplings namely functional and structural ones. As functional couplings we identify input-output relationships between different elements, e.g. parts of the value chain. A further example would be enabling products or services of one sector for another, e.g. the coupling between the gas and electricity sector via a gas turbine driven power plant or the provision of telecommunication services for the regulation of power generation technologies.

Structural couplings refer to elements which are at the same time part of two overarching complexes. These may be jointly used material structures, as water reservoirs used for the production of drinking water and power, or jointly used transport infrastructures, e.g. powerline cables used for telecommunication services. Structural couplings may also exist at the institutional level. These may be joint organisations as modern multi-utilities or traditional municipal utilities, joint professional associations of gas and water as they exist in Germany and Switzerland or laws and regulations applied to multiple sectors. On a normative level a further example may be the common conception of a basic service which is provided in an undifferentiated way to all citizens of a certain region, a public service.

If structures merely show a high degree of similarity between different sectors but do not actually constitute a common institution, organisation or material artefact we will not speak of structural couplings but of structural similarities.

A boundary between two regimes may now be identified if we find relatively dense and hardly substitutable couplings within two complexes of elements, whereas couplings between these complexes are less dense and more easily substituted. Furthermore, couplings within a regime will typically spread different structural dimensions as technologies, institutions or knowledge structures. In addition, as outlined in chapter 2, a regime as a whole has to fulfil a certain societal function.

Under monopoly market conditions the sectors considered here can be described as five regimes: an electricity, gas, drinking water, sanitation and telecommunication regime. They are characterised by a high degree of similarity and a number of couplings exist between them; however these are less dense as the ones within. Within these regimes specific and largely independent institutional and technical structures have emerged. These are specific networks and generation technologies and largely specific organisational structures – either as independent companies or highly separated organisational structures within a utility company. The regimes were largely based on different resources, regulatory bodies and laws; the provision of the services was based on specific knowledge and differentiated professional structures. We split up the water sector in a drinking water and sanitation regime, since these are also largely based on specific networks and appliances, specific organisational units and professional associations, knowledge and professional structures; also the societal perception of these two services differs substantially.

The concept of a regime may to some extent also fruitfully be applied to the socio-technical configurations which have developed around specific generation technologies, e.g. in the electricity sector, if these consist of a densely coupled and mutually stabilising set of technological, institutional,

knowledge and value structures. However, these are functionally highly – and *so far* in a hardly substitutable way – coupled to the overarching electricity regime.

Still the delineation of a specific regime may never be made as clear-cut as we may wish. There may be strong structural couplings at certain points of the value chain between regimes and other relationships within a specific regime may be in principle substitutable by alternatives.

3.2 Description of central regime characteristics

Once a socio-technical regime, or multiple regimes, is identified, central structural elements and characteristics are described. Furthermore, ongoing or potential changes of these characteristics are noted. This analysis allows to systematically create a rather encompassing picture of potential elements to be taken into account in an analysis of transformation processes.

A specific feature of the utility regimes as we know them today is that they show a large number of structural similarities. This must not necessarily hold also for the future (see also the next chapter). Telecommunications, which once showed important similarities to the electricity, gas, water and sanitation regimes, have already undergone important interrelated transformations in all three action domains, e.g. early liberalisation processes, changes of corporate structures, various technological innovations and important changes of user practices, have already departed substantially from the former monopoly-based regime. One may even discuss whether it is still appropriate to consider the by now rather heterogeneously structured telecommunications sector as a single regime.

The following table summarises a number of characteristics of the utility regimes as they have been valid so far and potential or recent changes to these characteristics.[86]

3.3 Transformation processes within and across action domains

While the concept of socio-technical regimes lends itself specifically for the analysis of processes across action domains (see below), it provides also a specific analytical perspective on transformation processes within the action domains. Firstly, the systematic identification of heterogeneous structural elements as technologies, use practices, arrangements of ownership and use rights, use knowledge and social norms, provides a starting point for an analysis of co-evolutionary dynamics of these elements. These elements may themselves be embedded in further regimes. So the consumption of utility services is typically embedded in various "use regimes", which fulfil a specific societal function such as laundry, body hygiene, food preparation and preservation, room heating and cooling or telephony in the case of private households or pulp-and-paper-production, aluminium production etc. in the case of industrial activities.[87] As historical studies show, these use regimes have often emerged and developed in co-evolution with the utility regimes (Schwartz-Cowan, 1983; 1987;

[86] The table is the outcome of a more detailed analysis in Konrad et al. (2004).

[87] For the laundry regime or laundry as a "system of systems" see Shove (2003). The concept of use regimes for the laundry and other domains has also been applied by Hirschl. et al. (2002).

Silberzahn-Jandt 1991; Heidenreich & Glasauer 1997; Nye 1998; Shove et al. 1998; Pantzar et al. 1999; Myllyntaus 1995).

Table 1: Potential transformations of utility regime characteristics

	Characteristics of utility regimes in the past	Potential or ongoing transformations
regime as a whole	spatial, temporal, social homogeneity of utility services	increasingly differentiated offers?
	universal service, technical and social reliability of provision dominant criteria for operation and investment	increasing importance of economic efficiency
	clear boundary between consumption and production with scarce interaction	blurring of boundaries and stronger interaction as a result of decentral technologies or differentiated offers and a stronger customer orientation of utilities?
	demand as external factor	demand side management?
	sectors are characterised by one dominant regime	competing regimes within sectors, regimes expanding across established sector boundaries?
provi-sion	central generation, wide spanning distribution infrastructure, separation of loci of production and consumption	increasingly decentralised generation; infrastructure serves for balancing and back-up?
	public utilities	increasingly utilities organised as private enterprises
	ecological impacts externalised or `informally' integrated in utilities procedures	reduction of internalisation and increase in external regulation?
consum ption	privatised use of utility services and intermediary technologies	increased use of service-based use and maintenance of intermediary technologies?
	„stand-alone" technologies, e.g. heating, electrical appliances, sanitary facilities	networked technologies (smart building)?
	pricing split into fixed and consumption dependent component	telecommunication: all types of pricing structure
governa nce	regional monopolies	partly competition, dependent on sector and part of the value chain
	governance by associations, 'co-operation-oriented self-organisation' of provision actors	fragmentation of associations, increasingly governance by political regulation
	prices and investment supervised by ministries of federal states	regulation of networks, competition by specific federal authority
	national policy	increased importance of European policy
	environmental policy based on laws	environmental policy based on commitment, economic instruments and negotiations

Multi-level dynamics between niches, regime and landscape may also be applied with a special focus on processes within an action domain, particularly, if a concept of niches is used, which considers not only technological, but also institutional or organizational innovations, which are particularly relevant in the consumption and governance sphere (Konrad et al., 2004b).

In addition to transformation processes within the action domains, the interrelations between processes in the different domains have to be taken into account, even more so, if transformation processes are concerned, which may ultimately imply changes of the overall regime. Dynamics and innovations, which looked upon as an isolated development, do not seem to imply radical changes may, however, result in fundamental changes, if these processes interrelate. We want to illustrate this by a hypothetical example from the water and sanitation regime (see also Rothenberger 200X).

In Germany, the per capital water consumption has decreased significantly in the past 20 years; this effect has been particularly strong in the Eastern part of Germany. The reduction in water use is probably a combined effect of technological changes on the side of the users as well as changes of use practices. The future development of water consumption is uncertain. We may, however, speculate that further reductions are possible, e.g. due to the further diffusion of water-saving appliances. The structure of pricing common in Germany does provide an incentive to do so, because costs charged to the users are to a large part dependent on the consumption.[88] This, however, does not reflect the actual cost-structure of the provision of water, which is only to a small extent dependent on the water distributed. Accordingly, if water consumption decreases, prices per litre are bound to increase, which creates further incentives to reduce the use of water. This may then create an incentive to users, either households or commercial users as hotels etc., to implement water recycling systems. In addition to the decrease in water consumption per capita, developments at the landscape level may lead to a further reduction of the absolute water consumption, particularly in specific regions. These are demographic changes in combination with a migration from Eastern German regions, which suffer from serious economic problems. In sum, these developments would be able to put a strong pressure on the side of the provision of water and sanitation, which need a certain flow for proper functioning. Moreover, these systems already face a substantial pressure because of the high investments for the infrastructure that will be necessary in the near future. Eventually, the combination of both, reduced water consumption and pressures from investments could create an incentive to implement decentralised sanitation systems, which would indeed imply radical changes to the regime structure.

4 Interaction of regimes

Transformation processes in the utilities are not restricted to transformations concerning one regime; as the hypothetical example just presented has pointed out, rather several regimes are involved, interactions between these regimes may contribute to the transformation dynamics and transformations may also lead to a shift of regime boundaries.

More precisely, to consider the interactions between regimes may also be important, if the focus of analysis is the shift of one regime to another, since also in this case interactions with further regimes may contribute to the dynamics. More clearly this is the case, if we are not so much interested in

[88] We do not claim that users follow a strict economic rationale, when consuming water. Nevertheless, the general impression that water is getting more and more expensive may have an effect on user behaviour. Increasing water prices have been quite an issue of debate recently.

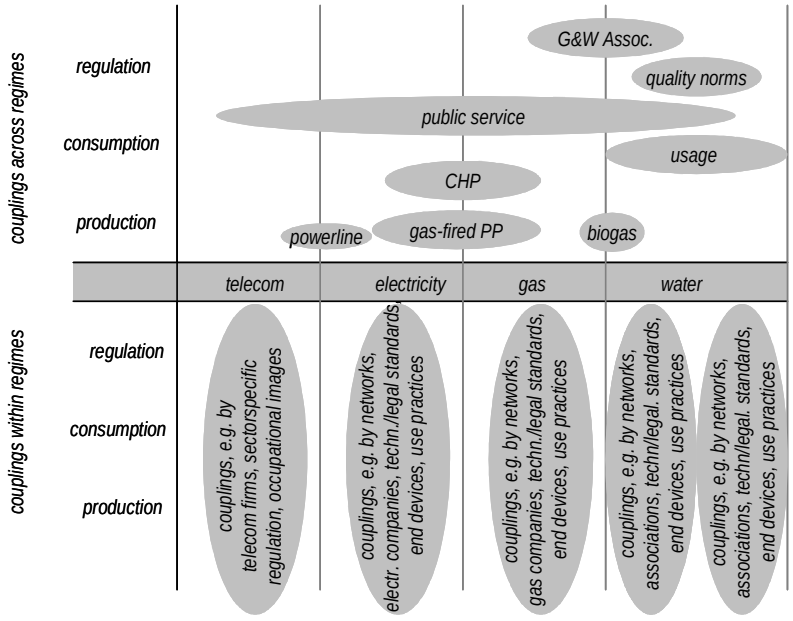
the fate of a specific regime, but on all regimes, which are able to fulfil a specific societal function. This is more obvious in cases like transport where different regimes co-exist in contrast to the current situation in the utilities. However, this situation could in principle change, as will be shown in the following. Furthermore, interrelations between regimes may play an important role, if a specific innovation and its relation to different regimes is the focus of analysis, particularly if this is radical innovation. Finally, it is central in the case at hand, that is, when a cluster of regimes is concerned.

To illustrate, how boundaries between utility regimes may change, we will first present two hypothetical example (4.1). Then, to analyse these dynamics, we identify different types of relationships between regimes (4.2) and finally present potential coupled dynamics of a multi-regime system (4.3).

4.1 Boundary shifts of utility regimes

In chapter 3.1 it was shown that under monopoly market conditions the utility sectors considered here can be described as five regimes: an electricity, gas, drinking water, sanitation and telecommunication regime. Figure 2 illustrates the structure of the couplings within and between these regimes.

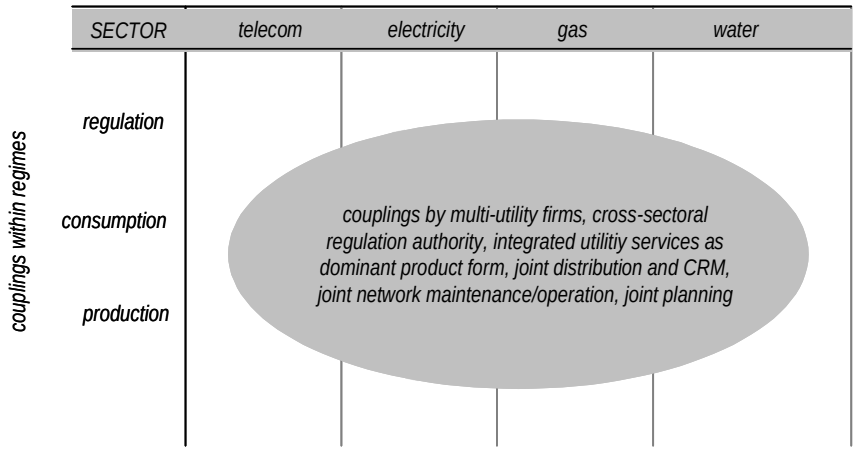
Figure 2*: Representation of inner-regime and cross-regime couplings for the case of monopoly market regulation.*



However with ongoing deregulation, utility firms have begun to restructure their business fields and this may have impacts on the interaction of the formerly separated regimes. Some international utilities for instance began to position themselves as multi-utilities combining several services into combined offerings. Transformations may lead to the merging of formerly separated regimes, the splitting into sub-regimes or the integration of regimes at different levels of the value chain as in the case of vertical integration.

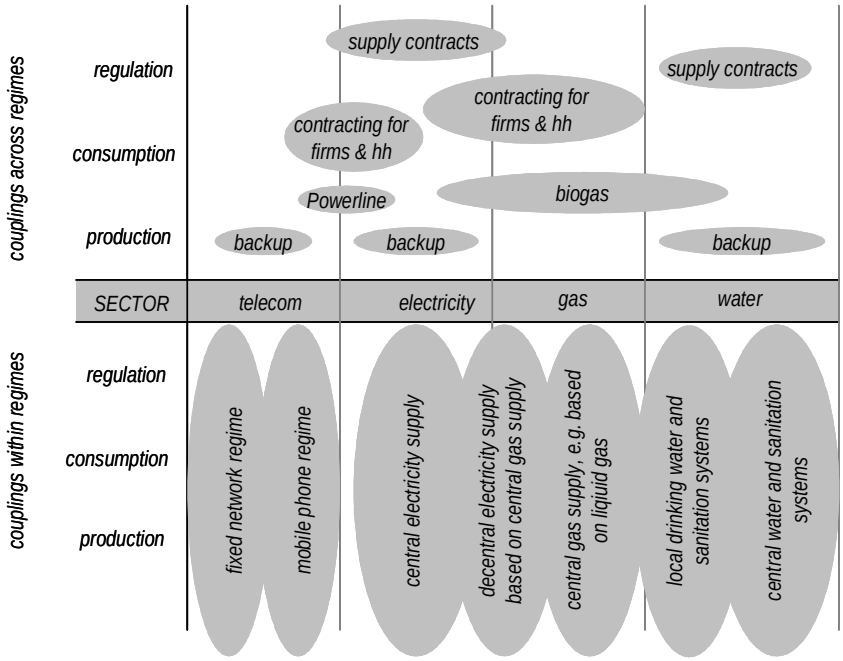
For illustration, we may identify two extreme scenarios which still seem realistic. On the one hand a strong integration of utility services may happen by the way of emerging new multi-utilities, the creation of overarching market regulators spanning all utility services, the joint planning, construction, maintenance and use of transmission infrastructures (see below) and the diffusion of new generators such as gas power plants. For the water sector a strong integration between water provision and sanitation seems feasible. Here boundaries between regimes become increasingly blurred and at the endpoint of the development an overarching utility regime may emerge (figure 3).

Figure 3*: Possible future regime of integrated utility services.*



However, also much more diversified developments may be imagined. The following figure 4 shows a newly reorganized set of utility regimes, which are not based on conventional media differences but which rather follow specific network structures. There might be a new decentralized electricity generation regime, which is combined with a centralized gas regime. This regime would still have to rely on some services of a centralized electricity regime. However, technologies, use patterns, institutions, knowledge and values might be largely different when the centralized and the decentralized regime are compared. A similar situation might be imagined for the water sector, if used water is recycled within the household or a firm and the dependence on a centralized water provision system amounts only to a fraction of the quantities compared to the current situation. Furthermore, new couplings between regimes may emerge, for example in the case of biogas, when biogas produced within decentralised sanitation systems is used for decentralised heat and electricity use or fed into centralised gas and electricity systems.

Figure 4*: Possible future reshuffled utility regimes based on a dual centralized/decentralized structure.*



Summarizing, we see that in order to discuss the future development alternatives of utility services, the focus of a single regime system is not sufficient. The changing relationship between regimes, the mutual influence between regimes becomes a major driving force and may be decisive also for the sustainability dimension of these sectors. In the following, we will discuss these interactions on a more systematic level.

4.2 Interactions between regimes

For the analysis of interactions between regimes, which exert an influence on transformation processes in the utilities, three types of relations between regimes have to be taken into account. Each type of relation implies different forms of interactions. We will first describe the three types of relations and then exemplify, which transformation dynamics between multiple regimes may result on the basis of these interactions in the case of utility systems.

Interactions between regimes fulfilling a similar societal function: Most studies of the historical development of regimes and regime shifts focused the competitive relationship between regimes, which fulfil a similar societal function. A prominent example is the interaction between private and public transport competing for passenger travel (Kemp, 1998; Hoogma et al., 2002). Competition in end user markets can be seen as a specific form of a structural coupling between two regimes.

Interactions between regimes on the basis of complementary relations: Regimes are functionally coupled with other regimes. For example utility systems are coupled with a large number of regimes, which structure the different uses of the utility systems (see above). The latter types of regimes – in our perspective from the utility sector, we may call them “use regimes” –

often develop in co-evolution with the utility regimes.[89] Furthermore, there are complementary relations between utility regimes, e.g. in the case of gas-based electricity generation.

Interactions between regimes showing structural similarities: interactions between different regimes may also take effect if structural similarities between two regimes exist. Interactions may in these cases take the form of transfer of experiences from one regime to the other or because structural similarities open up synergies, which may be reaped by forming new structural couplings.

The three types of relations are not mutually exclusive. Regimes competing for certain markets may have important structural similarities as in the case of gas and electricity. However, this must not be, as can be seen with the more structurally diverse regimes of public and private transport. Furthermore, regimes fulfilling in some instances a societal function competitively may fulfil this societal function complementarily at others (see below).

4.3 Potential transformation dynamics between utility regimes on the basis of competitive and complementary relations and structural similarities

Interactions between regimes may contribute in two ways to transformations of regimes: as transformation processes *by* interactions between regimes and as transformations *of* the structure of interactions. In the following examples in the field of utilities for both forms of transformations are given.

Transformation by interaction: firstly, dynamics in one regime may trigger off or contribute to dynamics in other regimes mediated by direct and indirect linkages between regimes.

Transformation of interaction: secondly, the structure of couplings and interactions itself may be modified in the course of transformation processes. The result may be an intensification of the couplings between regimes, which may eventually lead to a shift of regime boundaries and an integration of regimes. On the other hand, a decoupling of regimes or a shift of couplings, which does not imply changes of regime boundaries, is possible. The new structure of couplings will then affect further transformation processes.

4.3.1 Transformations on the basis of structural similarities

Regimes showing structural similarities are not necessarily coupled in any direct way. Nevertheless, transformation by interaction is still possible if transfer of experiences or imitation takes place. This applies to forms of regulation, most obvious in current tendencies towards liberalisation in all utility sectors or, more specifically, in the regulation of network access (Voß/Bauknecht 2006), but may also apply to changes in organisational structures, for example concepts of privatisation or internal corporate structures, customer management or new service offerings.

Structural similarities may furthermore form the basis for actualising potential synergies. In the case of utilities, we currently see such efforts in

[89] For the laundry regime see (Orland 1991; Shove 2003), for the co-evolution of electricity and a number of energy-intensive industries Myllyntaus (1995), for air conditioning Shove et al. (1998).

the form of integration or co-ordination in fields as customer management and network operation. Synergies exist here for instance in the parallel or coupled laying of cables and mains, such as telecommunication cables parallel to gas mains or in sewage canals, or the co-ordination and integration of maintenance activities for different networks. The latter is not the least driven by a development to telecommunication-based remote maintenance. In the field of customer management billing, metering and customer services could be integrated. Synergies are particularly important for structurally similar regimes, since synergies are more likely here than in other constellations. On the other hand, we may also find decoupling of processes, if former structural couplings are found to lack sufficient synergy at a later point of development. Generally these interactions are situated between specific elements of the regimes, e.g. specific parts of the value chain. They do not apply to the regime as a whole. Therefore increasing integration at one point of the linkages between two regimes may well go along with a decreasing integration at another.

The realisation of synergies between two or more regimes will easily bring about structural changes in the respective regimes. These are for example changes in processes, competencies and the organisational structures of companies, which may further go along with changes of corporate culture. Technological innovations may be implemented and patterns of qualification have to be adapted. In Germany new training courses are offered now that prepare for an integrated maintenance of networks (Rothenberger 2003). These structural changes do not *necessarily* imply profound changes in the overall regime structure. However, a dynamic is possible, where a stronger integration of regimes could induce further changes on the basis of the new structure of intensified interactions. A successful cooperation in the operation of networks could pave the way for the introduction of new integrated generation technologies and thereby a much stronger coupling of regimes. In quite the same way successful integration of customer management may be a first step in the direction of new offers of integrated services. An introduction of new integrated generation technologies and integrated services would most probably result in major changes in the utility regimes. Dynamics of this kind illustrate why in a prospective perspective it is difficult to differentiate between dynamics which do ‘only’ lead to limited transformations of a regime like the cooperation in the operation of networks or the integration of customer management and those, which ultimately result in more profound regime changes.

4.4 Transformations on the basis of competitive relations

Transformations by interactions on the basis of competitive relations could follow a shift from the use of electricity-driven to gas-driven technologies on the side of the users – be it via household technology or production machinery – or the other way round. As long as the shift is only marginal this will probably not affect the regime structure and the interactions between both. However, in the case of a far reaching shift from one dominant regime to another, changes in the internal structure as well as the structure of interactions between regimes are to be expected. Furthermore, markets will change and thereby also linkages with regimes fulfilling complementary functions.

A second type of transformation would be a shift from mainly competitive to more complementary relations between two regimes. Whereas regimes fulfilling a similar societal function compete on the one hand for common markets, at the same time this opens up a potential to fulfil jointly a common societal function. Quite often regimes competing at one point are functionally coupled at others fulfilling a certain function complementarily. In the course of a shift from competitive to more complementary relations new functional couplings are to be expected. In the domain of energy systems an increasing use of gas as primary energy carrier in electricity generation could be an example. A much more radical dynamic in this direction would be a rather tight coupling of electricity, gas and the sewage system in the course of a potential transformation path leading to highly decentralized systems. Here the endpoint could be the merging of until now fairly separate utility regimes into a common larger utility regime.

4.5 Transformations on the basis of complementary relations

Transformation processes on the basis of complementary relations rely on functional couplings. Partly these are indirect interactions between regimes via common complementary regimes, e.g. certain use regimes. This could be an increase in the gas or electricity consumed because of an increase in the use of hot water, or, just the other way round, if less water is consumed, because energy is to be saved. A similar case is an increase in the use of electricity following the spread of new telecommunication applications (Huser/Aebischer, 2002; Büllingen/Stamm, 2003).[90] These use regimes are themselves coupled with other regimes, for example the regime of room heating and cooling is coupled with the regime of housing. Therefore major changes in the housing regime may indirectly affect utility regimes.

As mentioned above, complementary relationships often lead to co-evolutionary dynamics. Utility regimes and a number of its use regimes, in the private as well as in the industrial sector, could only develop conjointly as has been illustrated in historical studies. This type of dynamics typically goes along with a transformation or gradual emergence of interactions.

An important example may be illustrated by demand side management, an orientation of demand following supply, because this implies a stronger interaction between utility and use regimes, either based on technical, institutional, knowledge or value elements or some combination of these. These changes would imply considerable changes of the provider-consumer-relationship in the respective utility regimes (Chappels et al. 2000; Van Vliet 2002). A rather extreme version is the possibility for supply side actors to actively turn on and off consumers of electricity (Kets et al. 2002). A development in this direction could be a correlative to an overall development in the direction to a decentralisation of utility systems.

[90] In the case of utility regimes the number of complementary use regimes is fairly large, so that an analysis of the role of complementary regimes for transformation processes in the utility regimes has to start by a selection of those complementary regimes that are likely to have a considerable impact on transformation dynamics of the utility regimes. This could be because of foreseeable internal dynamics and a strong coupling to the utilities, e.g. because they consume an important amount of the produced electricity, gas, water or telecommunication services.

5 Conclusion

In the present paper, we have shown how transition theory might be fruitfully applied in order to discuss ongoing transformations in the utility sectors. The analysis of landscapes, regimes and niches helps to focus on stabilizing forces as well as different sources of dynamics and to develop an integrated view of processes spanning consumption, production and regulation in order to identify future development paths, barriers and windows of opportunity. This step is an important precondition for identifying and assessing more sustainable futures of these utility sectors.

In this paper the approach was presented in a rather generic way as a conceptual tool for analyzing ongoing and potential future middle- to long-term transformation processes in the way specific societal functions are fulfilled. This generic approach or also parts of it may be applied in a more specific way to different types of studies. The basic step of the identification of central structural elements of a regime and the description of its characteristics can be used as a systematic way to identify important influence factors for transformation processes, which may then build the basis for further scenario-building processes, which serve to explore a range of possible developments. A transformation analysis may also serve to build scenarios in a more theoretical way. An analysis of specific transformation dynamics can also serve to identify loci where strategies and policy measures may concentrate on and to some extent also to analyse, which positive or negative side-effects may be implicated. Furthermore, it may also be used to more particularly explore a range of development pathways that a specific innovation may take, thereby considering processes in the different action domains and processes in relation to different regimes, competing and complementary innovations as well as processes at the landscape level.[91]

Moreover, the concept can be applied within different steps of a methodology – sustainability foresight - that has been developed within the project this paper has spun off from (Voß 2006). The aim of the methodology is to develop shaping strategies for long-term, sustainability-oriented structural changes on a sectoral level. The methodology consists basically of a participative scenario analysis, a sustainability assessment of these scenarios, the selection and in-depth study of a number of innovation fields and finally, the development of strategy options in collaboration with and for stakeholders from the three action domains.

Within this paper we could only point to the empirical implications by way of illustrative examples. It could, however, be shown that transformation dynamics in the utility systems are likely to imply changes in the structure and the delimitation of various regimes as well as in the interlinkages between these regimes. This has the rather obvious implication for policy approaches aiming at supporting a development to more sustainable utility systems that sector-specific approaches may be problematic and, similarly, that an integrative policy approach across action domains requires a co-ordinated policy approach involving e.g. the economic ministry and the ministry consumer protection.

[91] This analytical procedure (Innovation System Analysis), which combines the multi-level perspective with the innovation systems approach, will be elaborated in a paper, which is currently in preparation (Markard et al.).

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Chapter 34 Transition management as a model for managing processes of co-evolution towards sustainable development

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Abstract

Sustainable development requires changes in sociotechnical systems and wider societal change -- in beliefs, values and governance. In this article we examine policy aspects of managing processes of co-evolution. We discuss dilemmas for policy and possibilities for transition management: the management of processes of structural change towards sustainability goals. Through transition management society is being taken into a transition process to a new, broadly defined destiny in a forward-looking and adaptive manner. Transition management is a multilevel model of governance, which shapes processes of co-evolution using visions, transition experiments and cycles of learning and adaptation. Transition management helps societies to transform themselves in a gradual, reflexive way through guided processes of variation and selection, the outcomes of which are stepping stones for further change. It is being argued that societies can break free from existing practices and technologies, by engaging in co-evolutionary steering. This is illustrated by the Dutch waste management transition. Perhaps transition management constitutes the third way that policy scientists have been looking for all the time, combining the advantages of decentralized modes of coordination (based on mutual adaptation in markets) with the advantages of planning (based on long-term objectives).

Keywords: co-evolution, sustainable development, multi-level governance, incrementalism, planning, and goal-oriented modulation.

1 Introduction

Sustainable development is about the redirection of development (WCED, 1987). It is not about an identifiable end state. Sustainable development is a never-ending process of progressive social change. It involves multiple transitions or system innovations. Each transition is made

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up of processes of co-evolution involving changes in needs, wants, institutions, culture and practices.

In this paper we argue that sustainable development requires radical changes in functional systems and changes not only in government policy but also in current systems of governance (the orientation of society and patterns of interaction over collective issues). In our view, the existing policy frameworks with fragmented policy areas are not suited for dealing with social complexity and desired long-term change. Different types of governance are needed: more open, adaptive, and oriented towards learning and experimenting.

Special attention is given to co-evolution, where different subsystems are shaping but not determining each other (relative autonomy). We will argue that a co-evolution perspective is the proper perspective for thinking about governance for sustainable development (Norgaard 1994; Van den Bergh and Stagl, 2002; Rammel et al., 2004), and will describe a model of shaping co-evolution processes to sustainability goals, which is transition management. Through transition management (developed by Rotmans et al., 2000) alternative social trajectories are explored in an adaptive and anticipatory manner.

This paper consists of four parts. The first part of the paper examines the notion of sustainable development and its relation with co-evolution. The second part discusses problems of steering, offering suggestions for how problems of distributed control, dissent and political myopia may be overcome through transition management. The model of transition management is illustrated by Dutch waste management policies as a form of reflexive, co-evolutionary steering. The last part compares the model of transition management with other models for policy and governance: planning (relying on control) and incremental politics (relying on small steps). As we will see, in terms of governance, transition management makes use of what Lindblom (1979) calls “partisan mutual adjustment” but with special attention given to problem structuring, long-term goals and learning about system innovation. It combines the capacity to adapt to change with a capacity to shape change (Rammel et al. 2004) and is concerned with positive goals (collectively chosen by society following a process of problem structuring). The first element – of adaptivity of systems to its environment – is well-established within the literature on co-evolution (looking at resilience), the second element, of shaping subsystems and their environment received far less attention. It is on this that this paper intends to make a valuable contribution, using the waste management transition in the Netherlands as an example.

2 Sustainable development as co-evolution

Following the Brundtland report Our Common Future (WCED, 1987) sustainable development came to be defined as redirection of trajectories of change in ways that combine economic wealth, environmental protection with social cohesion. After the initial optimism about win-win opportunities it is increasingly understood that there are tradeoffs between the three goals in any type of development (at least in the short term) and that each development tosses up new problems for society. Car-based transport was once much more clean than horse-drawn carriages which filled the street

with horse excrement, giving rise to the occupation of road sweepers, clearing the road for people to walk (Kemp and Soete, 1992). These days, we have ozone problems caused by automobiles, congestion problems, noise problems and over a million traffic deaths yearly worldwide. In 2000, 1.26 million people died in road accidents (WHO, 2004).

Approaching sustainable development as a continuous process of change means that it cannot be translated into a blueprint or a defined end state from which criteria could be derived and unambiguous decisions be taken to get there: as a multi-dimensional and dynamic concept sustainable development can neither be translated into the narrow terms of static optimisation nor is it conducive to strategies based on direct control, fixed goals and predictability (Rammel et al., 2004, p.1). We face a dynamic process where the starting point cannot be a fixed idea of sustainability but derives from social consensus on what we consider to be unsustainable (Wilkinson and Cary, 2002 quoted in Rammel et al, 2004). Sustainability refers to a process and a standard and not to an end state: each generation must take up the challenge anew, determining in what directions their development objectives lie, what constitutes the boundaries of the environmentally possible and the environmentally desirable, and what is their understanding of the requirements of social justice (Meadowcroft 1997, p. 37).

In sustainability discussions, the term co-evolution is frequently used. For instance, Norgaard (1984) sees the solution in a co-evolutionary potential based on diversity in the widest sense (including diversity in governance). A co-evolutionary view indeed is important for thinking about governance for sustainable development for two reasons. First, it accepts that we have cause-effect-cause loops across different scales and systems, with effects becoming causes of other developments ('positive feedback' in systems terms). A good example is the use of cars, which facilitated travel and urban sprawl, which in turn increased the demand for cars. This simple example also shows that people's needs are partly endogenous to other developments. See for instance studies on the co-evolution of perceptions and bounded rationality, which point to the relation between human needs are partly endogenous and related to a selective environment (Hadfield and Seaton (1999); van den Bergh and Stagl (2003)). The same is true for policy, which is not independent from economy but a response to problems, pollution for instance, with the policies giving rise to new problems (high costs or waste). Second, very paradoxically, a co-evolutionary perspective sees developments in different subsystems as partially independent. Co-evolution is a special type of interdependency: A influences but not determines B and C, which in turn influence but not determine A, although both A, B and C change irreversibly. The different units of evolution enjoy relative autonomy in development. Technical change co-evolves with institutional change (within systems of governance and organizations and culture), they are shaping but not determining each other.

In the literature on societal change different types of co-evolution have been noted: supply and demand (Nelson and Winter, 1982); technology and users (von Hippel, 1988, Leonard-Barton, 1988); technology, industry structure and institutions (Nelson, 1994, Rosenkopf and Tushman, 1994;); actor and structure (Giddens, 1984); technology and society (Rip and Kemp, 1998); and ecology, economy and society (Norgaard, 1984, Kemp and Soete, 1992, Gowdy, 1994, Kemp and Rotmans, 2005).

Obviously, not every type of interaction should be called co-evolution. Strictly speaking, co-evolution occurs when two evolutionary processes are interlinked (van den Bergh and Stagl, 2003) but as some people will say that processes with teleological elements (as in human/social evolution) cannot reasonably be viewed evolutionary (because in economic evolution there is purpose and no gene type), we propose to use the definition of relative autonomy. The co-evolution idea has been taken up by many authors outside biology but the management and governance aspects remain underdeveloped. Useful attempts at that are provided by Lee (1993), Rammel and van der Bergh (2003), Rammel et al. (2004) and Bleischwitz (2003). These co-evolutionary approaches all build on the model of punctuated equilibrium in which periods of slow change are punctuated by periods of radical change. This means that in evolution we have panarchy (Gunderson and Holling, 2002) or transitions (Rotmans et al., 2001, Geels, 2002), transitional shifts from one dynamic equilibrium to another. Transitions in society or societal subsystems are the outcome of processes of co-evolution in the above sense (Rotmans et al., 2001). In transition terms we speak of co-evolution if the interaction between different societal subsystems influences the dynamics of the individual societal subsystems, leading to irreversible patterns of change. Within the context of transitions co-evolution has been dealt with partially: e.g. co-evolution between science and technology, between culture and technology and between technology and society (Geels, 2002). However, a comprehensive study of co-evolution in broad societal transitions is lacking (Rotmans, 2005).

In the next section we will examine an approach for guiding societal processes of co-evolution: transition management.

3 Transition management for sustainable development

The co-evolutionary perspective provides a fertile ground for thinking about policy and governance in the context of sustainable development. It implies that straightforward planning as well as incremental strategies are insufficient because these are not able to tackle system failures underlying persistent problems in an adequate manner, leading to suboptimal solutions. To bridge the gap between top-down planning and bottom-up incrementalism, the Dutch model of transition management appears useful. The model of transition management tries to utilize innovative bottom-up developments in a more strategic way by coordinating different levels of governance and fostering self-organization through new types of interaction and cycles of learning and action for radical innovations offering sustainability benefits. Transition management views societal change as a result of the interaction between all relevant actors on different societal levels within the context of a changing societal landscape. It is thus concerned with the use and coordination of interaction and co-evolutionary processes.

Transition management is developed as a model for governance based on a number of principles and instruments described below. Before we describe them we should first discuss key problems in managing processes of societal change. The problems are common problems for any type of steering. The novelty of transition management is that it sets out to deal with them in an integrated way, something that is important for sustainability transitions.

Problem 1. Dissent

Complex societal problems related to sustainability are characterized by dissent on goals, means, and nature of the problem. Different people have different perspectives on the (nature) of the problem and preferred solutions. For example, there is no consensus on what sustainable energy or agriculture means in real practical terms. For some biological agriculture is sustainable; for others the larger land requirements of biological farming makes it not sustainable in a global context. Each option has its own setbacks. Over and above this, there is uncertainty about long-term systemic impacts. A proximate solution for this is: continuous and iterative deliberation and assessment in a well organized discourse. Even when there is dissent about appropriate solutions, it may be possible to come to define key parameters for a future system, such as that a sustainable energy system is reliable, affordable and CO2-low. Other parameters could be added such as that there should be no biodiversity loss (relevant for bio-energy). Problem structuring methods (Rosenhead and Mingers, 2002) may be used for getting to a shared problem definition about the current system (the non-sustainable aspects). Assessment of long-term systemic impacts of various socio-technical options may lead to at least a better understanding of systemic impacts. Through such assessments visions of sustainability may be revised or made more concrete.

Problem 2. Distributed control.

In pluricentric societies control cannot be exercised from the top. Control is distributed over various actors with different beliefs, interests and resources. Influence is exercised at different points, also within government, which consists of different layers and silos, making unitary action impossible. The distributed nature of control calls for cooperation and network management. Current modes of network management are not equipped for long-term structural change. They are too little concerned about long-term substantive ends and too much with the process itself. We need another form of network management, which is concerned with expressing long-term aims and the management of transition processes. The essence of transition management is that substance and process go hand-in-hand, creating partisan mutual adjustment against long-term transition goals. The formulation of joint visions and common goals helps actors to coordinate their actions. Different visions are explored by different actors representing different interests.

Problem 3. Determination of short-term steps.

It is unclear how long-term structural change may be achieved through short-term steps. Short-term action for long-term structural change presents a big problem to policy makers. There exists little theory on this. Here we propose a dual strategy of forward reasoning and backward reasoning. The reasoning forward would first be based on trend-analysis and forecasting exercises. Second, reasoning forward consists of the identification of useful steps, short-term actions which generate useful lessons and facilitate further change. Experiments can be used to learn about user satisfaction concerning a range of technical issues. They help to identify problems and to create networks for cooperation. Backcasting may help to identify strategic

experiments and help to set goals for new sociotechnical systems. Integrated systems analysis may help to identify pathways, help identify robust options, and help set goals (Rotmans, 1998).

Problem 4. Danger of lock-in

There is a danger that one gets locked in to particular solutions that are not optimal from a longer-term perspective. For example by choosing the best available option at the beginning of a transition process while other options are still in development, the chances are that future development will be dominated by that specific option. An example is the fossil based energy-system, which is now difficult to transform since infrastructures, regulation and institutions are all in support of that specific option. A way to avoid the danger of getting locked into sub-optimal solutions from a sustainability perspective is the development and use of a portfolio of options. When there is a lot of uncertainty about which option is best this is a good strategy, which is widely practiced in business. Support for options could be based on promises and specific benefits for the nation or region in which it is used. The support should be regularly reviewed and adapted.

Problem 5. Political myopia.

From historical studies (Geels, 2005) we know that transitions in sociotechnical systems take one generation or more and thus span various political cycles. Transition management in some way must survive short-term political changes. There is no simple solution for this except that policy makers and politicians have to accept that a transition takes one generation or more and be willing to wait for long-term results. For this to happen they have to be convinced that a problem needs fundamental change and that time is needed for such a change to occur. The transition-arena (Loorbach and Rotmans, 2005) is proposed as an instrument that can be used when the sense of urgency is relatively high. The transition-arena forms the context in which the focus is on the long-term and on in-depth analysis of the problem at hand with a discourse about preferred long-term development. By creating a transition arena outside the regular political short-term cycles, more innovative and radical solutions can emerge as well as novel coalitions and consensus decisions. The structural change process should then be institutionalized, through the development of transition agendas, new coalitions and rules and laws and be made adaptive, to deal with changing circumstances and political wishes (co-evolution).

From this the following strategies emerge as useful strategies for managing sustainability transitions: problem structuring, participatory integrated assessment, complex systems analysis, vision-development, portfolio-management, iterative decision-making and adaptive policy, experiments, cooperation, and commitment to transitions. They help to alter regimes of governance and nested hierarchies in the provision of provision of goods and services through processes of variation and selection -- of beliefs, concepts, artifacts and institutions.

For changing the order and direction of society and managing transitions of societal systems, a form of multi-level governance is needed in which the above elements are integrated in some way. The way in which this is done in transition management is through the interaction between three levels (Loorbach, 2004):

- Strategic level: processes of vision development, strategic discussions, long term goal formulation, etc.
- Tactical level: processes of agenda-building, negotiating, neworking, coalition building, etc.
- Operational level: processes of experimenting, project building, implementation, etc.

The processes and outputs of the processes differ at each level (visions, strategies, agenda's, projects) and 'co-evolve' throughout the process. Transition management relies on the interaction between processes at three levels. Transition management tries to align these processes through a combination of network-governance, self-organization and process management leading to modulation of ongoing dynamics. At each level, specific types of actors participate, specific (policy) instruments are used and different competencies are needed. Transitions are the outcome of the interactions between actors on one level and interactions between levels (see Figure 1).

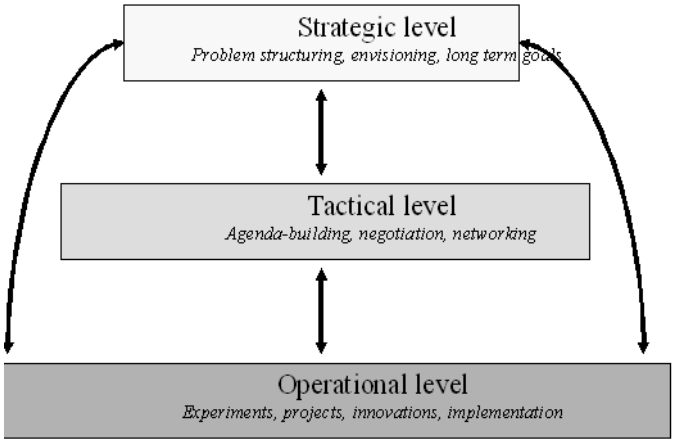


Figure 1: Multilevel approach to transition management

Operationally, transition management consists of four different clusters of activities: the strategic transition arena (problem structuring and vision development), tactical transition coalitions and networks (agenda-building, transition-paths), operational-level experiments and projects and finally the monitoring and evaluation of progress (both in terms of process as well as content), leading to adaptation (see Rotmans et al, 2001, Loorbach and Rotmans (2005).

This helps to deal with the issue of distributed control because every actor is 'managing' or influencing at least some part of the system. Through a process of partisan mutual adaptation against collectively chosen goals new interaction patterns, policies and socio-technical trajectories emerge, in a self-organised manner rather than through steering from the top.

Transition management can be considered as a specific form of multi-level governance (Scharpf, 1999; Hooghe and Marks, 2001) whereby state- and non state-actors are brought together to co-produce and co-ordinate policies in an iterative and evolutionary manner on different policy levels, adhering to the aforementioned principles. Transition management tries to improve the interaction between different levels of government for the sake of certain transitions. Transition management offers thus a framework for policy integration with the following types of policies.

- scence policy: sustainability assessments of system innovations, studies of past and ongoing transitions, focusing on the role of policy and usefulness of various governance models;
- innovation policy: the creation of innovation alliances, R&D programs for sustainable technologies, the use of transition-experiments, and alignment of innovation policies to transition goals;
- sector policy: niche policies (through procurement, regulations or the use of economic incentives), the removal of barriers to the development of system-innovations, and formulation of long-term goals and visions to give direction to research and innovation.

In short, the activities of transition management are aimed at influencing, organizing and coordinating processes at different (strategic, tactical, operational) levels so that these processes are aligned and reinforce each other. Transition management is concerned with the co-evolution of technology and society in a broader sense through analyzing interactions and feedbacks between various subsystems and use these insights for creating levers of influencing these subsystems in order to increase the possibility that these subsystems (and thus the system as a whole) moves into a more sustainable direction (Rotmans, 2005). The subsystems may be functional systems such as energy and mobility or housing and care, or different domains and levels of government. The space for innovation is opened up and there is less short-termism. Partial solutions are forgone for options offering a greater suite of benefits.

Transition management comes down to dealing with a multiplicity of steering activities by different actors, different mechanisms and different instruments and driving socio-technical activities in a shared and desired direction. Actor roles will change over time endogenously (as part of the development process). For instance, in the course of an energy transition process, oil companies may decide to become energy companies. Transition management will give rise to altered actor-system dynamics, leading to altered actor configurations and altered power-constellations and institutional arrangements that form a different selection environment wherein social innovations can mature more easily.

Actually, transition management is a co-evolutionary form of governance in the sense that it aims to develop an innovative governance context which enables processes of co-evolution. Transition management is about organizing a sophisticated process whereby the different elements of the cyclical transition management process may co-evolve: the joint problem perception, vision, agenda, instruments, experiments and monitoring through a process of social learning about radical innovations and new systems.

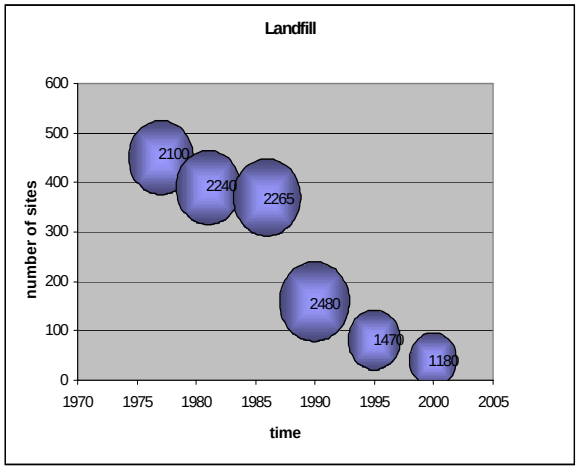
4 The transition in the Dutch waste management system

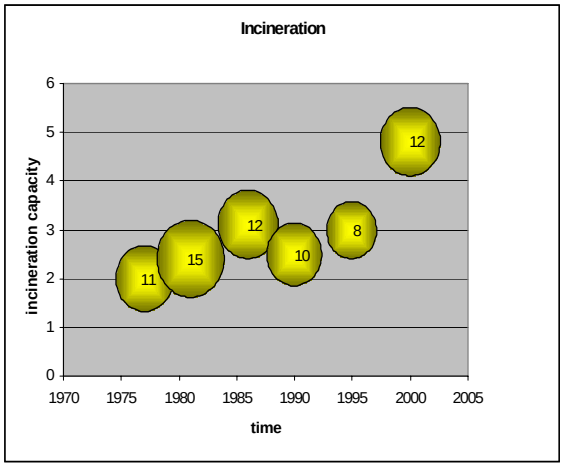
4.1 Introduction

An example of a co-produced transition is the Dutch waste-management transition (Loorbach, Parto and Kemp, 2003). Today around 80% of the total amount of waste produced is re-used (also through incineration), compared to 49% in 1985 (in this year they started collection of waste-related data). The number of landfill sites fell from 450 in 1977 to 34 in 2000. Today all landfills have advanced systems of soil protection and systems of methane extraction. The capacity of incineration increased gradually, from 2.2 Mton in 1980 to 4.9 Mton in 2000.

The transition from a local system of waste-collection to a national system of recycling and increased incineration with controlled landfilling as a last resort option is often viewed as the result of policy. Such a view, although not wrong in itself, overlooks that policy itself was heavily influenced by societal events and changes in consumption and production: the growing volumes of waste, the waste scandals in the 80s and early 90s, and changes in beliefs (such as the belief that waste is "a waste of resources" and the belief that landfilling should be done in a hygienic manner and be used as a last resort option) in a period in which environment was very much on the mind of people.

The transition towards better waste management is best understood as a process of co-evolution of the waste management subsystem and societal values and beliefs (a society growing conscious of waste problems and hostile to landfill sites). Waste scandals of polluted sites and dioxins from incinerators created attention to problems, which helped to close down old incinerators and build better ones. Various waste acts were introduced and a new organization was created for coordinating the actions of waste players, the waste management council AOO. The AOO was a network organization that brought together the three layers of government (local, provincial and central) and all waste players. The AOO served an important coordinating function, acting as a change-agent and mediator.





4.2 Strategic level

At the strategic level there was a change in thinking about waste. With the growing environmentalism and discovery of landfilled toxic waste (Vogelmeerpolder and Lekkerkerk) waste and waste management became a political issue. At the end of the 1980s environmental authorities realized that in order to effectively deal with the continuing increases in waste volumes and the negative effects of common waste management practices (mainly landfilling), long-term, integrated policies were required, replacing fragmented, locally organized management. Central to policy thinking was the "waste hierarchy" proposed in the parliamentary motion of Ad Lansink in 1979. This hierarchy prioritized between different management options and went from prevention, through re-use (of products), recycling (of materials), incineration (with energy-production) and landfilling as the last option. The motion became law in 1986 and was an important cognitive institution (Parto et al, 2003). To achieve such a differentiated form of waste management, waste management had to be organised at a higher scale (Commission Welschen). This important strategic direction of creating a national system of waste management based on the waste-hierarchy was incorporated in the first national environmental policy plan (NEP).

4.3 Tactical Level

At the tactical level there were negotiations, changes in market structure and organization of waste management at larger scales (first supra-local then nation-wide). A very important event was the creation in 1990 of a new coordinating body (Waste management Council, AOO), to coordinate policies between the Environment Ministry (VROM), the provinces (IPO) and the municipalities (VNG) and play an important role in the modernization of the waste system. Producer responsibility was introduced and the waste companies organized themselves in new organizations at the national level. The societal actors were willing to cooperate because the waste management subsystem was in a state of crisis due to acute capacity problem, dioxin problems from incinerators and problems of leaking landfills. A new multilevel form of governance was created which could deal with immediate problems in a forward-looking manner. The changes that happened subsequently can be considered as a form of incremental institutionalization, with an acceleration of this process during the 1990's. The creation of new laws and national policies (which in turn were the outcome of changed beliefs and new problem definitions) enabled lower-level changes. Organization of the businesses in the sector was for example made possible through the creation of AOO. These two developments combined facilitated the planning of national infrastructures and accordingly implementation and regulation of more differentiated waste policies.

4.4 Operational level

Operational changes consisted in the closing of old landfills sites and incinerators and creation of new ones with controlled disposal and incineration with heat recovery. In 1994 household waste-separation was introduced, which also stimulated the environmental (waste) awareness

leading to changes in consumer behaviour. This change in behaviour was accompanied by changes in the practices of waste operators and the structure of the waste subsystem. Waste operators had to learn how to accommodate regulatory requirements regarding collection and handling of waste while deposit depots (milieuperrons) were established to facilitate maximum citizen participation in waste elimination / minimization efforts. In 1994 so-called VAM-vats (green boxes for organic waste) were distributed to every household. Differentiated tariffs (Diftar) were introduced by some municipalities to stimulate recovery and re-use. This innovation diffused widely, also thanks to the information services provided by the AOO.

We are not sure whether to call the multilevel developments a process of co-evolution of co-dynamics, although it is clear that the waste management subsystem changed in co-evolution with changes on a societal level (in governance and beliefs) and in other societal systems (such as energy provision, consumption and production). The evolution of the waste management system was an unfolding process in which new institutions emerged (on top of existing institutions), such as the waste hierarchy and the waste management council AOO responding to pressing problems in an adaptive and anticipative (forward-looking) manner similar to transition management. A schematic view of the multilevel co-evololution story is given in figure 2. The process of change was path-dependent and could only be understood that way. Many institutional changes followed each other (the waste laws, the waste hierarchy, professional private companies, creation of the AOO and the view of waste as a waste of resources, with the new waste practices taking away concerns from citizens).

5 Transition management as a third way

Transition management combines elements of long-term planning with incrementalism and relies on markets and network management. We therefore refer to transition management as ‘perspective incrementalism’ (Rotmans, 2005), being the English translation of “Perspektivischer Inkrementalismus”. It is an example of goal-oriented modulation or process management against a set of societal meta-goals using sustainability visions and images. In the table below we compare transition management with incrementalism and planning, where we will see that goal-oriented modulation is not a simple mix of the other two models but a distinctive model (in the same way network management was distinctively different from markets and hierarchy as a model of economic coordination).

Transition management uses goals but does not aim to control the future (to use Wildavsky’s term). It relies heavily on market forces and decentralized decision-making. It does not blankly rely on market forces, but is concerned with the conditions under which market forces operate, by engaging in “context control” so as to orient market dynamics towards societal goals. It consists of government acting to secure circumstances that will maximize the possibilities for progressive social movement by promoting innovation and mitigating negative effects (Meadowcroft, 1997, p. 27). Private initiative is thus not curtailed but rather reoriented towards those activities that serve not only private goals but also serve sustainability goals. This is done through programs for system innovation and through the use of policy goals providing guidance to societal actors.

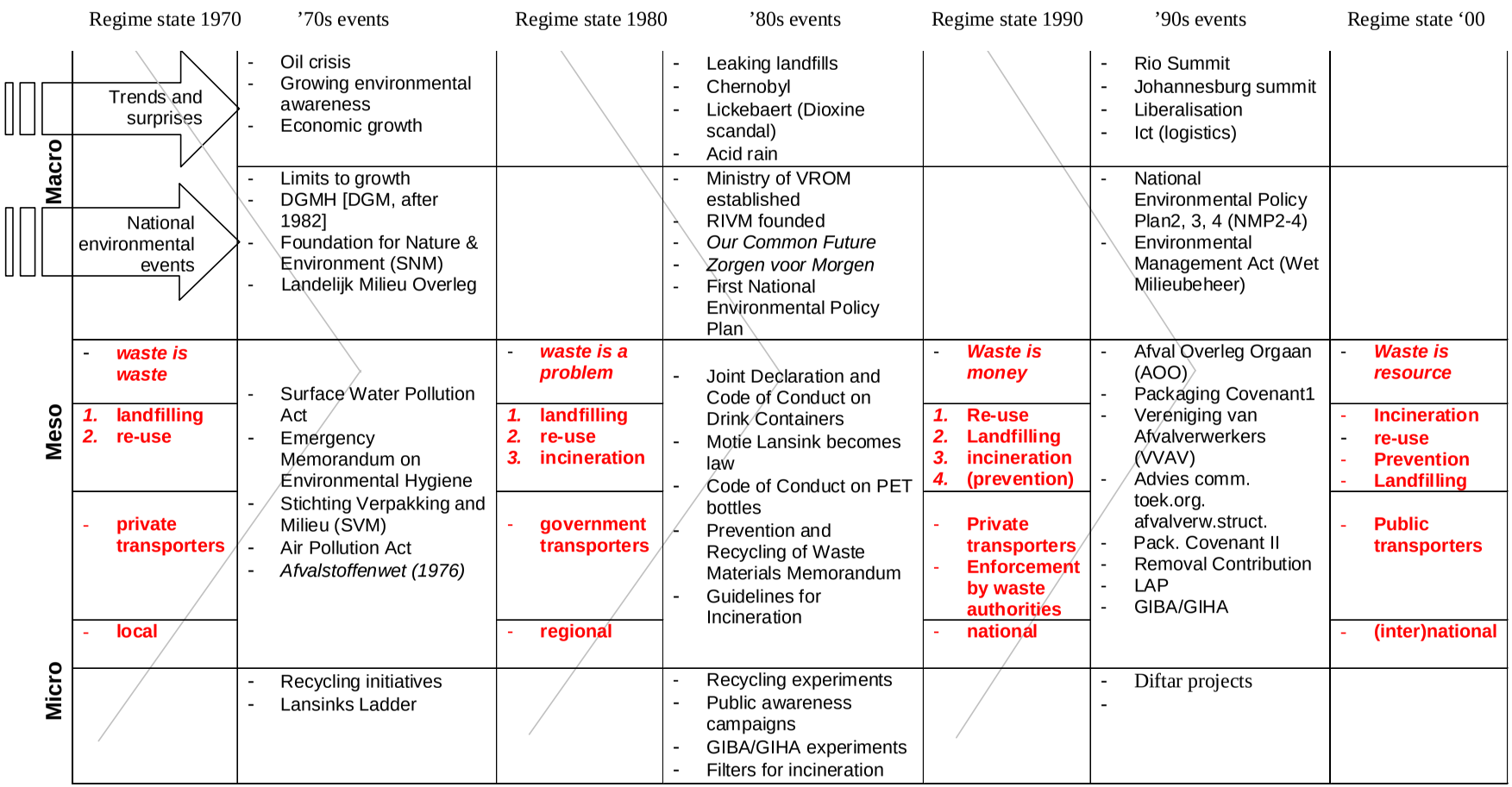


Figure 2. *Multi-level Map of the transition in the Dutch Waste sector, Loorbach, et al., '03*

Transition management uses advantages of incrementalism, which are the following. First, it is do-able because it is not disruptive from the viewpoint of special interests, second, the costs of a certain step being a mistake are kept low, third, it allows changing course to prevent lock–in from unwanted solutions and fourth, useful lessons may be learned informing further steps. Transition management is not a strategy of incremental politics but is rather an incrementalist strategy for changing functional systems towards a more sustainable society. The reason is that with new technology systems, as with politics, it is impossible to move to the desired state in a straight line since there are too many variables and uncertainties. The best strategy is to take small steps in what is generally perceived "the right (sustainable) direction", to try different solutions and to alter course when needed. Like politics, technologies are not born perfect (Latour, Rosenberg) but require adaptation before they constitute a good solution. It is often insufficiently realized that the efficiency of markets rests on the weeding out of sub-optimal designs of products and technologies through market competition (Nelson). Evolutionary change, founded on trial and error, while wasteful in the short term, leads to better outcomes in the long run.

Transition management is different from Lindblom's model of incremental politics and does not opt for disjointed incrementalism as the policy analysis method. Integrated problem analysis and complex systems analysis are part of transition management, which is also concerned with positive (sustainability) goals. For this reason it is better viewed as "logical incrementalism' (Quinn, 1978, 1980). Logical incrementalism is a strategy development process where managers have a view of where they want the organization to be in years to come and try to move towards this position in an evolutionary way. They do this by attempting to ensure the success and development of a strong, secure, but flexible core business, building on the experience gained in that business to inform decisions about the development of the business and using experiments. In transition management there is also a sense of where one want to be in the future, based on collective goals for functional systems, but without specifying the means for fulfilling them. Like incremental politics, transition management opts for steps but the policy steps are chosen to get closer to collectively chosen goals and visions of sustainability.

The use of adaptive, evolutionary steps helps to deal with the criticisms voiced against anticipatory rationality, based on backward reasoning from anticipated consequences. As March and Olsen write in their book on Democratic Governance:

"Too many atrocities of stupidity and immorality have been based on anticipatory rationality, and too many efforts to improve human action through importing technologies of decision engineering have been disappointing" (March and Olsen, 1995: 198-199)

To them the solution lies in adaptive management, in particular in developing capabilities to respond. They propose the creation of mechanisms capable of organizing experience in the service of improved learning (March and Olsen, 1995: 199). In our view, their criticism of anticipatory rationality should probably not be taken as criticism of anticipation or a call for short-sightedness but rather as a criticism of a particular method for dealing with

the future: strategic planning. A nicely worked-out application of the model of adaptive management is the "compass and gyroscope" model of Lee (1993) for combining science with politics. Conflict is kept within bounds but is accepted and even viewed necessary. Transition management also tries to keep conflict within bounds, through the orientation to social learning based on problem structuring and strategic experiments (as in the model of Lee).

The steering philosophy is the modulation of ongoing societal developments against a set of collective chosen goals. The various roles of the government are that of initiator, stimulator, facilitator and mediator. The structuring form is heterarchy, centralised, cooperative context-steering oriented to producing controlled structural change (Jessop, 1997, p. 109) in which there is modification of structural links and modification of the self-understanding of actors (identities), strategic capacities and interests of individuals and collective actors and hence their preferred strategies and tactics (Jessop, 1997, p. 109-100). Reinstitutionalisation is an important aim of transition management for which it relies on reflexivity (selfconfrontation and learning).

In our view, our model of transition management combines the advantages of both types of approaches. It inserts a strategic element in incrementalism and makes planning more adaptive (open with regard to outcomes) and participatory (open to stakeholders). In the following table (see Table 1) we delineate the key features. From the table it is clear that goal-oriented modulation is not a simple mix of incrementalism and planning but has a set distinctive features: problem structuring, social learning, portfolios and strategic experiments, transitions arenas for envisioning and institutionalisation of learning and capacity building in government and society. Perhaps it constitutes the third way political scientists have been looking for (c.f. Etzioni, 1986).

	Incrementalism	**Goal-oriented modulation —*of which transition management is an example***	**Planning**
Key actors	Private and public actors	Private and public actors, experts	Bureaucrats and experts
Steering philosophy	Partisan mutual adaptation, learning-by-doing	Modulation of developments to collectively chosen goals, government is facilitator and mediator	Hierarchy
Role for anticipation	Limited (no long-term goals)	Dynamic, adaptive anticipation of desired futures as basis for interaction	Future is analysed and implemented through blueprint plans
Type of learning	First-order: learning about quick fixes for remedying immediate ills	Second-order and first-order (rethink following problem structuring)	First-order (instrumental)
Mechanism for coordination	Markets and emergent institutionalisation	Markets, network management, institutionalisation (both designed and emergent)	Hierarchy (top-down)
Degree of adaptivity	Adaptive	Highly adaptive thanks to institutionalized evaluation and (policy) learning, portfolios and re-evaluation of goals	Hardly adaptive
Role for strategy and plans	Limited role	Important role for goals and strategic experiments for exploring social trajectories, undertaken as part of adaptive programmes for system innovation.	Plans with steps
Things against which policies are evaluated	Individual goals and short-term gains	Policy goals and learning goals, helping to determine what to do next	Predefined outcomes
Interest mediation/ conflict resolution	Individual gains for everyone	Rewards for innovators, phase out of non-sustainable practices through markets and politics (collective choice)	Little mediation (implementation and enforcement)
Policy integration	Minimal	Important but typically evolving	Narrow if present
Type of change that is sought	Incremental, non-disruptive change (system improvement)	System innovation (renewal) and system improvement	Predetermined outcomes which could be an improved old system or a new one

Table 1. Goal oriented modulation: between planning and incrementalism

6 Conclusions

In this paper we examined co-evolution aspects of sustainable development, focussing on possibilities for managing processes of co-evolution into more sustainable direction in a co-evolutionary manner. We examined three approaches for shaping co-evolution: incrementalism (dealing with ills through mutual adaptation) as a bottom-up approach, comprehensive planning as a top-down approach and transition management as a combined bottom-up and top down approach of goal-oriented modulation. All three approaches are concerned with the normative orientation of societal processes and seek to different degrees to overcome the conflict between long-term imperatives and short-term concerns. Based on what we know, incrementalism is useful but by far not enough; experiments with innovative solutions and are best pursued as part of a broader approach such as transition management. Overall, transition management is a co-evolutionary steering concept that involves a cyclical process of notions, ideas, instruments and mechanisms that co-evolve: shared problem perception, sustainability vision, agenda, experiments, instruments and monitoring through a process of social learning about radical systemic change offering sustainability benefits besides user benefits.

Transition management employs an integrative and multi-scale framework for policy deliberation, choice of instruments, and actions by individuals, private and public organizations, and society at large. It comprises elements of network management, self-organisation, a perspective-based (guided) form of process management, portfolio management, planning, and market coordination. Transition management is inclusive and calls for setting long-term and intermediate goals, alignment of policies short- and long-term policies, and strategic experimentation besides traditional policies. Because it aims for long-term change in functional systems in a gradual manner through variation and selection, it is do-able in a society in which interests are well organized and steering from the top is basically impossible. It is used in the Netherlands for managing the transition to sustainable energy, sustainable mobility, sustainable agriculture, sustainable water use and the biodiversity and natural resource transition.

The presented concept of transition management has been derived from the complex systems approach, new forms of governance and social theory. These management principles have been translated into an operational model. This management concept is both descriptive and prescriptive in the sense that it can be used to analyse as well as to influence transitions. Looking at different levels of governance, the way innovations at each level are organized and developed will provide understanding of their impacts in the context of transition. But perhaps even more importantly, the concept can be used to prescriptively formulate a governance model to select, organize and structure the appropriate governance styles and tools. This governance-mix is context-specific, but its general outlines and framework are generic.

Transition management is possibly best described as "Perspektivischer Inkrementalismus" or directed incrementalism (Grunwald, 2000), taking on board criticisms voiced against incrementalism such as lack of orientation, conservatism, and negative stance against analysis as noted in Weiss and Woodhouse (1992). Transition management builds on processes of co-evolution, which are shaped in a reflexive manner through multilevel processes of variation and selection.

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Chapter 35 System Innovations in Innovation Systems

Experiences with Adaptive Foresight in Austria

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Abstract

Recent conceptual debates on system innovations are being fuelled by three main sources. First of all, the three-level perspective on landscapes, regimes and niches has been very helpful for reconstructing past processes of system innovation. Secondly, functional and sectoral innovation system approaches have opened up new inroads for guiding policy-oriented analyses and assessment of system innovations. As a third element, insights from research in complexity have enabled a better understanding of the dynamics of innovation processes in a multi-level framework.

In this paper, we will formulate a conceptual approach that integrates elements from the niche-regime-landscape vocabulary within a functional and sectoral innovation systems framework. In order to capture time- and path-dependent mechanisms in a multi-level setting, conceptual insights from complex systems research will be used. The purpose of this approach is to provide guidance to explore pathways and scenarios for processes of socio-technical change, and in particular for system innovations. The approach shall be sufficiently differentiated to take sectoral and technological specificities into account and at the same time to devise normative insights for policy-making.

This approach will be illustrated by examples from recent empirical work on production-consumption systems (energy supply, biorefineries, wood-plastic-composites) and their implications for different policy levels (priority-setting at national and sectoral level, programme development).

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1 Introduction

The need for system innovations towards sustainability has been frequently underlined in policy as well as in scientific debates. Different approaches and inroads have been suggested for how to guide long-term transformation processes of socio-technical systems in line with the principles of sustainable development. With this paper, we aim to draw together some of our recent experiences with attempts to capture such processes conceptually and to tackle them by means of policy, with the emphasis being put on the role of research, technology and innovation policy (RTI-policy).

At the basis of our argument lies the assumption that radical changes (such as the transition to a sustainable economy) cannot be reduced to isolated technical innovations but require innovation at a systemic level, i.e. the interplay of technologies, actor constellations, institutions, etc.

Adapting earlier definitions of environmental system innovations (Rennings et al. 2003; Butter 2002), one can define system innovations for sustainability as a set of innovations that provide a service in a novel way or offer new services, involving a new logic (guiding principle) and new types of practice, and giving rise to a step change in several of the dimensions of sustainability.

System innovations tend to imply changes both at the level of the components and at the level of the architecture of technologies (Henderson & Clark 1990), and equally at the level of social and institutional arrangements, such as mechanisms of coordination (regulation, governance) or patterns of interaction at the supplier and the user side of innovation. Time also matters a lot for the realisation of system innovation, because system innovations tend to take a long time. On the one hand, this implies that they should be initiated early on to become effective in time and in order to avoid painful and fast adaptations in moments of crisis. On the other hand, they tend to be initiated only once the improvement potential of simpler innovation options is exhausted.

With these considerations in mind, the concepts of transitions and of transition management (and other similar concepts) have been introduced (Rotmans/Kemp/van Asselt 2001), i.e. collective management strategies to initiate smooth and long-term multi-level transformation processes. Initially being developed for large-scale socio-technical infrastructure systems like energy supply, transport, water supply etc., its basic notions have been taken up and adapted to other technological areas as well.

Transition concepts are based at a multi-level model of technological change separating the 'breeding' of new technologies in confined technological niches from a meso-level of socio-technical regimes (e.g. the system of mobility) and a broader context of the socio-technical landscape, which encompasses cultural norms, values or dominant economic or governance regimes. A 'socio-technical regime' means a rule set or grammar that structures the socio-technical co-evolution process. The way such a regime evolves "is structured by the accumulated knowledge, engineering practices, value of past investments, interests of firms, established product requirements and meanings, intra- and interorganisational relationships [and] government policies" (Kemp et al. 2001, 273). The creation of novel technologies thus is shaped by the interactions at the micro level of users, firms and households, the meso level of technological regimes and the macro

level of sociotechnical landscapes. These levels change simultaneously in a co-evolutionary process. The value of such a concept is to point to the multi-dimensionality of processes of socio-technical change and the embeddedness of local practices and niches in various contexts with their own specific history and dynamics.

The dynamics of innovation are also addressed in other fields of innovation literature, where a systems language has become the dominant approach in the past ten years. While the notion of socio-technical regimes puts an institutional perspective to the foreground (norms, practices, 'grammar'), the system concept puts more emphasis on actors and their relations, the boundaries between system and environment, emergent patterns in the dynamics of systems etc. System research is currently being enriched by insights from complexity research in order to better understand the underlying dynamics of the transformation of innovation systems, for instance to tackle the dynamics of R&D collaboration networks (Barber et al. 2006). With the functions of innovation systems approach, a new inroad has been opened for strengthening the normative value of the innovation systems framework, an issue for which IS research has been criticized in the past. Regimes and systems can be used as complementary concepts, each emphasising different analytical perspectives and specifically contributing to a better understanding of transition dynamics and the design of policy strategies.

As regards policies and the management of system innovations, forward-looking approaches have been widely applied in the past ten years as a tool to underpin strategy development both in government policy and in firms.

In this paper, we would like to revisit the debates about system innovation and the management of long-term processes for realising system innovations and reposition them in a conceptual framework that will be outlined in Section 2. We will organise this debate around three main dimensions to the problem of system innovations: i) the descriptive dimension, ii) the analytical dimension, iii) the normative dimension, iv) the strategic dimension.

We argue that these four dimensions need to be clarified in order to have a solid conceptual foundation for devising a methodology that could help guide collective processes of managing transitions as well as individual processes of decision-making. While different conceptual frameworks are in principle possible, we believe that a systems language is best suited to capture the different aspects. On that basis, a methodology shall be introduced in Section 3, which we call adaptive foresight. It will be underpinned by examples and experiences from recent research project and strategy processes in RTI-policy that dealt either specifically with processes of long-term transitions to sustainable-production consumption systems or with broader RTI-policy strategies. Finally, we will draw some conclusions on the experiences made with adaptive foresight in a policy context.

2 Building blocks of a conceptual framework: transition fields as complex, socio-technical innovation systems

In the following section we will introduce a perspective on socio-technical transformations that takes up elements from existing transition

thinking, but merges it with a systems approach to innovation, which puts a stronger and explicit emphasis on the role of actors. More recent variants of innovation systems approach that focus on the sectoral level or on the functions of innovation systems will also be used to complement the normative dimension of transitions. These elements are regarded as important to make the approach useful as a basis for policy-making and policy advice, where agency and normative considerations about both sustainable development and coherent innovation systems are crucial.

2.1 The descriptive dimension – the patterns of transition processes

As a first approximation of how to conceptualise and understand socio-technical transformation processes, descriptive models that capture the aggregate evolution path of system innovations can be used. The notion of transitions has been introduced in recent years as a conceptual framework that is useful to capture the essence of processes of system innovations (Rotmans et al. 2001).

Based on historical examples, past cases of transitions have been reconstructed (see e.g. Geels 2004) and generalised into a model of how transitions take place. Several examples of transitions are known from past history. For instance, the move from a coal-based energy supply system to a gas-based system, or from an industrial to a service economy can be interpreted as transition phenomena. Usually, transitions are long-term processes that can stretch over several decades,[92] and they are characterised by a co-evolution of institutional settings, markets, technologies, cultures, behavioural patterns and policy-making and policy.

At an aggregate level, transitions are described in a three-level model of niches, regime(s) and (socio-technical) landscape. The basic model was initially developed on the basis of the innovation systems framework, but giving ample room for technological aspects as embedded in practices of users, suppliers and other actors and in institutional settings which are captured by different types of sub-regimes (e.g. user and market regime, policy regime, etc.) (Geels 2004, p. 912). One of the strengths of the transition framework is thus the explicit consideration of socio-technical arrangements rather than just innovations.

Smith et al. (2005) have differentiated the initial transition model by introducing four types of transitions, which depend on the contexts in which these transitions are taking place. This context is determined by a) the level of coordination to purposively transform a regime (high/low), and b) on the location of resources (internal/external to the regime). This framework gives rise to four type of transitions which the authors call endogenous renewal (high/internal), re-orientation of trajectories (low/internal), emergent transformation (low/external) and purposive transition (high, external). The role of the socio-technical landscape or generally speaking of the (system) environment is thus taken into account explicitly as a source of resources.

[92] Transition processes can thus be interpreted as comparatively smooth transformations, whereas terms like rupture, revolutions or breaks imply a rather fast and abrupt type of transformation process.

The initial transition model has been developed for large socio-technical and infrastructure systems or functional sub-systems of society (mobility, energy provision). However, such a broad delineation does not work so well for other sub-systems, such as the production system, which are more heterogeneous in terms of technologies, actors or institutions (e.g. regulation). Currently, RTD programmes or innovation perspectives aiming at changes in the production system often focus on the level of individual projects and technologies or at a rather general level of entire industries.[93] What tends to be lacking, however, is a useful operationalisation at an intermediate level of analysis, i.e. a description that is sufficiently concrete to relate easily to individual technologies, but at the same time sufficiently general to be compatible with more abstract visions of the future.

When trying to apply the approach of transition management to more specific domains within the broader system of production-consumption, thus a higher 'granularity' in defining system or transition domains is needed. One approach to address changes and innovations within the production system at an intermediate level is to specify more limited "transition fields" which can still be characterised as systems (i.e. can be demarcated from an environment and develop some degree of internal coordination and logic) but are more homogeneous and easier to address by policy measures. Such a transition field can be specified as a sub-field of the production system that is sufficiently coherent and limited in scope to be addressed by an operational and well-defined transition process. To address such transformations, transition fields should link the level of *technologies* with the level of society, e.g. *needs areas* to be fulfilled.

In more detail we mean by these two terms:

- Needs areas: As a starting point, we take the observation that production is meant to serve certain "needs". The fulfilment of these needs is ensured by systems of production and consumption, i.e. socio-technical systems that range from the provision of raw materials (including recycling) to service concepts and products for final consumption.[94] The closer you get to the needs side of this chain, the more prominent are the social practices and routines of the users for defining this stage. By concentrating on satisfying these final needs, it is possible to overcome the conventional product orientation and think about alternative ways of meeting needs by providing the necessary services and/or products. For instance, the final need of "mobility" cannot only be met by individual car ownership, but also by means of new service approaches such as car-sharing, door-to-door mobility services, etc. Often these alternative concepts are embedded in wider "visions" or "Leitbilder" that capture both these new services and the changes in social, regulatory or organisational practices required. "Sustainable mobility", "sustainable household", "factory of the future" or "green chemistry" are examples in case, often expressed even in terms of concrete performance targets.

[93] See e.g. the analysis of the Austrian RTD programme "Factory of Tomorrow" in Weber et al. 2003.

[94] See for instance the EU-funded project SusHouse where final needs in the realm of the household have been analysed and explored (Vergragt, 2000; Green/Vergragt, 2002).

- Individual technologies: The practice of research programmes shows that individual projects often focus on specific technologies, without particular attention to final needs or social context. In other words, they tend to be conducted in a rather isolated way and need to be integrated and adapted at the level of the transition fields. In other words, these specific technical solutions need to be contextualised at the level of transition fields in order to diffuse more widely. In principle, an individual technology can be applied in different domains to meet different functionalities or needs, and correspondingly a functionality can be realised by using different individual technologies. For instance, travel information can be provided in real-time to your mobile phone using GSM, but it can also be transmitted by means of local information terminals or by phone services. Integrated intermodal services can be achieved by standardised integrated ticketing (like in urban transport "Verbünde") or by means of an electronic bidding service where prices may vary according to demand, etc.

Transition fields are positioned between these needs areas and the supply of technological opportunities in technology projects, and they mediate between them. They represent the arenas where systemic solutions for meeting needs are developed. Transition fields thus are specific innovation systems formed by technologies, actors and their objectives, and they can be interpreted as arenas, where systemic solutions for ensuring the provision of certain functionalities evolve. In other words, it is in these transition fields, where specific technologies are tied together with and embedded in social and organisational practices in order to offer alternative solutions. Transition fields are thus an intermediate systemic level, at which the integration of individual technology projects into the provision of needs-oriented products and services takes place, guided by an orientation towards long-term sustainability.

For instance, in the case of sustainable mobility, the introduction of an intermodal and integrated mobility service is an example of a transition field. Real-time travel information could be another example, as well as on-line or mobile booking. As an example of an intermediate transition field, vehicle maintenance services could be mentioned.

In principle, transition fields can be categorised in several different ways. They can be described in terms of different functionalities they address, in terms of policy arenas or in terms of networks or industrial branches. Especially in the case of manufacturing, a sectoral differentiation can be useful (at least in some cases) if this is in line with the production-consumption system under study. "Printing" is an example of a functionality that can be roughly represented by specific industry branches while "dyeing" is scattered over many industrial branches and policy arenas. Thus it should be noticed that usefully delimited transition fields can also be constructed around branches (the paper industry) or resource bases (biomass use). In order to reduce the complexity of e.g. scenario developments and the policy process it appears to be helpful, if a transition field does not consist of too many actor constituencies and if it relates to a limited set of needs areas and technology fields. A certain homogeneity in these areas may be an important argument to select or delimit certain functionalities when demarcating a transition field.

Summing up, transition fields are specific innovation systems connecting social needs areas with technology projects at an intermediate level. They are thus a different way of segmenting transitions, complementary and orthogonal to the differentiation into landscapes, regimes and niches, and they are a way of introducing an innovation system perspective to the discussion of regimes and their transitions.[95]

2.2 The processes driving transition dynamics - from a quasi-evolutionary to a complex model

Apart from the aggregate description and patterns of transition processes and the delimitation of what we have called transition fields, there is a second important aspect of analysis to be considered, namely the analysis of the processes driving transition dynamics at the micro-level. Agency and interactions must be key elements of such a model of transitions dynamics. This is particularly important if the conceptual framework is supposed to serve as a foundation for political (or other) intervention and steering because policy initiatives tend to be directed at influencing actor behaviour and interactions.

The transition models developed so far are presented as quasi-evolutionary and stress the co-evolution of research, technologies, markets, regimes and organisations and essentially use the classical notions of variation, selection and stabilisation/alignment, with regimes playing an important role as coordinating mechanism (see e.g. Geels 2005, Smith et al. 2005). However, models that put the notion of self-organisation and complexity at the centre are better equipped to capture the role of actors, interactions and decision-making processes.[96] It can also build on the body of knowledge that has been accumulated in complex systems research over the past years.

For the analysis of transition fields - here interpreted as *socio-technical innovation systems*[97] - the principles of self-organisation shall thus be applied to capture transition dynamics. This approach still allows interpreting them as being embedded in wider transition processes.

Central to our perspective is the consideration of interactions between different types of *actors* playing a role in shaping a transition field:

[95] In principle, the niche-regime-landscape model could also be re-interpreted using a systems language Regimes then reflect the rules that govern interactions in innovation systems, whereas the socio-technical landscape can easily be understood as system environment. Technological niches are equally an element that can be easily fitted within a systems framework, e.g. in the sense of innovation and/or policy networks where interaction and learning between developers, users, policy-makers and other stakeholders take place. However, while learning processes in niches are mainly a "bottom-up" process to embed new technologies in new emerging regime, socio-technical change can also be induced from different mechanisms, e.g. "top-down" by way of regulation or regime changes (like e.g. liberalisation of energy or water supply).

[96] This is also reflected in the possibility to describe complex system by means of agent-based modelling techniques.

[97] We prefer to speak of *socio-technical innovation systems* when analysing specific fields of technologies or services from an IS perspective, e.g. around specific industries/sectors (printing industry), themes (waste management), or technologies (wind energy). This understanding is similar to the notion of sectoral systems of innovation, but is – amont other differences - more flexible by not necessarily focusing on sectoral delimitations only.

technology suppliers and developers, intermediary and final, policy-makers and administration at different levels, various stakeholder and other intermediary organisations.

In the end, all these actors do take *decisions* that exert an influence on the evolution of a transition field. As a first simple approximation, it may suffice to distinguish between innovation decisions, adoption decisions and policy decisions. These decisions can result in the flow of money in a market, in the exchange of services, products or other technological artefacts, in the exchange of information in the implementation of a legal act. Policy decisions comprise for instance the setting up of a research programme, the introduction of a new regulatory framework, or the creation of a new intermediary agency that serves as carrier organisation for a new technology or transition field. Decisions are shaped by several factors of influence, including interactions with other actors, future expectations, preferences and objectives, resources, established rule sets and beliefs, etc. From the perspective of agent-based modelling, one could speak of the decision rules that characterise an agent.

Obviously, although decisions are finally taken by individual actors, they are influenced and prepared – to a varying degree - by *interactions* with other actors. We speak of decision arenas where such decisions are prepared. A further important element in our conceptual model are *expectations and visions,* and related to these also *objectives* an actor may pursue.

At the level of the transition field, it is possible to identify certain aggregate features that characterise the transition field. These are the *structural properties* of the transition field, which comprise also the collective rules and institutions that guide the interactions within the transition field (i.e. the "regime" at the level of the transition field).

These building blocks can now be used to analyse complex self-organising mechanisms and how they determine the observable aggregate patterns of dynamics of transition fields. In this context, the central role of the concept of circular causalities (i.e. reinforcing, delaying or stabilising feedback mechanisms) for our interpretation of innovation system dynamics must be highlighted. Circular causalities is a term that has been used to explain the origin of emergent properties in self-organising systems.11 This concept can be applied to the three levels of socio-technical innovation systems, that is, both between the levels of the transition field (e.g. vertical relations between structural properties and actor level) and within each of the two levels (e.g. horizontal relations between actors) .

Emergent properties at the level of structural properties are, for instance, the organisational structures, the diffusion patterns and the regulatory frameworks. They 'emerge' from the interactions among the different types of interrelated network and/or actor, and are in turn perceived by these actors and translated into expectations, preferences and decisions.

As an example of a vertical circular causality, actors perceive the situation and the changes in that part of the environment that is relevant to them (i.e. the structural properties as well as developments in the wider context), possibly mediated through interactions with other actors in decision arenas. The interpretation of these perceptions and interactions then gives rise to individual decision.

The perception of this external world, the interactions with others and also their own experiences contribute to their learning and thus to the expansion

of the societal knowledge base. In line with their perceptions and assessment of the different available systems (innovation hypotheses) individual decisions are made. These decisions contribute to the shaping of the emerging structural properties of the transition field. Some decisions can also directly exert a structural impact, e.g. the policy decision to create a new agency or to abolish a monopoly structure for the supply of certain public services.

An example of a horizontal circular causality mutual learning between users and suppliers of a technology can be mentioned, but also the interactions between users and regulators that not only enable adjustments of the regulatory rules, but also adjustment of users' decisions to the adjusted context.

Circular causalities could in principle also be interpreted in evolutionary terms, i.e. as being at the origin of variation, selection and stability. The joint operation of reinforcing and delaying mechanisms, applied to different technology options, gives rise to a selection process. For example, a circular causality of the learning-by-experimenting type reinforces, if successful, the transformation process in a favourable way for the technology in question. It favours its selection by users, manufacturer and policy makers. If in parallel the competing options are disfavoured, for example by unsuccessful experiments, a selection pattern emerges as a result of the combination of these circular causalities. Similar arguments can be made with respect to variation and stabilisation which have been elaborated elsewhere (Weber 2005). They show that the conceptual model building on principles of complexity and self-organisation as well as on the explicit consideration of actors and their behaviour provides an underlying rationale of the (quasi-)evolutionary model that has been used so far to explain transition processes. As a next step, it would be interesting to explain the four different types of transition processes as proposed by Smith et al (2005) by means of this model.

2.3 Orientating transitions - functions of innovation systems and sustainability

The third dimension to be investigated concerns the normative dimension of transition processes, i.e. the question of the direction of change. Usually, the broad notion of sustainable development is used as the "leitbild" or vision, but it tends to remain vague because it is contingent on future framework scenarios and thus needs to be translated into certain guiding principles or objectives or assessment dimensions. At this more concrete level, there is also a need for a continuous adjustment of objectives while maintaining the general principles and vision. Innovation is usually seen as a crucial element when it comes to defining objectives to be pursued for achieving sustainability. Unfortunately, the innovation systems approach as the dominant approach in innovation research – while being useful for descriptive purposes and as a heuristic device - has been rather weak when it comes to providing normative guidance for how to shape and manage innovation systems. Over the last years some attempts have been made to develop the innovation system approach further in a way that allows for such guidance. These are related to the discussion on the "functions" of innovation systems. For sectoral innovation systems Bergek et al. (2005)

suggested a framework for analysis. Similar to that Kubeczko et al. (2005) suggested a functional framework that should allow for a combination of sectoral and regional approaches. A different approach was used by Kubeczko et al. (2006) for regional innovation systems using a more theoretical approach to systems. These can be seen as attempts to make innovation systems research more beneficial for policy-making, beyond serving as a general heuristic and "lense" for looking at innovation in the economy.

This functional approach to innovation system analysis seems quite compatible with the need to orient innovation processes (and thus concepts for innovation research) towards sustainable development objectives. We thus suggest combining the functions of innovation systems framework with sustainability objectives.

In general, three types of functions of innovation systems can be distinguished:

- *Structure*: Innovation systems shall provide structures for innovation activities and support functions of the IS itself. This can be achieved by the introduction of actors, institutions (rules, norms, etc.), networks or artefacts.
- *Orientation*: Orientation can be given by means of "Leitbilder", visions or other "open methods of coordination", or more concrete as information flows or financial incentives.
- *Adaptability*: Adaptability is a prerequisite of a system to maintain its other functions over time. One possible way to maintain this function is by means of strategic intelligence, or involvement of users into innovation process.

The second function of orientation is crucial because it opens up the possibility to combine normative arguments about the direction of socio-technical change within an innovation systems framework. The functions of innovation systems literature (for an overview see Bergek et al. 2005) specifies further functions like creation of knowledge, facilitation of market formation, supply of resources, facilitation of information and knowledge exchange, etc. which can in principle be regrouped and used to enrich the three aforementioned main categories.

The relevance of the functional approach and the notion of transition fields becomes obvious when considering their policy relevance. Policy needs to build on a clear rationale and justification for intervention, and the functional approach in combination with specification of the orientation function in line with sustainability objectives provides a clear rationale for RTI-policy.

2.4 Strategies and pathways towards the future

The key difficulty of transition management is to ensure the link between open and collective learning and innovation processes on the one hand and the societal goals implicit in the transition concept on the other. Transition strategies thus generally consist of the following phases or elements: 1) development of long-term sustainability visions and overarching joint strategies, 2) organisation of a multi-actor network, mobilisation of actors

and execution of projects and experiments, and finally 3) monitoring and evaluation as inputs to the collective learning process.

This is a very optimistic approach with respect to the collective ability to shape the future. It assumes that these three types of processes allow initiating and steering socio-technical systems in direction that is compatible with societal objectives like sustainability. However, in reality the future evolution of many – if not most – socio-technical systems is large beyond the control even of the collective efforts of the key actors in an individual country. The room for manoeuvre is highly constrained by global technological and economic developments, by European policy, by societal developments that evolve independently of the socio-technical system in question (e.g. demography). External factors tend to exert a much stronger influence on the future pathway of a socio-technical system than those factors that can be influenced even by a collective effort at national or sectoral level.

The fact that many of the determinants of future transition processes are beyond our influence calls for an adaptive strategy for managing transition processes. Supporting the development of policy strategies by way of what we call the 'adaptive foresight' methodology thus draws extensively on recent advances in adaptive planning.

The classical approach to adaptive planning is based on a staged development process with key decision points to confirm or reject a development trajectory depending on the progress made and the changes in context. More recently, adaptive planning approaches have emphasized the need to combine scenario development to capture a wide range of possible future contexts with the maintenance of a set or portfolio of real options. It has thus developed into a much more flexible tool for supporting strategic decision-making, by applying principles of continuous monitoring and decision-making (Eriksson 2003). The portfolio-based approach is particularly well suited for dealing with contexts that are in themselves characterised by adaptive strategies of other actors.[98]

Socio-technical scenarios are thus a first important building block for operationalizing the principles of adaptive planning. They serve to capture the range of possible futures in which the addressee might be operating and which he can partly influence. In other words, scenario development serves in the first instance to make different possible future contexts for action explicit, in scientific-technological and economic as well as in socio-political and cultural terms. For the purposes of adaptive planning, socio-technical scenarios should be neither purely exploratory nor purely normative. In fact, it is important that they represent a mixture of desirable and undesirable elements in order to be able to derive non-trivial conclusions.

Usually exploratory scenarios are taken as a starting point for adaptive planning exercises. However, from a policy perspective, exploratory scenarios alone are not sufficient as a basis for policy strategies. Different exploratory scenarios just describe how different future worlds might look

[98] The concept of real options is usually applied with respect to a specific actor or addressee who has the choice between different options. It is important to be very clear about the addressee of an adaptive planning activity and about the scope of his or her decision options because this determines what is to be regarded as an endogenous or an exogenous variable, i.e. as a factor he/she can or cannot influence. In most policy-oriented exercises, this addressee can be society at large, but in more operational terms it is usually a public agent like a ministry or a regional government.

like. While for instance a national government may be able to exert an influence on the course of future events, it is by no means in a position to determine what the future will look like. It only has a rather limited power to shape the future; its room for manoeuvre is restricted by the extent to which the exploratory scenarios developed are driven by exogenous factors. The normative dimension comes into play when assessing and selecting different decision options that would allow influencing these – largely exogenously driven - exploratory scenarios in a direction that could be regarded as desirable, even if the actual influence of these decisions may be rather limited. Still, the exploratory scenario approach needs to be combined with a normative element in order to realise future oriented policy strategies that are in line with major societal objectives (e.g. sustainable development).

The notion of portfolios of real options is the second main building block considered here. Initially the notion of portfolios of options was introduced in finance, describing a set of financial options that allows the investor to minimise (or hedge) financial risks. Sophisticated models have been developed to deal with portfolio optimisation. In the world of research and innovation, modelling approaches are also tested but real options cannot be easily captured in financial terms (Schauer 2006).

The key argument behind maintaining a portfolio of real options can be best explained by a simple question: "What preparatory and precautionary actions can be taken today in order to make sure that an actor can adapt to unexpected adverse conditions and exploit unexpected upcoming opportunities tomorrow?" This approach admits that our possibilities to shape the future are constrained to a large extent by developments outside of our scope, and that we must be able to adapt to these. It implies that a good portfolio of real options is characterised by two main features: First of all, there are options that are helpful under the conditions of all scenarios considered. These "robust" options represent the quick gains from a portfolio-oriented scenario analysis. In other words, robust policies are those that do well under the conditions of all scenarios considered. Secondly, there are policy options that enable adaptivity, i.e. they are meant to maintain the ability to rapidly exploit upcoming opportunities or to cope swiftly with major unexpected risks. This can be achieved by maintaining an appropriate portfolio of options and by developing options that are flexible and adaptive in themselves.

The notion of a robust and adaptive portfolio of options can be applied both to technologies and policies. Looking first at technologies, the approach suggests maintaining two types of options, namely a) options that would be beneficial under all circumstances in the different scenarios ("robust technologies"), and b) options that would allow us to react swiftly to unexpected events or different courses of development than we had initially expected ("adaptive technologies"). In concrete terms, for instance, this approach is compatible with policy recommendations to develop competencies in generic technologies that are likely to be applied in a wide range of sectors the relative importance of which may differ across scenarios. Obviously, although generic technologies are characterised by a certain degree of robustness and adaptivity, they are usually not sufficient to ensure the level of adaptivity needed. Advancing additional technological options may thus be necessary. The history of renewable and energy-saving technologiescan serve as an example of the benefits of an adaptive technology portfolio. After the first oil crisis the introduction of alternative and efficient energy technologies was promoted but it took several years to

make some of the options in questions (e.g. heat pumps, combined heat power generation, solar collectors, etc.) technologically and economically viable. In those countries where these technologies had already been developed early on, their uptake took place much faster and thus facilitated the adaptation to the scarcity and high price of fossil fuels.

In terms of research and technology policy, adaptivity can be achieved by keeping a fairly broad range of research programmes and activities in order to be able to build on the acquired competencies if a research field turns out to "take off" or if changing circumstances require adapting and changing course rather swiftly. Rather than focusing on a very restricted set of research and technology priorities (which is currently the dominant argument in the context of competitiveness policies), a portfolio-based and risk-averse research and technology policy strategy would aim at advancing a broader set of options in a kind of 'waitstate' and support technologies that are inherently adaptive. Obviously, as it is not possible to keep all options open, it is still necessary to prioritize, but the notion of portfolios of real options should be taken into account as an additional building block for designing strategies to cope with the uncertainties, risks and opportunities inherent in different future scenarios.

The timing of exerting policy options is an important aspect of a portfolio-based policy approach because of the criticality of the timing for the impact of a decision. We know from evolutionary and sociological S&T policy studies that there are "windows of opportunity" when exerting an option (for instance starting a major R&D programme to give a new emerging technology area a boost) can have a particularly strong impact because it allows self-reinforcing processes of change to operate effectively and thus makes a policy strategy effective with minimum resources (Erdmann 2005).

3 Adaptive foresight as a methodology for policy support

3.1 Adaptive foresight - A methodology for scenario and policy portfolio development

Based on the conceptual framework outlined, we have developed and implemented different projects that were set up either as broader participatory exercises involving different actors, or more specifically to support decision-making processes of individual policy actors (e.g. ministries, programme agencies, etc.). The methodology of adaptive foresight as suggested below links the perspectives of transition management and socio-technical innovation systems[99] with the experiences gained in adaptive planning processes and foresight.

Adaptive foresight aims at making foresight more effective for policy-making by i) having a more realistic level of aspiration as regards the ability to shape the future and put stronger emphasis on the necessity to adapt also to future developments, and by ii) using a flexible and adaptive methodological approach that may well differ over the different phases of

[99] See for instance also Markard (2005) for a framework that shares some features of adaptive foresight.

the policy cycle it aims to support (e.g. in terms of the participatory character, or the balance between analytical and prospective methods).

3.2 Methodological foundations

Today more is expected from policy research than retrospectively analysing and generalising hypotheses as inputs to policy-making. Instead, more attention needs to be paid to devising transparent and constructive methodologies in support of forward-looking policy strategy development. In this section, such a methodology will be presented under the headline of 'adaptive foresight'. It is based on insights from past experiences with foresight methods and socio-technical scenarios, but also reflects principles of adaptive planning and reflexive governance.[100] Conceptually, the adaptive foresight methodology builds – as outlined above - on findings from the combination of system approaches from innovation research and transition-type of approaches from science and technology studies that emphasize the importance of complex mechanisms for the explanation of innovation dynamics. Such a 'socio-technical innovation systems' perspective as discussed in section 2 delivers the main elements to be addressed by the methodology. Providing an explicit theoretical foundation of the methodology has several advantages: it facilitates the interaction process with the participants of scenario workshops, it allows an explicit interpretation of the findings of the process, and thus contributes to the overall understanding of potential future innovation dynamics and the role of policy interventions in these.

3.3 Looking back: problem definition, system delimitation and analysis

Before looking ahead as part of a policy strategy development process, it is necessary to conduct a solid retrospective analysis of the field of investigation, i.e. of recent and current developments along the lines of the conceptual framework of complex innovation systems. And even before starting such analytical work, two initial clarifications need to be achieved. First of all, one needs to be clear what the focal issue of the strategy development exercise is, i.e. the main question or problem that the addressee of an exercise would like to have tackled. In government-led exercises, these focal issues are usually related to societal goals and the (policy) strategies to pursue in order to achieve them. They can be at highly aggregate levels ("How can we achieve an overarching transition towards a more sustainable energy supply system?") or more specific to individual sectors and policies ("What innovation and technology policy strategies should be pursued in order to contribute to the joint objectives of sustainable mobility and enhancement of the competitiveness of domestic transport technology industries?").

[100] See also Elzen et al. (2004) on socio-technical scenarios and their application to the evolution of different large technical systems. However, they mainly applied the scenario method for purely experimental purposes and did not link them up with actual policy-making processes.

Project example 1: The impact of ICT on transport and mobility - developing a portfolio of robust and adaptive policy options

The impact of ICT on transport and mobility (ICTRANS) is a scenario development exercise that aims to explore in a qualitative way policy options at European level in order to enhance the impact that the use of ICTs could have on the volume, the modal choices and the efficiency of mobility service provision in the realms of living, working and producing (Wagner et al. 2004). As the potential impacts of ICT on mobility are subject to a high degree of uncertainty and dependent on the future of the information society in general, the scenarios developed had to span a wide spectrum of possible futures. Moreover, potential impact chains of ICT use on transport and mobility had to be identified before the actual exploration of future impacts could be implemented. The role of different policy options for shifting impacts in a more sustainable direction could then be explored under the conditions of the different scenarios. Some options clearly turned out as "robust" in the sense of being helpful in all scenarios, while others could be identified as being "adaptive" in the sense of being needed to prevent negative impacts in one specific scenario or to maintain the ability to exploit upcoming opportunities specific to that scenario.

Secondly, the analytical boundaries of the innovation system that determines the evolution of the focal issue need to be clarified. This implies making a distinction between the inside and outside of the system under study, i.e. the distinction between the aspects that can be influenced by, for instance, national policy, and those that are outside its scope and thus to be regarded as exogenous factors. This delimitation of the innovation system will be further refined in the course of the scenario-building exercise.

There are several typical elements and aspects that need to be addressed in the course of an innovation system analysis:

- Actors, i.e. the entities that exert an influence on processes of innovation, either directly or indirectly. These entities do not necessarily have to be individuals or organisations, but can also be based on loser forms coordinated behaviour like networks. The set of actors that makes up an innovation systems can obviously change in the course of time.

- Decision-making processes and interactions, i.e. the objectives, rationales and behaviour of the actors identified, and the processes of interaction by which these decisions are influenced.

- Structures, i.e. an analysis of the structural characteristics of the system and their transformation. This includes institutional and organisational changes like, for instance, a liberalisation of relevant markets or a financial crisis, but also major technological developments or changes of socio-technical regime.

- Socio-technical knowledge base, i.e. the entirety of the distributed knowledge that is available to the different actors. Apart from describing the capabilities and competencies that exists in an innovation system and the knowledge-base also comprises information about the performance and the potential of new technologies and innovations. Moreover, it may be used to anticipate impacts and generate future visions and Leitbilder.

Apart from describing these changing patterns in actors, interactions, structures and knowledge of an innovation system, it is also important to understand the underlying system dynamics in terms of interdependencies between the different levels of analysis (e.g. between actors and structures). Currently, mechanisms from complex systems research are increasingly tested to capture basic principles of innovation system dynamics (Fischer/Fröhlich 2001), but it has to be admitted that this is an area which much research work still remains to be done.

In methodological terms, this first phase is usually based on a combination of analytical desk research to collect important background information and interactive workshops to define the focal issue and interpret them with respect to key mechanisms determining system change.

3.4 Looking ahead: combining exploratory and normative elements

The forward-looking step consists of three main parts, namely an exploratory part, a specification part and a normative part. The exploratory part aims to define different possible future scenarios which serve as frames for further specification and also for adjusting the scenarios according to the normative objectives and goals.

Both endogenous and exogenous developments (i.e. the ones from within the system and from outside) are taken into account as possible factors of influence that are likely to shape the future evolution of the system under study.

After collecting the range of factors of influence, an analysis of current trends and possible trendbreaks can be performed in order to differentiate between factors that are likely to be stable and others that are still open to evolve in qualitatively new ways. Especially the latter ones are useful to differentiate one scenario from another. Such trends and trendbreaks can be of a technological as well as of a socio-economic nature.

Trends and trendbreaks are the basic material from which to develop scenarios. Here, a variety of methods is available, ranging from ‘bottom-up’ methods of constructing and clustering storylines into scenarios to ‘top-down’ methods that concentrate on selected dominant factors of influence, possibly supported by cross-impact analysis, Delphi-methods or simulations to strengthen the credibility of results. However, most of these methods rely in the end on expert or stakeholder judgement, thus reflecting these actors’ implicit theories about impact-chains.

What is essential for these scenarios is that they are plausible, multi-facetted and challenging. Rather than as predictions of the future they must be regarded as tools to stimulate thinking about potential future developments. Moreover, the distinction between endogenous and exogenous factors of influence helps identify where the opportunities and limitations for action are for the main actors addressed, i.e. for instance a national government. Trends and trendbreaks also point implicitly to important decision options of the different actors, i.e. the strategic moves they can make. Games (“Planspiele”) are a tool by which these implicit strategic options can be made explicit.

When the basic scenarios are defined, they just represent different frameworks that still leave much room for further specification. In fact, they just define a corridor of actions that needs to be refined and related to the focal issue under investigation. As guidance for how to describe such

framework scenarios, the main types of factors of influence can be taken as a starting point. Typically, categories such as technologies, producers, users, policy, etc. are defined by the participants, i.e. categories that can easily be related to actors' strategies.

The normative dimension is addressed in the subsequent stage. At this point, goals and values of the different actors come into play. A possible starting point is therefore a debate on visions related to the focal issue of the exercise. This is useful in order to clarify shared (or diverging) policy and/or societal goals, ambitions and underlying values of the actors and stakeholders involved. A second element is related to the potential future risks and opportunities tied to the focal issue of the exercise.

Both elements serve in the end to agree on the dimensions along which the exploratory scenarios are to be assessed. In many current cases, sustainable development is taken as a guiding vision that needs to be operationalised in terms of different assessment dimensions, for instance along the lines of the pattern developed by the German Helmholtz Society (Coenen & Grunwald 2003).

When assessing the scenarios along these main dimensions, it would be unrealistic to expect clear-cut statements on which is the better or the worse scenario from the perspective of sustainable development. First of all, the scenarios are designed in a way to avoid scenarios that are simply "good" or "bad"; on the contrary, multi-facetted scenarios are regarded as most productive. Moreover, in most cases the level of uncertainty of impacts is such that it will at best allow identifying "critical issues" that require the attention of policy-makers or could potentially have significant impacts on the focal issue. These tend to be issues where additional research needs to be conducted in order to better understand potential impacts in the future. In other words, the assessment serves to identify potential but uncertain levers for shaping future development in a more desirable direction.

Project example 2: Wood-plastic composites, fibre composites and biopolymers from renewable resources – scenario development of adaptive policies

In order to support the medium- to long-term strategy development of a research programme on "The Factory of Tomorrow", a scenario-building exercise has been implemented for the area of wood-plastic composites, fibre composites and biopolymers from renewable resources (see Weber et al. 2005). The emphasis was put on the policy options on the basis of which Austrian technology and innovation policy could influence the future evolution of this transition field towards more sustainable production systems. As the ability to shape the evolution of this field from within a rather small policy area in a small country like Austria are comparatively limited, policy options were explored within the context of different framework scenarios that were largely driven by developments external to the reach of Austrian technology and innovation policy. By using this approach, the limits to the political shaping of the future were explicitly taken into account, and the emphasis rather put on the need to adapt to and prepare for scenarios that are driven by external factors, and not the least also international and European developments.

The basic argument behind this approach is that the framework scenarios determine to a large extent the future evolution of the focal issue, but within corridor they define there is still room for manoeuvre and adjustment in a direction that is converging with the negotiated goals and objectives

The assessment and subsequent identification of critical issues opens up the opportunity to modify the scenarios developed towards best possible variants ("What could be best achieved within each of the framework scenarios?), but it is not a necessary condition for the subsequent backcasting and portfolio analysis.

Methodologically, this step is largely based on interactive and creative methods, but can at least in principle be supported by computer tools, forecasts and modelling.

3.5 Pathways towards the future: multiple backcasting

Conventional backcasting approaches take a single and desirable image of the future as their starting point (see e.g. Vergragt 2000). While this is a valid method for clarifying necessary steps towards a desirable future, it underrates the limitations imposed on the ability to shape a desired future, and in particular the dependence on decisions outside of one's own control. In order to make use of backcasting in a more realistic, strategy-oriented manner, its application to each of the scenarios developed is regarded as more helpful ("multiple backcasting").

In essence, backcasting looks at the steps necessary to achieve a specific scenario. This requires analyzing barriers and incompatibilities with which the realisation of a scenario may be confronted in the course of time. Key decision and bifurcations points need to be identified, and the compatibility of, for instance, technologies, values and actors interests to be assessed as a first consistency check.

By staging the pathways leading to the realisation of different scenarios, it is possible to identify needs for action and intervention that can serve as an important input to the subsequent portfolio analysis. In principle, this stagewise backcasting of the scenario pathways allows also discussing the appropriate timing of policy and other measures, for instance in terms of 'windows of opportunity' for introducing a new technology or starting a policy initiative. By developing consistent pathways, the backcasting exercise represents a second level of testing the credibility of a scenario.

Methodologically, backcasting tends to rely on qualitative methods in order to capture the full range of aspects that can potentially come into play in the course of a scenario pathway, but in particular consistency checks can also be supported by means of quantitative tools.

3.6 Portfolio analysis: robust and adaptive policy options

So far, individual scenarios were developed, refined and analysed. Each of the scenarios and pathways can be characterised in terms of technologies and policies that have been realised. The options delivered by the scenarios have also been assessed with respect to our focal issue.

From today's perspective, portfolio analysis looks then across different scenarios in order to assess and select those technology options and corresponding policies that promise to be either robust or adaptive (or both). In other words, robust options are fairly easy to identify because they are positively assessed in all or most scenarios. Adaptive options have been identified as part of normative stage of scenario development when

possibilities are sought to move the basic scenario in a more desirable direction. Adaptive options are thus either crucial for avoiding major negative impacts or for exploiting specific opportunities in a single scenario. These kinds of insights should then serve as an input for today's policy-makers to prioritize, for instance, emerging technologies and design corresponding policies.

Of particular interest are technologies that embody characteristics of both robustness and adaptivity, i.e. in general terms they are beneficial in all scenarios, but their specific shape depends on the conditions of the respective scenarios. In fact, many technologies tend to have a double-edged character, because they can be beneficial under certain circumstances and detrimental under others. It will depend on the context of use and on often politically defined framework conditions what kind of impact they will have. Embedded systems, to take an example from the information and telecommunication technologies, are expected to have a very positive impact within an optimistic information society scenario. The same technology, however, can be abused in a 'big brother' type of scenario when used for invading the privacy sphere of individuals.

The matter is further complicated by the fact that policy options can have an impact at different levels. For instance, they can refer to the promotion of individual technologies (e.g. an R&D programme) as well as to the structural settings of the innovation systems (e.g. liberalisation of energy supply). Moreover, the impact of policies depends on their time of implementation.

Project example 3: The future of freight transport in Austria: overcoming barriers between political administrations

In a project dealing with the future of freight transport in Austria, several different, sometimes also contradictory policy objectives had to be taken into account in order to derive insights into opportunities for defining the future strategy for transport technology and innovation policy. Transport policy objectives as well as environmental and industrial policy considerations had to be brought to bear for the conceptualisation of future policy initiatives and strategies. Although, for instance, transport and technology policy were hosted in the same ministry, the level of cooperation between the respective Directorates General was only weak. Clarifying these objectives was thus crucial for incorporating them in suggestions for new technology policy initiatives as well as for the success of the entire exercise (Whitelegg 2004, Weber et al 2002, Seibt et al. 2002).

These examples show that the analysis of portfolios of real options is far from easy and that technological options and policy options are closely intertwined. However, the basic principle still holds that promising technology and policy portfolios are composed of options that promise to have at least the potential to help improve the focal issue in all scenarios (robust options) and either avoid major problems or help exploit opportunities in some selected scenarios (adaptive options).

Methodologically, interactive methods can be used to discuss different options from a range of viewpoints. In order to come up with new and fresh ideas for policy options, comparative analysis of other countries' practices can be instructive. Finally, while being by far less sophisticated than in

financial portfolio analysis, modelling tools are being developed that promise to be applicable also to real options in quantitative terms, for instance for analysing research and technology portfolios (Schauer 2006).

3.7 Policy strategies: from open participation to closed processes

Especially when it comes to defining policy strategies, where the fundamental orientations and guidelines for policy need to be discussed as a basis for triggering and framing more specific initiatives, it is extremely difficult if not impossible to involve a broader audience. Hidden agendas and political bargaining position cannot be discussed in an open or even public setting. This holds for private firms as well as for government bodies. On the other hand, these debates are essential for consolidating forward-looking insights and making them effective in policy-making. For the sake of bringing foresight to bear on policy-making, we argue that the foresight community needs to accept supporting policy-preparing exercises that are of a rather closed nature as a necessary and complementary element to public and participatory foresight exercises.

In early phases of opinion-building, open consultation and participation are necessary to exchange information, improve our ability to sense and assess future developments in their socio-economic and technological dimensions. At later stages, however, when individual actors need to make up their minds about their strategies and concrete decisions, such forward-looking consultations need to be kept internal to an organisation in order to protect its knowledge and improve its ability to act. These internal processes need equally the support by foresight specialists and should thus be considered more explicitly by the corresponding communities.

Box 4: RTI policy strategy development at ministry level

As part of a strategy development process in one of Austria's ministries in charge of RTI-related issues, an internal foresight and strategy development process was launched in 2005. It serves to re-define the strategic guidelines for RTI-policy within the confines of the ministry's responsibilities. It builds extensively on available strategic and prospective intelligence" that was generated in several projects over the past year. Many of these projects were of an analytical nature, others were set up as consultative, forward-looking exercises. The strategy process itself is organised as a fully internal process without other external participation than from some policy advisors and process consultants. Due to the sensitivity of issues raised in the process, e.g. relating to the positioning vis-à-vis other ministries, agencies or the Austrian Council for Science and Technology Development, a closed process was the only possibility to discuss these matters thoroughly. Building extensively on foresight knowledge and applying foresight-type methodologies in a closed setting, this process has been a highly effective way of bringing foresight knowledge to bear in policy strategy development.

3.8 Policy implementation and learning: monitoring, shaping and adjusting to the future

Developing policy options and portfolios, and even policy strategies is just an input to actual policy design and implementation. In other words, so

far we have been mainly discussing the early phases of the policy process. The actual design and implementation of specific policies, and the learning processes that take place in the course of the stage of the policy cycle from design to implementation represent the wider context to which adaptive foresight processes are supposed to contribute.

If the principles behind adaptive foresight are to be effective, they thus need to be closely tied not only to policy design, but also to policy implementation and learning, at strategic as well as at local level. More specifically, the experiences made in the course of local implementation need to be monitored and fed back to strategy development.

In other words, adaptive foresight should be interpreted as part of a broader continuous learning process that comprises the implementation and evaluation of specific policy measures as well as a monitoring of relevant developments in policy at large.

Strategy development, policy design, implementation and learning should thus not be understood as distinctly separate phases but rather as a continuous process of mutual adjustment. This adjustment refers to goals and objectives, to the identification of new socio-technical options, to the growing knowledge and understanding of their impacts, to the design of new types of policy options and to their integration into portfolios. However, in the course of this process, the degree of participation may change from open participatory processes to closed internal strategy and policy design processes.

Within such a comprehensive setting, the impact of guiding policy strategies should not be underestimated because in particular public policy strategies fulfil an orienting function for many private actors as well, and in the best case play an implicit coordinating function for their decision-making.

One of the main difficulties of this continuous process consists of the fact that all actors involved can recur to strategic and adaptive (and thus interdependent) behaviour. This is why issues of policy coordination – both between different policy areas and between public and private actors – have started to play such an important role in policy-making.

In practice, processes of scenario developments and portfolio analysis will nevertheless hardly be conducted on a continuous basis but rather be repeated every few years, for instance in line with an update of the overall technology and innovation policy strategy. The practical tools and methods are available, based on many years of experience with foresight, adaptive planning, evaluation and monitoring; what is still missing is the integration of these methods in a continuous and long-term strategy development process.

4 Conclusions and assessment

The conceptual framework and methodology presented have been developed and tested in the course of a number of forward-looking projects in Austria and for the EU that aimed either at underpinning or at directly supporting processes of shaping future development paths in a sustainable direction. In all cases, this implied exploring opportunities and conditions for system innovations, and in most cases these analytical and forward-looking

activities were closely tied to the concrete development or adaptation of policy strategies or research and technology programmes.

In this policy context, the conceptual framework turned out to be particularly useful for a number of reasons:

- It clearly puts actors, their decisions and interactions as well as new policy institutions or organisations at the centrestage:
- It provides a clear rationale for sustainability-oriented RTI-policy, but set within the context of the – at least in Austria – dominant paradigm of innovation systems that inspired most recent initiatives in RTI-policy..

From a methodological point of view, the adaptive foresight approach has been very useful in three respects:

- By accepting the need to do foresight work in a rather closed setting of internal strategy support, preceding research and participatory processes could be effective brought to bear on policy-making and policy strategy development.
- Moreover, the methodology is strong by being more realistic in terms of the level aspirations with respect to the political shaping of change; a purely normative "leitbild" type of approach may be useful to develop orientations, but it is less helpful when it comes to devising concrete strategies that need to take the limited possibilities to shape future development paths into account
- Although the experiences so far have been mainly made in a public policy environment, we believe that it could in principle also be applied strategy processes for private firms because it is geared towards both providing a public forum for forward-looking debates and for then targeting the results of these debates to decision-making for individual actors..

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Chapter 36 Systemic Changes for Sustainable Consumption and Production

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1 The nature of the challenge

Transition towards sustainability requires radical changes in the way we produce and consume. We understand better now that reaching sustainability is linked not only to improving environmental situation, but also to learning how to live better and how to improve the quality of our social structures. Even more so, since it is clearly not possible to reach the necessary reductions of environmental impact and resource consumption purely by technical solutions directed at improving efficiency of production processes and greening products. Why is that so? Research shows that aggregate environmental impact continue rising due to increasing population and levels of affluence. It was hoped that technological improvements could compensate for increase in these factors. To keep within the limits of environmental impact of the year 1990 in the year 2025, some commentators argue that a *factor 10, 20* or higher improvement in material and energy efficiency is needed (Jansen 1993; Schmidt-Bleek 1996).

Is it possible to reach this goal? And what kinds of changes are needed to achieve factor 10 or 20 improvements? These questions are not new within the environmental debate. Historically environmental problems were addressed at different levels, including production processes and products. For example, experiences with cleaner production projects and eco-efficiency initiatives demonstrate that it is economically feasible to reach Factor 2 improvements, after which on average the efforts are becoming more expensive than the expected savings (IVA 1998). The best cases of product improvement with product redesign provide us with maximum Factor 4 improvements and on average Factor 2 (Rathenau Institute 1996), (Brezet and van Hemel 1997).

Proceedings: Changes to Sustainable Consumption, 20-21 April 2006, Copenhagen, Denmark. Workshop of the Sustainable Consumption Research Exchange (SCORE!) Network (www.score-network.org), supported by the EU's 6th Framework Programme.

Lately however attention has been focused on the potential benefits from more systemic changes encompassing changes in both production and consumption, and the relationships linking the act of producing and consuming. An approximate exemplification of such changes can be found at function innovation level, which includes systems for shared use, pay-per-use offers and functional sales, which could be summarised under the name of product-service systems (PSS). At this level, on average Factor 2-3 improvement was reported in various examples, including: washing centres (Weaver, Jansen et al. 2000), (Hirschl, Konrad et al. 2003), car sharing (Sperling, Shaheen et al. 2000), ski rental services (Hirschl, Konrad et al. 2001) and integrated pest management (Schmidt-Bleek and Lehner 1998).

Summing up the impact of these changes, it seems to be possible to reach Factor 6-7 improvements in environmental performance, but the challenge of Factor 10-20 still remains. Some proponents argue that higher levels of environmental improvements can be found at the so-called system level, which includes demand-side strategies and initiatives towards sustainable consumption. However there are a number of conceptual and analytical challenges with the call for system level changes.

The discussion on system level changes with regard to sustainable consumption and production has so far been mainly at a conceptual level with a focus on specification of requirements of socio-technical changes at best (Kemp, Johan et al. 1998), (Geels 2002). There are very few cases in the real world to rely on in exploring the dynamics of change particularly with regard to desired changes towards sustainable consumption and production patterns. We actually do not exactly know what novelties and discoveries can lead to desired changes, nor have we been good at anticipating these changes. A discovery taking place somewhere on the margin might actually through uncoordinated process lead to fundamental changes in the structure of dominant industries creating new consumption paradigm and perhaps new consumers and users.

We do have on the other hand from a long history of innovation studies, various ideas on the dynamics of technological change and influencing factors. The emergence of the concept of innovation systems - linking the innovating firms, their interactions with other firms and organisations and the institutional environment in spatial and sectoral contexts – illustrates the broader scope for analysis of innovation processes and the dynamics of change. The innovation systems approach may bring more structured discussion on the various factors influencing the development, diffusion and use of innovations. However the emphasis is still on how innovations come about and diffuse in the market where the innovating firm takes central role. Still even within this view, the central concern is the rate of innovation and not necessarily the direction of innovation (Edquist 2005). The call for system level changes is directional in one sense and ideological in another, as it prescribes desired actions of actors in producing and consuming. So what lies underneath this system level changes? What is the nature and dynamics of change involving both transformation in production patterns and consumer behaviour? And what role institutions play in this transformation?

In this paper we take on the experience with function innovation and the concept of PSS as a starting point for theoretical and conceptual exploration of the above questions. We draw on existing cases of different levels of

maturity within PSS. However we do not claim that these cases represent system level changes as descried by proponents of the system innovation idea. The cases are interesting because they approximate desired changes for system level improvement or what we termed systemic changes; affecting both the act of producing, the conception of utility/function and the act of consuming. In the next section we describe and position *PSS cases* within the system innovation idea. In section 3 we discuss novel changes assumed in PSS cases leading to a discussion on the dynamics and transformation for PSS. Important to point out is that the novelties described are not necessarily novel to the world, but rather to the actors involved in the innovation process.

2 Systemic changes and PSS cases

2.1 Levels of systemic changes towards SCP

The central thesis of PSS concept is that by redesigning systems of provisions that deliver function of product by alternative to private ownership means, additional environmental gains can be made. The concept builds on the need to stimulate innovation at the function level, which is considered at the high end on a scale of changes promoted within the idea of systems innovation. Tukker and Tischner distinguish three levels of changes towards sustainable consumption and production (Tukker and Tischner 2006):

1. *System optimisation*. This level of improvement includes improving existing systems of production and consumption with existing tools, such as eco-design of products and services, informing consumers about environmentally sound alternatives and consumption patterns. There is no change in the structure of the production-consumption system. Incentives for change are a mixture of hard (primarily for producers) and soft (for both producers and consumers) policy instruments. The typical sustainability improvement at this level is 20-30%.
2. *System re-design*. System of provision is redesigned to become less environmentally burdensome and is often based on function innovation. For example, instead of fulfilling mobility need by private car ownership, an integrated mobility system is offered, in which people use public transport where feasible and car sharing systems are used as a back-up option. At this level, the typical sustainability gains are 50% or more. Together with tools that optimise the system, the structure of the production-consumption interactions changes, new forms of function provision with new products and services or new combinations of existing products and services are found, albeit still shaped within existing context and market framework.
3. *System innovation*. At this level not only products, services and production systems are optimised and new ways of satisfying consumption needs are found within existing institutional frameworks and infrastructures, but new infrastructures, spatial planning and incentive systems are developed and implemented that promote more sustainable lifestyles. One example are

> community-based washing centres in Sweden that became a part of urban planning, follow energy and water efficiency standards and provide washing function to millions of households.

In this style of categorisation, we can say that PSS cases can be found within both system re-design and system innovation level. Therefore we can expect different dynamics in the change processes leading to PSS depending on the level of change. The starting point for our discussion is function innovation, which has been discussed in PSS literature in two ways. Some authors equate leasing and renting with function innovation. If we take the same starting point, then system optimisation level may also include function innovation. Research however demonstrates that the environmental outcomes of this kind of function innovation may not lead to significant improvements and even on the contrary increase environmental impact of providing function. For example, comparison of various scenarios for providing function of do-it-yourself tools, including ownership, community-based sharing scheme and rental companies, demonstrated that the distances households have to drive to rent the tool makes rental companies the worst alternative (Mont 2004). Thus, the function innovation that is understood as only leasing or renting does not guarantee environmental improvement and does not represent system optimisation level.

On the other hand, if function innovation is understood as the starting point for developing products, services and actor networks that are suited for providing function, then environmental improvements have better chance to occur. For example, instead of designing a car with environmental criteria in mind (eco-design), car manufacturer may ask: what is the function that I would like to sell to the customers? The answer would probably be "mobility". The next step for the manufacturer would be to organise a system for mobility provision, which would include establishing contacts with other mobility providers, such as public transportation, car sharing schemes and rental companies, designing cars for multiple use, and facilitating services that substitute the need for transportation (e.g. videoconference). Reduction of environmental impacts would then be expected from better designed cars such as development of electrical or hybrid vehicles for car sharing and renting, adjustment of train and buss schedules, and support of municipalities in providing designated parking places for shared cars – all steps aligned to provide mobility function in the least environmentally burdensome way.

To sum up, in our understanding of PSS, function innovation can be the starting point for transition, however the extent of systemic change depends on the degree of changes in the entire product-service value chain and not merely on function delivery. In the following section we elaborate further on levels of change in specific cases from business-to-business (B2B) and business-to-consumer (B2C) markets.

2.2 Levels of changes in PSS cases

We make distinction between two types of cases. In the B2C market two interesting cases to examine are the car sharing and communal washing centres in Sweden. In the B2B market we look at the two most cited examples of Xerox and Interface Inc.

2.2.1 Car sharing

The number of car sharing systems is slowly growing in many countries. It is an alternative system for satisfying mobility needs of people. Although it is still a niche market, car sharing idea is popular among people who do not use car often or among families who want to avoid buying a second car. Members of car sharing organisations typically have access to several types of cars, which they can book through a telephone or Internet booking system and pay for using by receiving a monthly bill.

The majority of existing car sharing systems are provided by other actors than car manufacturers and therefore no design changes of cars usually occur. Car sharing is a niche market and there are largely no supporting normative and regulatory institutions. Moreover, the idea of sharing cars contradicts the established norm of car ownership and the perception of a car as a status symbol. Car sharing organisations are working with improving the image of shared cars as a status good. For example, Mobility, a Swiss-based car sharing organisation, sacrificed having its logo on shared cars in order to satisfy the needs of its members for status. Another interesting way to embed car sharing into every day life is practiced by StadtAuto in Bremen and StattAuto in Berlin, which offer full mobility services by combining public transport and car sharing into a single mobility solution (Glotz-Richter 2001). At the regulatory level, car sharing has recently paved its way into the list of possible solutions to transportation-related problems, e.g. in the European Commission's White Paper "European Transport Policy 2010 – a time to decide" (European Commission 2001). In addition to including car sharing as a part of the Dutch Policy Plan on the Environment and the Economy, the Dutch government established a foundation for the promotion of car sharing. Summarising the features of car sharing outlined above, we can categorise car sharing systems as being at system redesign level, but not at system innovation level.

2.2.2 Communal washing centres in Sweden

Communal washing centres in Sweden is an example of system level innovation. The communal washing centres provide the function of clean cloth to households through the system of facilities that became an integral part of the urban development. The idea was initiated by a real-estate company HSB in the 1920s and was picked up in the 1930-40s by the Swedish Housewives' Association and other women organisations (Hagberg 1986) as a measure to help women with household work. In the mid-1940s, the decision to integrate women into the work market was taken and the issue of assisting women in their washing activities got regulatory support. For example, during 1939-1946 direct financial support was given to cooperative washing centres in the countryside (Kjellman 1989). Official report from 1947 advocated self-service washing centres and external washing services to washing at home (SOU 1947:1 1947). At the beginning of the 1960s, the countryside households started using private washing machines, but in cities communal washing centres were spreading (Henriksson 1999). First in the 1950s, real estate companies started to regularly equip newly built houses with washing rooms (Mitchell 1993) and by the end of the 1960s, 80% of the population had access to small washing centres, equipped with automated washing machines. Out of these, less than half owned washing machine at home.

Later, Swedish regulation developed guidelines on the location of communal washing centres and their baseline equipment for building and housing companies. In addition, the Association of Tenants and Society of Tenant-Owners provided recommendations on accessibility and availability of communal washing centres for newly built and existing multi-flat houses. In the mid-1990s, the energy authority and other organisations devised guidelines and advocated instalment of energy-efficient equipment in communal washing centres. Therefore, nowadays communal washing centres use semi-professional washing machines and drying equipment, which is more efficient than individual washing equipment both in terms of water and energy use. Since this equipment is used more intensively by many households, it gets technically worn out faster and is updated to the new equipment more often. Thus, the function of clean cloth is delivered through a collective system, which has lower environmental impact than the system where the function is provided through individual ownership of washing machines. Unlike car sharing example, communal washing centres are not a niche market, but are very widely used in Swedish towns and cities.

2.2.3 Xerox Corporation

Xerox Corporation started as a photocopier manufacturer, and over the last decade has been turned into a document company, focusing on the entire commercial documentation process. Xerox's Asset Management Programme is one of the most elaborated PSS in business-to-business market. Products are leased or sold under a multi-year contract, which guarantees customer satisfaction through functioning machines and payment of a fixed price per copy. As was mentioned before, leasing does not necessarily lead to environmental improvements. In business-to-business market leasing practices are widespread and companies lease for a variety of reasons. For example, Xerox leased first copiers already in the 1960s, because of unfamiliarity of the users with the new process and for tax purposes. However, a system design was needed in order to keep the leasing strategy successful. This means that products and processes had to be designed for remanufacturing. The product design process was enhanced by applying the commonalty principle to component design. A new Asset Recycling Programme was set up as soon as products started to come back from the market.

These programmes demand more time in the design phase of products and components. However, the possible losses due to the increased time-to-market and loss of economy of scale through region (re)manufacturing are offset by considerable savings in raw material procurement and waste disposal. A historical bias exists against remanufactured products, but Xerox has taken steps to overcome this by promoting the remanufacturing products as "proven workhorses", and by giving a 3-year replacement guarantee on all products. This lead to that in the end of the 1990s, in Europe, the demand for remanufactured Xerox machines exceeded supply by 50% (Ayres, Ferrer et al. 1997; Ferrer and Ayres 2000). To support the new business model, Xerox also provides quality training to its suppliers and a special training to its service personnel. After the success of Xerox, many large office equipment manufacturers, e.g. Ricoh and Océ, shifted to leasing and remanufacturing.

2.2.4 Interface, Inc.

Another case from business-to-business market is of Interface, Inc., which operates a carpet-leasing programme for its range of commercial carpet tiles, called Evergreen Lease. The Evergreen Lease is based on a modular system of flooring. Interface, Inc. maintains control of all stages of the product's life from production, through use and maintenance, to recycling and disposal. The system leads to a number of environmental benefits, such as greater life expectancy of the flooring and its refurbishing, closed-loop recycling system and production of new carpets with some percentage of the recycled materials, resulting in lower consumption of raw materials. For the customer, the system has lower costs.

When introducing the system, the company faced several problems, such as the general reluctance of customers to embrace the concept of a continual lease arrangement and difficulties with developing technology for recycling old carpets. The company encountered significant economic problems with operating closed loop systems (Fishbein, McGarry et al. 2000). Difficulties were associated with the relatively inexpensive raw materials for carpet production, which made carpet recycling a more costly enterprise. Another problem was that the Evergreen Lease programme that was planned as operational lease did not meet a number of requirements of the Financial Accounting Standards Board. This made financial institutions unwilling to finance the leasing arrangements. It was also unclear how Interface and their clients should handle this lease within the traditional accounting system and what consequences this might have for the tax treatment. After these problems, the company offered take back and recycling options in addition to their standard capital leases. This example also demonstrates that making the economics of closed loop system work might be a challenging task, the fulfilment of which does not only depend on the company's performance, but also on existing economic (tax) frameworks.

Despite these difficulties, Interface is persevering with the concept with the aim of developing a sustainable floor covering business, which is able to reclaim and recycle its products and "never have to take another drop of oil from the earth" (Interface 1998). The leasing concept extends the company responsibility for the entire life cycle of carpet. The idea of providing service to customers is not new in itself, while accepting responsibility and turning it into profit centre is. In addition, changes are required not only in company culture, but also among its customers and existing financial and regulatory frameworks. Together with Interface, Inc., a number of other companies are selling the function of flooring, e.g. MilliCare, DuPont, BASF, Monsanto, Collins & Aikman, and Milliken Carpet.

3 Innovative processes in PSS

The two aforementioned B2C cases of car sharing and communal washing centres are both considered successful cases in the PSS literature, but our brief evaluation demonstrated that they are quite different in terms of societal changes involved in their dissemination, including the diversity of actors involved in promoting them and the regulatory and normative institutions that are being modified in the transformation process. The other two cases from business-to-business market - Xerox and Interface, Inc. – are

cases of incumbent actors leading the transformation in the business model within the existing regulatory and normative institutions.

In general terms, PSS cases illustrate a number of changes that can be characterised as novel to the constellation of actors involved in the production-consumption process. This implies new learning and de-learning among actors, new interactions and relationships, and perhaps new ”rules of the game”. The critical question is how these changes co-evolve for successful shift to take place. In the following section we elaborate on key transformative processes in PSS.

3.1 Shift in ownership

One of the main features of PSS is the changing nature of relationships between producer and user. While in traditional sales, value is directly associated with “the amount buyers are willing to pay for what a firm provides them” (Porter 1985: 38), in PSS value is co-produced and recreated and cannot be reduced to single monetary metrics (Hampden-Turner 1990: 2-3). In traditional sales, the profit centre and the point of transaction is tied to material product, while in many PSS cases, profit is tied to the number of functional units the material product delivers. This leads to that in the latter case consumers do not have to own product to be able to use it. They pay per use, per unit of function consumers themselves or service providers extract from products, and they do not pay for the product.

In PSS, incentives for providers are created to increase the number of functional units that the product delivers, since functional units are the price carriers, and consequently to treat products as capital assets that are worth maintaining, just like production equipment (Braungart 1991). Thus, the shift in ownership structure provides incentives for increasing product durability, design products for easy upgrading, reuse and remanufacturing. In addition to that, if PSS providers are responsible for the operation of products in the use phase, also incentives are created to reduce the costs associated with the use phase; including costs for consumables and auxiliary products, as well as costs for maintenance and upgrading services. For customers, incentives are created to know how much the product is used and thus the cost of the use phase becomes transparent and creates incentives for users to reduce product use. In that way, possibilities for shared use of products is created.

The shift in ownership in the business-to-consumer markets may sometimes be associated with higher barriers than in business-to-business cases. In B2C markets the shift typically occurs in the form of switching from owning a product to leasing-renting-sharing systems. The success of these systems depends, to a large extent, on the type of the product to be shared-leased and on how customers feel about owning the product. A distinction between so-called functional and emotional products may explain some of the differences. In the case of functional products, customers are not emotionally attached to these products and are mainly interested in the function delivered. For example, utility companies provide “functional products”, i.e. energy, water, with which customers do not have emotional attachment. Contrary to functional products, emotional products, besides providing function, also create image, secure certain status and make customers feel emotionally attached to them. Therefore, a somewhat different incentive structure for customers needs to be developed if

emotional products are to be substituted with systems where ownership of products is abandoned. It is not so easy, as many studies showed, to replace car ownership with mobility services provided by car sharing and pooling schemes. Purely financial incentives, which work better in the case of functional products, need to be substantiated by image-making and/or status-building incentives in the case of emotional products.

3.2 Shift from product to offer

As the name suggests, in product-service systems not only products are sold, but offers, comprising both products and services. At the first glance, this might not seem to be a big change. However, taking into consideration that the majority of companies are used to developing and selling products, the shift to providing offers becomes a significant challenge that entail many changes within and outside the product manufacturing company. Firstly, being part of PSS, services also need to be designed with similar considerations as products. The issue of service design has not received similar attention as product design (Bullinger, Fähnrich et al.), and has been discussed mainly within the service marketing context. However, service design should include much broader perspective than just marketing. For example, services need to be adapted to the current systems of provision. In addition to that, service design needs to include environmental considerations to ensure that the offer does have a lower environmental impact than traditional business models of selling products. Secondly, services also include special "sales techniques" that need to be changed from existing practices of "product-transfer" sales into functional sales, where consumers can experience functional qualities of products and understand the service component in the communication process with personnel. In PSS, the point-of-sale becomes the point-of-service. This entails changes in the design of the "sale" stage that should include different techniques of selling product use.

3.3 Shift from supply chain to value chain actor-networks

The shift to a product-service system may have a considerable impact on the supply chain structure. New actors may play a role in the existing product chains (Halme and Antonnen 2004; Mont 2004), providing services that add value to products or that close the product life cycle. There may be a need to consider not only the product chain in the design phase, but also networks of companies that may jointly fulfil customer needs in a less environmentally burdensome way (Mont 2004). Sometimes, non-traditional actors deliver utility to customers in the most efficient and effective way, for instance actors who are usually placed outside the traditional supply chain, such as real estate companies, non-commercial cooperatives, etc.

In addition to these considerations, the shift to actor-networks is necessitated by the need to improve the product-service offer and several life cycles that comprise it. For example, in the case of selling washing machines, production processes can be improved and resource use optimised along the life cycle of a washing machine. In the case when a function of clean cloth is sold, optimisation should take place at these levels, but should also include optimisation along the life cycle of washing detergent, electricity and water used, maintenance and end-of-life services of the washing machine. Thus, the complexity of actor-networks is increasing in comparison to selling products when PSS is to be delivered or optimised.

4 Discussion on dynamics and transformation

In general terms, specific innovations are the result of both intentional and unintentional choices and actions taken by individuals or organisational actors. However, a growing body of literature has come to recognise the systemic nature of innovation and the importance of learning and institutions in the innovation activities. Thus actors, interactions and institutions are important components in the conceptualization of innovation processes (Malerba 2005). The innovation system approaches brings these components in a system framework to conceptualise the activities enabling and constraining these processes (Edquist 2005). The system boundaries can be defined on a spatial scale such as national or regional and on sector level. The dynamics and transformation of innovation systems are the result of several different processes. These processes may involve co-evolution of various elements such as technology, knowledge base, learning, demand, firms, non-firm organisations and institutions (Malerba 2005). Similarly the transformation towards PSS entails co-evolution of various elements.

As illustrated previously, transformation to PSS entails intricate shifts including shift in ownership structure and supply chain structures. Clearly we see also that these processes can take place in different product-service markets and social contexts. The concept of sectoral system of innovation provides an interesting and relevant entry point for conceptualization of change processes towards PSS. This is particularly relevant for PSS cases because the sectoral system of innovation is at the level where societal functions are fulfilled.[101] In Malerba (2005) clear differences were shown in the behaviour of different sectoral systems such as the role of knowledge, actors and institutions. This has relevant implications for our discussion. First, stimulating transformation for PSS needs to consider these sectoral differences. However in the case of PSS when starting from function innovation, broader systemic changes for sustainable consumption and production need to take place. For example new agents might be involved beyond the boundaries of the sector. Therefore the focus should be on the dynamics and transformation of particular societal functions (e.g. mobility rather than cars).

Looking back at the innovative processes in PSS cases, the shifts occur in the presence of incentives (economic or regulative) for existing actors – involved in the production, diffusion and use of a particular societal function -to change and adapt, or for new agents to enter into the chain. The dynamics were different in PSS cases between B2B and B2C markets. Even within B2C cases, there were differences in relation to the meaning given to the act of consuming, such as the distinction given between extracting function (electricity for lighting) versus emotional utility (image and status).

A shift in ownership structure occurs in diverse user contexts. In the B2B cases, the consumers are generally organisations. The concerns were mainly about costs, tax regime and trust in the new business model. In the B2C cases, consumers are generally individuals and households. The critical issues here were meanings, norms and routines in owning products and the

[101] Geels (2003) refers to examples such as transport, communications, materials and housing. However in the case of PSS we extend this to the utility in perspective of the user such as mobility, shelter, etc.

very act of consuming. The dynamics here were much more complex and path dependent. This is perhaps more visible in the case of communal washing centres in Sweden. The context of sharing evolved through long history of normative rules and values within the fabric of the society. Several historical reasons contributed to formation of the prevalent norms in Swedish society, on which existence of collective sharing schemes rests. Examples of this could be the concept of "*lagom*" (just enough or with moderation), the acceptance of the notion of collective good and the tradition of non-conflict. The concept of a common good originates from early religious postulates and implied that it was sinful to strive for more than satisfaction of individual needs. In the modern times, the 70 years of the rule of socio-democrats in Sweden also contributed to the institutionalisation of solidarity tradition. These historical decisions have greatly contributed to the evolution and acceptance of community-based forms of living representative for the contemporary Swedish society. If similar values are present in a society, there is perhaps a better chance that collective sharing systems or business models based on leasing arrangements will be easier to embed into everyday choices and will have higher acceptance than in cultures with values based on possessive individualism.

A point to make from this is perhaps an understanding of the socio-cultural and even historical context, in which consumption-production activities take place, is needed to provide useful insights into how socio-technical innovations can be institutionalised and embedded into everyday life.

A shift from product to product-service offer has implication to system of provision and relationships among actors involved. This perhaps explains why car sharing has not evolved into a full fledged systemic change and remained a niche market. The dominant actors in the car business, auto manufacturers, perceive themselves to be in the business of car making, not in the business of mobility. Therefore, mobility provision through other means than private car ownership is perceived by them as a threat. They are typical actors of the prevailing regime and are locked into old ways of thinking. Their main focus is on improving existing technologies, optimizing existing systems and not on innovating new systems. Therefore the driving forces behind car sharing are external agents. Car sharing organisations are on the other hand operate in niche market, in which new ideas for mobility provision are being developed, often in close collaboration with other mobility actors, such as public transportation companies, car rentals and leasing firms. Car sharing organisations thus establish new actor networks for provision of mobility. However, in order for car sharing to become a mainstream option for mobility, other changes are needed that would shape social values, built environment and infrastructures, and economic incentives. In this respect, the development of collective structures suited for and facilitating car sharing is of particular importance. It is perhaps impossible to devise policies that specifically promote car sharing per se. However, by altering the incentive structures (restrictive policies) for the use of cars particularly in urban centres, the opportunities for shared systems can be enhanced.

Communal washing centres on the other hand were never a niche market. Their development went hand in hand and, at some periods of time, rivalled with the technological development of washing machines for individual use.

In this sense, communal washing centres were radical innovations, combining innovation at both the technical and organisational levels. From the first examples of communal washing centres provided by a housing company HSB in the early 1920s, the journey took few decades until a significant number of communal washing centres were built in Sweden in the 1950s.

B2B cases of Xerox and Interface demonstrate that although shifting the business model from selling products to selling function may encounter problems with existing regulatory, normative and financial frameworks, the idea is viable and is spreading in various sectors. The change in selling functions instead of products leads to the change in ownership and responsibility structure. Depending on the size of operations and the market, many companies have to find collaborative networks and new agents, which can help provide functions. In case of Xerox, Interface, Inc. and washing centres, service organisations are involved in servicing the products and in ensuring provision of function.

5 Concluding remarks

What the PSS cases demonstrate is that shifting the ownership structure and shifting from selling products to selling offers on their own do not guarantee an improvement in economic, environmental and social sustainability. Companies do not have to drastically change the way they do business in order to optimise existing production processes, products and services. However, in order to move to the next level of systemic changes towards SCP shifting the ownership structure may become a necessary prerequisite. Even here, on its own, changing the ownership structure along the product life cycle may not guarantee any sustainability improvements, as traditional cases of leasing and renting demonstrate. What is needed is the systemic changes in the structure of consumption-production interactions and new ways of function delivery. This fundamentally depends on the creation of new institutions or adjusting existing regulatory and normative frameworks.

The dynamics and transformation in PSS cases provide an insight to some of the challenges in systemic changes to sustainable consumption and production. Institutions play a central role in the transformation process. In line with Geels (2003) we recognize the conceptual problems with sectoral system of innovation particularly in relation to the role of institutions. One of the largest gaps in both institutional frameworks and innovation systems is lack of attention and hence understanding of how changes can be instigated in consumption realm.

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Chapter 37 Elements of System Innovations for Sustainable Consumption & Production

Opportunities for Policy Makers as Stimulators

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1 Background: Essentiality of system innovations for sustainable consumption and production

It is widely recognized by world leaders that more efficient resource is one of the changes needed to make economies more environmentally sustainable. However, recent findings indicate that the world has made little progress towards preventing economic growth from translating into higher natural resource use (EEA, 2001).

While market forces already favour resource efficient production due to reasons of competitiveness, in absolute terms, resource use still remains at unsustainable high levels with regard to both its volume and the structure. For instance, resource productivity has been increasing in at the EU level. However, there is a lack of an absolute decline in the volume of direct material inputs and total material requirement. This implies that the environmental burden related to resource use is remaining constantly high, as waste production is directly related to resource use. (Moll et al., 2005)

Besides, there is a clear burden shifting in resource requirements from domestic sources towards use of imports in the western world. This apparently creates a shift in environmental burden of resource use to other regions. Therefore, resource use is increasingly becoming a matter of international burden shifting. (Moll et al., 2005)

The phenomenon of growing resource use goes hand in hand with extreme inequality of resource consumption. The evidence for the "distorted geography of consumption" indicates that the overall consumption of the richest fifth of the world's population is 16 times that of the poorest fifth (OECD, 2002). Correspondingly, the footprint of an average Western European citizen is factor five higher than the footprint of an average

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African citizen. (WWF, 2004)

On the whole, it became apparent that achievement of sustainable consumption and production requires a focus on global product chains and a variety of actors related to them. In other words, a multi-level approach would be required. Change is crucial at the individual scale, at the organisational scale (within organisations and among organisations) and as well at the societal scale (among operationally autonomous functional systems with its own operational code).[102]

As Rotmans et al. (2000) states; "transition of a system is a gradual process of societal change in which society or an important subsystem of society structurally changes". According to him, transitions are not caused by single variables such as a policy act, a price change or a new technology, but are the results of developments in various domains, which sustain each-other: technology, economy, institutions, behaviour, culture, ecology and images/paradigms (Rotmans et al., 2000)

In this paper, we propose that businesses could play a significant role in transitions to sustainable patterns of consumption and production, and therefore they have the responsibility of improving triple bottom line (TBL[103]) performance of their products and services. Businesses interact with all the domains mentioned by Rotmans et al. Thus, business functions such as strategy development, product design, marketing, sales, etc. can affect or can get affected by these domains.

We moreover suggest that the process of triple bottom line improvements can be explained using the literature on innovation processes. Since global product and service systems are composed of complex array of actors and actions, system innovation perspective can be taken.

However, in the sustainability literature, how the process of innovation in the production and consumption system occurs is not well studied. Capabilities and skills, in other words, conditions required for achieving innovations, which would improve TBL performance of products and services are rarely addressed. Hence, the elements of TBL performance are still not known. While several authors mention drivers of eco-innovations (for example Beard and Hartmann 1999, Rennings 2000) or social innovations, a TBL approach on the production and consumption system is missing. As shown in Figure 1, conditions for system innovations remain as a „Black Box", which requires to be studied. This paper introduces an initial attempt in this vein.

Hence, following an initial study of this "black box", our **overall goal**[104] is to develop an initial framework for an approach that can allow business to identify opportunity areas for system innovations for SCP. These opportunities can stem from managerial and resource use practices. We

[102] The levels of scale are taken from Jessop (1997) in Parto (2003).

[103] The agenda of sustainable development for business emphasizes the importance of addressing all three pillars of sustainable development i.e. economic justice, environmental quality and social justice (Elkington, 1997). Being considered as any other activity of business, the system of innovation shall also have positive implications on all three pillars of sustainability.

[104] This study is, in fact, carried out in the scope of the overall project, entitled "Life Cycle Approaches to Sustainable Consumption"[104], which was commissioned by the National Institute for Advanced Industrial Science and Technology (AIST) in Japan. The overall study intends to examine new ways to reduce CO_2 emission and environmental loads from the viewpoint of the consumer.

propose that corporations can work on the factors affecting their managerial and resource use practices in order to develop product and service ideas for sustainable consumption and production (SCP).

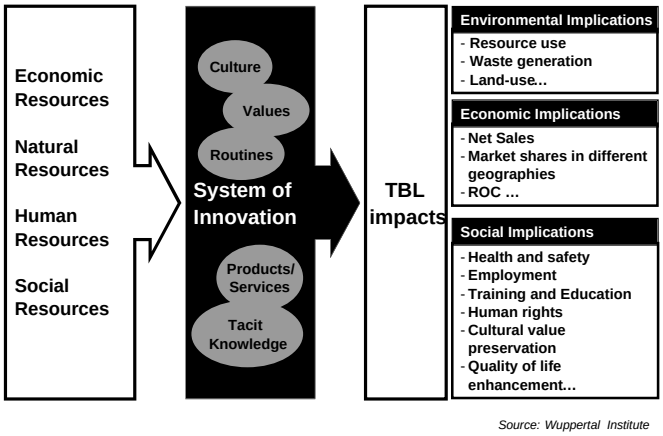

Figure 1 - The resource use and creation of triple bottom line improvements by system improvements.

In this sector, we focus on the information and communication technology (ICT) sector in order to identify factors for system innovations, which would lead to system innovations. Our research questions are as follows:

- Which internal factors have to be in place in ICT companies to be able to develop products and services with superior environmental, social, and economic performance?
- How can ICT companies assess (measure) their readiness for system innovations?
- What issues do ICT companies need to consider for facilitating TBL innovations?

2 Triple Bottom Line Innovations: Scope and definition

Focusing on novel improvements or processes of innovation, most of the innovation management literature does not have concerns for establishing a "direction". For example, Reenings (2000) states that general definitions of innovation are neutral concerning the content of change and open in all directions and this should not be the case regarding innovations aimed at sustainable development. Hence, the only direction commonly mentioned can be stated as the economic dimension, whilst environmental dimensions are rarely being mentioned and social dimensions are often ignored.

The agenda of sustainable development for business emphasizes the importance of addressing all three pillars of sustainable development i.e. economic justice, environmental quality and social justice (Elkington 1997). Innovations, as novel creations of business or improvements in their processes, can also be assessed as any other activity of the business. Hence, all innovation bottom lines shall be balanced and the system of innovations shall have positive implications on both input and output sides. What would that mean for business? How can innovations satisfy economy, environment and society, simultaneously?

The significance for the *environment bottom line* of the innovations can be evaluated in terms of their use of natural capital (Lovins et al. 1999) and the impact created on the environment. Hence, all stages of development of innovations shall take into consideration that the capacity of ecosystems and the biological engines of the planet are declining. Acknowledging the limits of the ecosystems, business can then follow an eco-efficiency strategy encompassing improvements in all environmental aspects such as energy, water, raw materials and land use, whilst enhancing recyclability, product durability and closing the material loops (Weizsäcker 1997). This would in turn mean reduced air emissions, water discharges, waste disposal and elimination of toxic substances.

Additionally, *environment bottom line* for innovations can pursue a cradle-to-grave approach. Life-cycle focus of a product, which begins and ends outside the boundaries of the company's operations, allows a full assessment of all inputs to the product and examine how customers use and dispose it. In this regard, a diverse set of concepts and approaches for environmental product stewardship in line with a life-cycle emphasis such as life cycle assessment, design-for-environment, eco-design, eco-innovations, sustainable product design can be followed.

However, resource efficiency improvements for a single product unit even along its life-cycle are insufficient to conserve the capacity of ecosystems. As mentioned in the introduction, this is due to the fact that increases in consumption units may hamper eco-efficiency improvements per product unit. Hence, assessments regarding the environmental bottom line shall focus on absolute improvements. Otherwise, rebound effects will enhance depletion of natural capital.

The *social bottom line* significance can concentrate on use of the societal resources and the impacts created on the society. Systems approaches to innovation can be considered as the initial point of departure for developing a link to societal actors. On one hand, similar to any business processes, innovations would require use of a certain level of human resources such as knowledge and skills of the employees or networks and social resources such as community infrastructure, public services and cultural values. On the other hand, processes of innovations would have impacts on the internal workforce and the society at large.

Social performance of system of innovation has not been well studied. The social dimension is often mentioned depending on its relation to knowledge requirement and learning through innovation processes (Orozco, 2002), while the impact side of the innovation system stayed out of focus. Recently, consideration of social aspects, simultaneously with environmental concerns, is in discussion and on the policy agenda in relation to the concept of Corporate Social Responsibility (CSR)[105].

Hence, the demand for social assessment tools is increasing. In this respect, ethical labelling initiatives for products, ethical screening by the financial institutions and initiatives by social non-governmental

[105] CSR mainly refers to business decision-making linked to ethical values, compliance with legal requirements and respect for people, communities and environment. It aims to operate a business in such a way that it meets or exceeds the ethical, legal, commercial and public expectations that society has of business.

organisations (NGOs) might provide tools for business to understand the relevancy of social aspects for innovative conducts.

In search for the significance for the *financial bottom line*, firms can concentrate on the effect of innovation activities regarding the economic resources of the corporation. However, in doing that, sustainable innovations need to move well beyond traditional understandings of economic capital, namely physical or fixed capital and financial capital. Assessing the significance of innovations requires a forward-looking approach rather than an evaluation of the past performance of the firm. Therefore, traditional forms of assessment of economic capital would not be sufficient. Economic sustainability definitions may embrace more diverse forms of economic capital such as "financial capital (i.e. equity and debt), tangible capital (i.e. machinery, land, stocks) and intangible capital (i.e. reputation, inventions, know-how, organisational routines)" (Dyllick and Hockerts 2002:11).

In the light of the above discussion, a formal definition of TBL innovation can be expressed as follows:

"Triple bottom line innovations are novel improvements developed within a network of institutions aiming at preservation of absolute amount of natural resources and enhancement of social and economic capital".

3 The Process of TBL Innovation

Innovation process is sketched in various ways in the literature referring to different types of innovation processes such as product innovations (McKee 1992, Dougherty, 1990), innovations in organisations (Roger 2003), technology innovations (Spath et al. 2003). A simplistic overview, which stays common to all, can be expressed in three major steps: strategic identification of innovation potential, preparation for innovation and realization of innovation and management of innovation (Spath et al. 2003). **Strategic identification** refers to both identification of opportunity areas to innovate and development of ideas. Then, feasibility of the ideas shall be tested and the organisation needs to be prepared to realize the innovation, since all resources may not be in place. Finally, **realization** refers to the assessment of an action plan and implementation of the innovation.

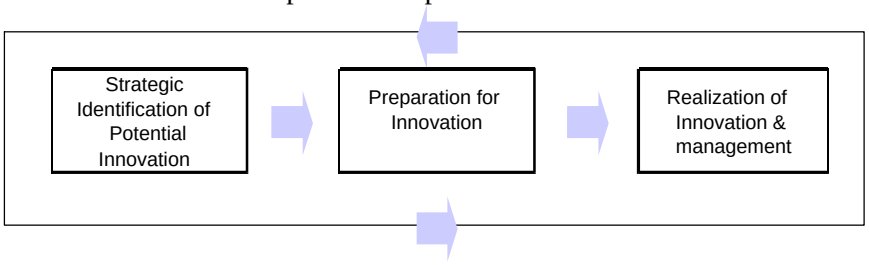

Figure 2 – Phases of the innovation management process (Source: Spath, et al., 2003, p. 11).

Roger's (2003, p.420)[106] five stages model of innovation process (See Figure 3) can be used to study innovations starting in organisations. His model is quite well accepted in the organisational innovation management literature (See for example Ven 1986, Monge et al. 1992, Damanpour 1996).

[106] His well-known diffusion model first appeared in the first edition in 1962. In our study, we use the fifth edition of Roger's work published in 2003.

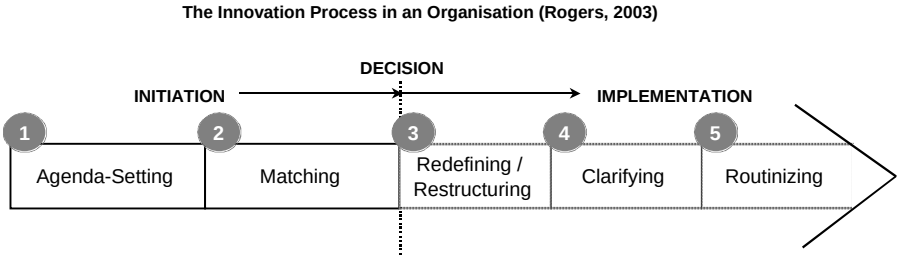

Figure 3 – Innovation Process in an Organisation (Rogers 2003: 421).

On the other hand, his approach fails to include characteristics of system innovation. Although Roger's model is valuable to grasp the main stages of innovation, his model needs to be extended to include characteristics of system innovation. As an initial point, orientation towards **more external feedback and involvement of stakeholders** is essential. This is due to the fact that system innovation is a collective process requiring involvement of actors also external to the organisation.

Another crucial point is that according to Roger's model, **the assessment of the need for new organisational structure** is considered only at the redefining and restructuring stage. However, businesses aiming at making changes in the production and consumption system need to assess the need for organisational structural changes from the beginning of the procedure. This capability assessment, different from Roger's model, needs to be initiated earlier, since system innovations might require dramatic structural changes at later stages. Organisations shall be aware of the gaps in their capabilities and decide at the initiation phase how much of capability acquirement and institutional change is required. Distance to system innovation (gap between required capabilities and the organisational capabilities) shall be a factor in deciding whether to continue with the innovation process.

4 Putting the Innovation Process into Place: The TBL Innovation Audit Tool

In order to serve our ultimate purpose of developing a practical approach that can aid businesses to identify opportunities for system innovations for SCP, we developed the idea of a TBL Innovations Audit Tool. This tool comprises of two pillars: **"TBL Significant Scan Tool"** and **"TBL Capability Scan Tool".**

For the development of the Tool, we focused on the initiation stage of Roger's model (See Figure 4). At the Agenda Setting stage, the condition is **recognition of the need for system innovations with TBL significance**. Businesses, which do systematically study market opportunities and risks, can get hints of TBL opportunities. As an illustration, recognition of opportunities behind non-traditional ownership models such as renting of products rather than ultimate sales of products can trigger the innovation process[107]. In the ICT sector, recognition of the information access problem

[107] For example, in the area of Commercial Cleaning Equipment, Electrolux euroclean in Sweden has a product-service line shifting from supplying products to providing function.

of local communities especially in the developing world has been a motivation for the development of new product and service ideas. Senior management, operational or marketing department can take the lead for the development of new concepts or product ideas in this context.

Similarly, recognition of trends, which may pose business risks, can also trigger the innovation process. For example, recognition of GHG emission risks might urge corporations to pay particular attention for lessening their air emissions.

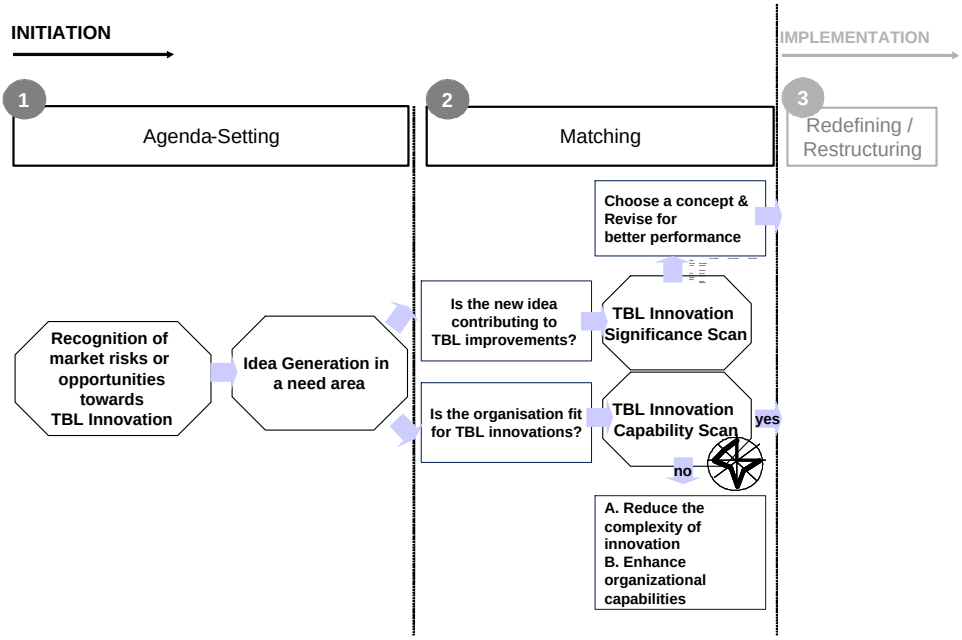

Figure 4 – An overview of the TBL Innovation Audit Tool.

At the matching stage, an organisation can judge innovation potential of these concepts and ideas using the **"TBL Significant Scan Tool"**. This would enable a comparison for social and economic value creation and as well environmental improvement potential. This tool also helps the organisation to place the idea in the context of the production and consumption system. In parallel, **"TBL Innovation Capability Scan Tool"** aims at assessing whether capabilities internal to an organisation and institutions external to an organisation are suitable to achieve system innovations for SCP.

The ownership of the product is retained by the company and the conventional sales strategy has been replaced by leasing and service contracts (Agri *et al*, 1999).

4.1 TBL Innovation Capability Scan Tool

4.1.1 Theoratical Background

For system innovation to happen corporate capabilities and a supporting institutional framework should be in place.

Elements of corporate capabilities can be found in the evolutionary economics literature (Nelson and Sidney 1982). *"Static capabilities"* and *"dynamic capabilities"* are two major elements for the attainment of an innovative organisation. Routines of an organisation are central elements in determining its *static capabilities*. Major function of routines is often understood as the co-ordination of the skills of an organisation (Dosi 1988:5). Routines in corporations would also refer to daily business operations. Thus, how an organisation makes use of its financial, social and natural capital in its day-to-day business is relevant for an understanding of its static capabilities. Development of static capabilities for TBL innovations would mean set up of systemic working procedures in an organisation and rearrangement of them, where necessary.

On the other hand, "communication channels, information filters and problem-solving strategies that develop between groups within an organisation and between organisations" (Henderson and Cockburn 2000) are relevant for *dynamic capabilities*. Hence, collaborations[108] through horizontal and vertical networks within the organisation and co-operation with other organisations are crucial for successful system innovations.

The conditions of the institutional framework would also influence the orientation of micro level capabilities. Institutional economics, which is oriented towards the set of factors that mould and define humane interactions, provide clues on these elements.

According to North (1990), institutions consist of both *"informal constraints"* and *"formal constraints"*. He explains them along a continuum from customs and traditions at one end to written regulations at the other (North 1990:46). *Formal constraints* imposed by the stakeholders on the corporation, which may include all political and judicial rules, economic rules and contracts, can directly affect the micro capacity development. On the other hand, *informal constraints* such as codes of conduct, norms of behaviour, creation of trust, shared visions and informal agreements affect the implementation routes or outcomes of the formal institutions[109].

[108] The importance of inter-organisational and intra-organisational links and learning networks in corporate environmental management has been mentioned many times in the literature (Gray, 1989; Clarke and Roome, 1995; Hartman et al., 2002). This has been also mentioned by the "stakeholder theory", which advocates the need for companies to be responsive to concerns of a broader range of "stakeholders" (Freeman 1984, Mitchell et al. 1997, Zadek et. al. 1997, Hopkins 1999). Similarly, theories of "organizational learning" (Agyris and Schön 1978, Senge 1990, Agyris 1993) stresses the importance of internal communication channels, external multistakeholder dialogue, partnerships with the NGOs and "social learning" as a crucial mechanism through which firms could acquire the knowledge, values and competencies needed for success.

[109] For example, it can be said that stakeholder dialogue based Dutch environmental policy making procedures enhanced informal institutions for eco-innovations. The Ministry of Housing, Spatial Planning and the Environment (VROM) aims at preservation of a collaborative environment based on stakeholder dialogue, which was initiated with the preparations of the first National Environmental Policy Plans in 1989. (VROM 1998)

The performance in terms of the organisational and institutional framework elements can directly affect the level of *enhancement of social and economic capital and to which extend, absolute amount of natural resources is preserved; hence, TBL innovation significance.*

In the context of the ICT sector, this means that the ability to put first, second and third order environmental impact improvements into practice shall be need in place, otherwise institutionalization [or according to Rogers (2003), routinization] of innovation can not take place.

4.1.2 Practical Context

For the success of system innovation for SCP, as many organisational and institutional level elements as possible should be in place. "TBL Innovation Capability Scan Tool" allows an organisation to conduct a SWOT analysis for TBL innovation by reviewing its strategies, corporate culture, management routines, stakeholder involvement capabilities, and so on. In this respect, this Tool is an assessment of readiness of an organisation to carry out TBL innovation or contribute to system change in cooperation with its stakeholders.

A systematic process of concept specification was used to construct an ultimate list of organisational and institutional level elements. The organisational level elements include: IM(1) vision, policy and strategy; IM(2) corporate governance; IM(3) management systems; IM(4) top management leadership; IM(5) corporate culture; IM(6) organisational learning; IM(7) internal stakeholder involvement, and IM(8) external multistakeholder involvement. Institutional level elements include: IM(9) Ability to contribute to the Sustainability Agenda; IM(10) Innovation inducing business environment or stakeholder support, and IM(11) Regulatory Framework.

Then, each element was detailed based on the information got from financial and benchmarking indices[110]. For example, corporate culture element questions company openness and dynamism, and as well existence of a belief in collective decision-making for a TBL vision and strategy.

We suggest that the **operationalisation of the Capability Scan Tool** can include three major steps involving an inter-departmental team. Initially, a multi-disciplinary team including staff from different business units and hierarchical levels i.e. senior management, middle management and production floor can be established. To identify the status quo of their capabilities, the team can provide answers according to the performance scale running from one to five under each listed sub-category (see Figure 5). The results of the evaluation can then be placed and illustrated on a spider-web scheme (See Figure 6).

[110] Five major socially responsible investment (SRI) analysis organisations *(FTSE4Good Index Series Criteria, Dow Jones Sustainability Indixes-SAM Questionnaire, Ethibel Sustainability Index, Ethical Screening Criteria, DOMINI400),* two rating indices *(Corporate Responsibility Index 2002 Business in the Community, Social and Environment Risk Management Model),* indicators for sustainability reporting *(the GRI Telecom Sector Supplement)* and indicator lists developed by research institutes working on innovation management *(Erasmus Research Institute of Management Report, SIID-Phase 2) were utilized to detail the elements*.

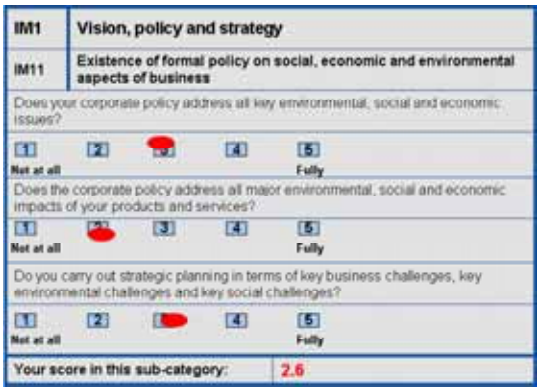

Figure 5 – Extract from the TBL Capability Scan Tool: detailing of "vision, policy and strategy" element.

Following, the team can get a picture of strengths and weaknesses at organisational level, and opportunities and threats at institutional level. An action plan can further be developed on how to overcome the weaknesses and how to face the threats.

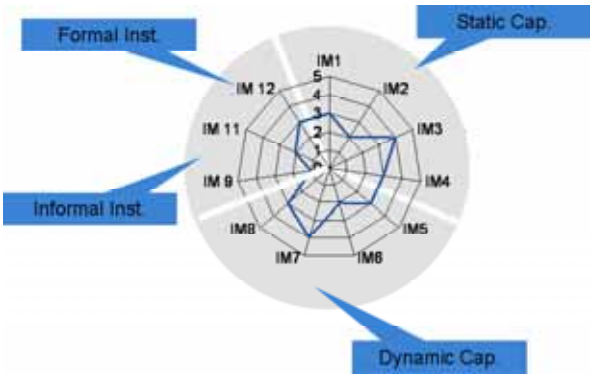

Figure 6 – Spider-web delivering the results of TBL Capability Scan.

4.2 TBL Significance Scan Tool

Besides organisational and institutional elements, organisations aiming at TBL innovations require mediums to compare TBL innovation potential of various product and service ideas. TBL Significance Scan Tool serves this purpose.

How can a medium to judge system innovation for SCP be prepared? At the first place, the design of the product and service should include stakeholder concerns. TBL innovation can occur only when environmental, social and economic performance is significantly improved.

For the construction of the tool to assess ICT products and service ideas, stakeholder concerns are collected from the state-of-art documents (GRI 2002, Kuhndt, et al. 2003c, Charter and Clarke 2003, Fichter 2003, GRI 2003) discussing the environmental, social and economic implications of ICT products and services. All resources aim at categorizing the TBL or

sometimes solely environmental impacts of the ICT sector products and services in terms of first order, second order and third order effects. Even though the definitions used by these publications differed, consensus definitions are written for each level of impact. Then, a list of major environmental, social and economic concerns for each impact level is constructed (See Table 1).

Table 1: Major criteria listed in the "TBL Significance Scanning Tool" (Adapted from EITO 2002; GRI 2002; Charter and Clarke 2003; Fichter 2003; GRI 2003; Kuhndt, et al. 2003c;).

	First Order Level	**Second Order Level**	**Third Order Level**
Env.l Impacts	-Impacts from energy use such as GHG emissions and land use -Other resource use impacts such as material and water consumption - Wastewater discharge, air emissions, solid waste discharge -Biodiversity impacts -Toxic release impacts (with respect to the aspect of design utilizing toxic components) - GHG emissions (All impacts applies to manufacturing, operation and disposal phases)	- Environmental impacts of increased or decreased transport -Environmental impacts of the product-service mix on other sector businesses -Environmental impacts from increased product life-times	-Possible energy use impacts such as carbon emissions stemming from aggregated ICT product-service mix use at the macro economic level -Possible environmental impacts on regions due to changing settlement patterns -Land-use impacts from aggregated ICT product-service mix use at the macro economic level -Environmental impacts of the rebound effects created by a change in consumer behaviour
Social Impacts	-Change in employment structure (quantity and quality) -Occupational and Customer Health and Safety Impacts -Intellectual property rights impacts -Customer privacy impacts (*can be also second order effect*)	- Social impacts from access to better services (such as access to health services, E-learning, government services, E-commerce, government information and telework) -Social impacts from barriers of access -Social impacts/risks from security challenges -Availability in emergency situations and disaster relief	-Cultural homogeneity -Cultural diversity -Enforcement of local communities -Enhancement of civic culture -Impacts from having new communities online

	First Order Level	Second Order Level	Third Order Level
Eco. Impacts	-Net Sales -Financial impacts to employees: Payroll and personnel benefits -Financial impacts to company: Liquidity impacts (such as debt, borrowings, dividends position), subsidies received, tax exemptions or decrease in tax received) -Financial impacts to society: Impacts on community, civil society and other groups in terms of donations, impacts on other geographic locations and low-income groups	-Economic impacts from application of the ICT product-service mix within other sector businesses -Enhancement on innovation and competitiveness -Establishment of new financial markets enabling growth and wider participation -Business market relationship - Growth of the ICT market	-Economic impacts from long-term and fundamental changes to the global economy: economic impact on patterns of wealth, provision of new solutions to nesure economic benefits to be shared

The Innovation Significance Scan tool consists of a questionnaire based on the three pillar concerns and a score comparison table. Following the derivation of ICT product-service mix concept ideas, the corporation can use this tool to compare them and choose the one with the highest TBL improvement potential.

An inter-departmental team can carry out the process of evaluating various concept ideas by seeking answers to the questionnaire. Assessment of first, second and third order triple bottom line impacts surely requires multi-disciplinary expertise. Scores can be calculated for each impact level of the triple bottom line and visualized on a graph (See Figure 7).

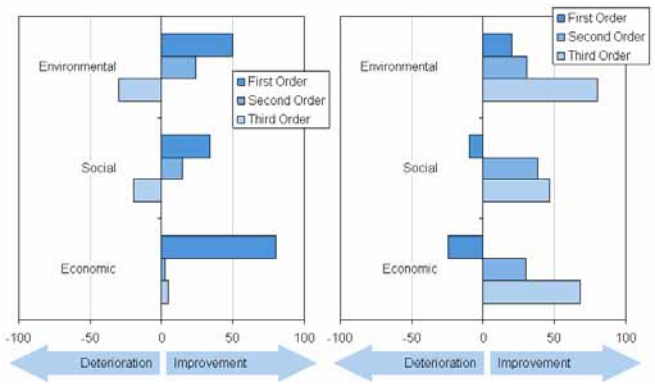

Figure 7: Comparison of various product and service ideas using the Triple Bottom Line Significance Scanning Tool.

Particularly, getting a grasp of tertiary effects is a difficult task for the company and assessment process would require expert input. It might be argued that structural changes in the economy might fall beyond responsibilities of a corporation. In our opinion, as product chains become more global ever than before and as interdependencies increase, corporate responsibilities have to expand. Corporations should also assess probable

aggregated impacts of their products and services on the production and consumption patterns, since single product unit assessments do not make a meaningful contribution to sustainability process.

5 Overall conclusion & implications for policy makers

The challenge of making a change in the patterns of production and consumption is a problem of achieving system innovations. This would once more imply that a blend of product innovations, organisational innovations and technological innovations is required. In this study, we have focused on the abilities of organisations to mobilize their resources to achieve a change in the production and consumption system. While staying economically competitive, business have to holistically address the challenge of decoupling material flows from growth and increasing social disparities.

At the environmental level, corporations shall strive decreasing their absolute resource consumption i.e. not only internal or first order operations or not only that of a single product chain, but that of all services provided to the society. On the social side, corporations have to reflect more on local quality-of-life priorities, regional differences such as equity of access to basic needs, cultural distinctions, when they are developing new product-service ideas / concepts. Consequently, business is in need of approaches, which can allow incorporation of TBL factors into their organisational structure and processes to address these concerns.

Concentrating on the initiation stage of the innovation process, we suggested a two-step procedure, which can function in collaboration with external stakeholders. “Capability Scan Tool” aims at assessing whether organisational capabilities and institutions surrounding the organisation are suitable to achieve innovations contributing to sustainable consumption edge. In parallel, an organisation can locate innovation potential of these concepts and ideas using the “TBL Significant Scanning Tool”, which integrates stakeholder concerns. This would enable a comparison for social and economic value creation and environmental improvement potential. This tool also helps the organisation to place the idea in the context of the production and consumption system.

The “TBL Capability Scan Tool” and the “TBL Significance Scan Tool” can be valuable sources for other sectors. The Capability Scan can be tailored to sector specific capability requirements. Even in this case, the list is neutral and has been not adapted to the ICT sector specific capabilities. A further research on these capabilities might also provide setting up the initial links between the impact side and the capability requirement as discussed in the previous point.

On the other hand, in the Significance Scan, the impact points surely have to be adapted according to stakeholder priorities and concerns in another need area. The first, second and third order effect separation can also be valid for other need areas. For example, for provision of mobility, assessment of the new product chain is possible at the first order level, while at the second order implications of this new form of mobility on other sectors can be assessed. At the third level, the change in daily habits, pros and cons of creation of new life-styles can be assessed.

Assessment of relative importance of impact areas is a challenging matter, which requires further research. In our study, the Significance Scan

tool does not consider the relative importance of different product-chain phases or listed impacts i.e. each question is weighed equally. For example, in terms of environmental first order evaluation, gain in the energy use at operation/use phase can be more valuable compared to the disposal or recycling phase. This weakness of the tool should be well comprehended by the team, which is interpreting the results.

Last but not least, government can have a key role in creating the framework to stimulate and to encourage change in organisational capabilities and at the institutional level. In this study, we have shown that attainment of skills, knowledge and communication with societal actors is essential for corporations, which have a direct role in the design and management of production and consumption systems. However, it is seldom that governments handle the issue of improving organisational capabilities linked to product-service system development.

Policy makers aiming at facilitating change at the organisational scale, which would in turn lead to a transition at the macro level, can use the two tools discussed in this study. Policy makers can concentrate on understanding the organisational elements located in the "Black Box" (see Figure 1). Encouragement of capabilities for system innovations would eventually lead to resource use and impact side improvements.

Possible applications can be listed as follows:

- Establishment of a benchmarking medium based on a more advanced version of the TBL Innovation Capability Scan tool: similar to the BITC platform in the UK, organisations can compare their performance in terms of system innovation capabilities. These scores can further be aggregated to identify sector level TBL innovation potential.
- Facilitation for the development of TBL Significance Scan tools for different industries: Working groups in each need area can be established to facilitate discussions. Instead of individual organisations forecasting risks and opportunities regarding their products and services in a need area, a collective process can be facilitated.
- Preparation of a guidebook introducing business TBL innovation: Ministry of Environment in collaboration with another ministry (e.g. Ministry of Trade) can prepare this guidebook. This publication can be similar to the guidebooks prepared by ministries such as the material flow environmental accounting guidebook prepared by the Japanese Ministry of Environment. Another encouragement mediums might be system innovation competition workshops or award campaigns.

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Chapter 38 Sustainable consumption innovations – instrumentalization and integration of emergent patterns of everyday life

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1 Abstract

This paper suggests two views on sustainable consumption innovations. First, under the heading of eco-efficient innovations, it discusses the prominent ideas of product-service-systems and service orientation. It is argued that the innovation logic in this realm relays on a rational and goal-directed view on human action. An alternative integrative innovation logic is demonstrated with a case study of contemporary wooden boating. It is argued that a collective process of integration has resulted in new emergent ways of thinking and acting around wooden boats. It is also argued that boats, in some occasions, enable the individuals to resist market imperatives and pursue more authentic action. Finally, the paper discusses the knowledge bases and relationship of these two logics of innovations, and the possibilities to make research on and promote integrative innovation.

2 Introduction

Sustainable consumption is a title for an ensemble of different research interests and policy objectives. Major momentum of the debate originates from UNCED Rio conference in 1992, which pointed out the need of changing the patterns of production and consumption toward less detrimental patterns in the wealthy Northern countries. Since then, sustainable production and consumption has been a more or less hidden agenda and label for growth critical points of view in the environmental debate.

However, sustainable production and consumption has also harboured close to the progressive theories and policies of ecological modernization, which envision self-regulation of industry and technological progress

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towards greater resource productivity (Mol 1995). In such a position the debate around the sustainability of contemporary patterns of production and consumption has focused on innovations (Cohen and Murphy 2001). How to make more out of less? How to decouple economic growth and resource use, and ultimately how to solve the problem that social stability and individual well-being in contemporary societies take place with an unsustainable strain on the environment?

Both of these views continue to legitimate the debate over sustainable consumption. Improvements in the efficiency of provisioning stand for an apparently easy and more feasible solution in the debate, and account for much of the political success of ecological modernization. However, the critical voices around sustainable consumption are gaining legitimacy as well. Frequent calls for news models of wealth and better quality of life (Reisch 2001) as opposed to increased growth in material well-being increasingly resonate with various grass root level activism. Accordingly, innovation studies and policies also face this dual imperative and the bifurcated views on the role of technological advancement.

The focus of this paper is on such innovations that take place in consumption and imply changes in the everyday life of consumers. Frequently, the field of sustainable consumption is ambivalent in terms of whether the locus of interest in on consumption or production. Some argue that these are inseparable, since the flows of resources and money interconnect production and consumption. However, in this paper I pursue a difference between consumption innovations and production innovations and ask what sustainable consumption is if it is not efficient household production.

The main thrust of this paper is the difficulty of simultaneously addressing both the efficiency of production-consumption chains and the growth-critical questions of sufficiency and contentment in everyday life. I take for granted that the co-existence of these two tracks is constitutive for the research agenda of sustainable consumption. In respect to innovation studies, I will explore the difficulty by asking two questions. Firstly, are there any particular features that apply to innovations in sustainable consumption, and secondly how do the different points of view interact. Are they mutually exclusive? How do the growth critical ingredients affect sustainable consumption as a particular subject field of innovation studies? How are innovations pursued in the field and how should they be pursued?

I will start by shortly considering eco-efficient innovations and the representations of everyday life that prevail in this discussion. The result is a distillation of a rationalizing approach toward everyday life. Thereafter, I focus on empirical material which documents a social process of integration under which wooden boating has become available as a specific category of action in everyday life. The description of this process is more elaborate to allow for the through treatment of how needs and desires arise in the processes of social integration and how also the position of objects changes relatively swiftly. I conclude the paper by returning to innovation studies and contrast the two approaches; that of eco-efficiency and that of the integration of social practices.

3 Eco-efficient consumption innovations

The notion of eco-efficiency has captured wide interest across the participants of the environmental debate. Originally, eco-efficiency is a business-oriented concept - a business response to sustainable development in the words of DeSimone and Popoff (1997). As such it has promoted the possibility that profitable efficiency gains exist within and between businesses along the value chains. The idea of market failures constitutes the central theoretical basis for eco-efficiency discussion (Reinhardt 1999). Accordingly, innovation and an 'engineering-take' contain the promise of win-win situations (Weizsäcker et al. 1997). Technological progress and organizational alignment for increased resource productivity and improved eco-efficiency are seen as possibilities for green growth and for profits in sustainable development (Hawken et al. 1999).

While eco-efficiency and the wider title of ecological modernization have originally been production oriented concepts, innovations in eco-efficiency are perceived to be equally feasible in private consumption. Schmidt-Bleek (1994, cited in Heiskanen and Pantzar 1997) has even claimed that the possibilities of innovation are greatest in final phases of value chains. In the literature on eco-efficiency, this imperative for consumption innovations is often reformulated as a claim that consumers do not want the products, but the end-results and functions these service-producing-machines yield (e.g. von Weizsäcker et al. 1997).

A shift of focus from products to services is indeed central for the eco-efficiency debate. Heiskanen and Jalas (2003) elaborate on the service debate; they make a distinction between traditional service sectors, the growth of which may contribute to a less material intensive economy as a whole, and, on the other hand, services which seek to replace existing products, extend the life time of the products, or organize their shared use. It is this latter kind of services and the business model of service-orientation that have been thought of as novel means to improve eco-efficiency and that also imply new ways of conceptualising consumption.

The focus on the end-services implies a particular, highly functional view on consumption. On one extreme, Hirschl and colleagues state that "*The core idea is very simple: Products fulfil certain functions, e.g. by taking us from A to B, by washing our laundry, or by drilling a hole in the wall.*" (2003, p. 873). What can be inferred based on this stream of thinking is that in order to achieve radical changes in the environmentally detrimental patterns of production and consumption, we *must* fundamentally question the ways we strive for and derive utility while consuming, focus on the end-services of consumption and pursue radical innovations in (the technologies of) consumption. Framed in this way, the notion of products as service-producing-machines promises to unleash great innovation potential and has proven persuasive and rhetorically successful.

Empirical research on service-orientation and functional sales on the consumer markets has proliferated. Car-sharing is probably the most widely documented case of eco-efficient services (e.g. Mejkamp 1998; Prettenthaler & Steininger 1999; Schrader 1999). However, also leisure and sports equipment (Hirschl et al. 2003), white goods (Goodkoep 1999; Weaver et al. 2000; Schrader 1999) and durable household goods such as tools and garden equipment (Littig 1998; Mont 2004) have been investigated with the concepts of the service-orientation debate.

Service-orientation is a concept that is also increasingly present in the policy documents. A report published by the United Nations Environmental Programme focuses on Product-Service–Systems and exhibits many core ideas of service-orientation. Accordingly:

> *Promoting an understanding and greater use of life-cycle thinking provides significant opportunity for change… Within this context, the concept of Product-Service-Systems (PSS) – promotes a focus shift from selling just products to selling the utility, through a mix of products and services while fulfilling the same client demands with less environmental impact. (UNEP 2002, p. 3)*[111]

The thoughts on product-service-systems also bear a close resemblance the words of the household economists in the 1960's who theorised consumption as household production (Becker 1965; Lancaster 1966). When summing up his approach, Lancaster states as his first point that, '*The good, per se, does not give utility to the consumer; it possesses characteristics, and these characteristics give rise to utility*', and secondly that '*In general, a good will possess more than one characteristic, and many characteristics will be shared by more than one good.*' (1966, p. 134). Based on these principles, Lancaster argues that utility is detached from market-produced goods and calls for a focus on the efficiency of consumption. It is crucial to note that these ideas, and often also their heirs in the eco-efficiency debate, represent consumption as instrumental and goal-directed action. By no coincidence, also Dryzek (1997) has proposed that tidy, *far-sighted, well managed* households might serve as a metaphor of ecological modernization. However, when applied to household consumption, the core concepts of ecological modernization – words such as innovation, efficiency and technology – have far-reaching consequences. They impede the possibilities of contentment and portray a controllable view on the development of technology. Furthermore while service-orientation puts forward an integration of value chains in terms of functional sales, it simultaneously fragments and disintegrates everyday life into separate functional outcomes to be optimized. The logic of eco-efficient service innovations has thus been disintegrative.

Innovation studies within the field of sustainable consumption are faced with contradictory interests and views on proper human life. The discipline appears, however, capable of stretching towards both sets of these divergent interests. Ideas of path-dependency and the inertia of technological systems represent choices constrained. Accordingly, studies within sustainable consumption have focused on *promoting* more sustainable technologies; on the availability and fit of green technologies (Spaargaren 1997) and on the institutional environment in which eco-efficient technologies and business models become feasible (Mont 2004, Halme et al. 2005). However, the discipline of innovation studies is equally equipped to account for the integration of new ensembles of technologies, needs and ideas that break away more radically from the past. Faced with such questions, the discipline discusses choices not as merely constrained but as constructed. Innovation research in this field may also benefit from and gain legitimacy by distancing itself from the technological imperative. This implies the use of

[111] Indicative of the particular economising view of consumption, the words customer, consumer and client are used as synonyms in this report as in many others of this genre.

the conceptual resources of the discipline to produce more critical accounts on the social construction and co-determination of needs and solutions.

In the following I take on the case of contemporary wooden boating in Finland and demonstrate how the practices of wooden boating have co-evolved with new technologies and news ways of thinking. The outcome is not a result of overcoming constrains of adoption or powerfully redirecting a trajectory. Rather, it is a subtle process of integration which has resulted in unintended consequences that, I argue, cannot be understood as results of rational choices and purposeful pursuits, but rather as a truly emergent phenomenon. The description brings forward a practice, which praises piety in material relations, a non-instrumental concept of time and alternative ways of being. However, this rosy façade of wooden boating raises many questions; I ask whether this is a valid interpretation of the phenomenon, and most importantly what are the processes of integration that are involved.

The description is based on my personal career as a boat-owner, on more deliberate participant observation during the years 2003-2004 and on interviews with hobbyists and professionals within the practice. Important written data consists of the wood-related articles in the boating magazine Vene in the period from 1967 to 2000 and in the major daily newspaper Helsingin Sanomat from 1990 to 2004.

4 The emergence of wooden boating in Finland

The scope and the nature of the phenomenon of wooden boating vary. To begin with, 45% of the population of Finland have a small boat or a canoe at their disposal, and 6% have disposal of a cruising boat (Sievänen et al. 2003). The actual number of boats made out of wood is not available and would make a rather questionable proxy for wooden boating. Enthusiasts are much fewer: the distribution of the dedicated Finnish magazine Puuvene is about 1300 pieces, the dedicated Internet discussion pages have 450 registered users, the same Internet discussion pages list 30 dedicated associations, the largest single association for wooden boat owners has 370 members and the largest race for wooden sailboats in the Helsinki area gathers about 200 boats annually. On the other hand, the consumption of the symbols of the practice is much more common; the visitors at the wooden boat summer festivals are counted in tens of thousands, media coverage of the phenomenon is versatile and extensive, and the wooden boat department at the annual Helsinki Boat Show has been repeatedly voted as the best section of the fair.

A first glance at the enthusiasts reveals dedicated individuals who seek alternative ways of being. However, a deeper look through –or a deliberate tack around – the individuals also reveals a social pattern of action and a shared practice of boating or boat-owning, which regulates the ways of thinking, speaking and acting around boats. In such a collectively shared practice, the objects assume a central role. Wooden boats are not merely tools for getting around or summer residences for the short season. Rather, they are objects towards which action is oriented and onto which individuals project their desires and future prospects, but which at the same time place demands on the individuals. Boats are not only used, they are also appreciated and worked on. Furthermore, the activity encompasses acquiring

the proper skills for such work and proper knowledge to discuss the practice. Thus, with the term boating I refer not only to the use of the boat at waters, but to all the activities that take place around boats year-around.

5 Leisure boating

5.1 Introduction

The emerging contemporary practices of wooden boating can be related to numerous other developments. Obviously, the new practices revolve around the history of leisure boating, concerning which I discuss two points in below. The first is the development of the very idea of leisure boating and the second important development concerns the substitution of fibre-glass for wood as the dominant construction material for leisure boats. However, and as will be shown later, wooden boating co-evolves with and draws on other, more distant developments such as the wide acceptance of the need to preserve the material objects of (maritime) history, the economic recession in the early 1990's, and finally, the use of the Internet as a medium for organising social activity.

5.2 Tools and toys on water

Waterways and vessels are intimately connected to our ideas of culture, and boats as artefacts seem timeless. Different types of vessels have developed to serve various purposes and to perform in various conditions. In short, boats have been highly practical tools. It is thus an interesting question of when and how they become the subject of romantic feelings; when did the boat become a way of escape and adventure and when was it aestheticized; when did it become possible and acceptable to ponder whether a boat was beautiful or not? And finally, when did the most tool-like traditional vernacular boats become toys *par excellance*.

Sailing for fun was invented in late 17th century Holland and England and the first yacht club, the Water Club of the Harbour of Cork, was founded in 1720 (Janhem, 1975). In Finland, similar developments can be distinguished. The first yacht club was established in 1856 in the town of Pori (Rovamo and Lintunen, 1995). The first Finnish leisure boating magazine *Frisk Bris* was established in 1903. The boat designs gradually evolved from the vernacular designs and materials into more specified designs for various types of leisure. The farewells to the old vernacular designs were warm but definitive. As an editorial in the magazine *Frisk Bris* stated in the newly founded magazine: the sport of sailing must grow out of the old vernacular vessels with which we started to sail in our childhood.

Yacht clubs and later also national organizations were founded to organize racing activities, and boat designs evolved according to the racing rules. The first sailing races set no rules for the boat construction, but there soon emerged construction rules that delineated a formula for measuring the performance of each unique boat. Just as sailboats developed through racing, also the motorboats first appear on the racecourse during the early 1900’s. Altogether, the beginning of leisure boating was to a significant degree

driven by and organised around the notions of sailing, sports and entertainment.

5.3 Material transitions

The use of fibre-glass-reinforced polyester as a boat-building material has constituted a major change in the boat-building industry and to a great deal also the foundation for the current practices around wooden boats. The substitution of wood and wood composites with other materials in the hulls and the interiors appears as a gradual evolutionary process, in which some manufacturers resisted the new materials while others went along, and in which new fibre-glass designs replicated the wooden era for a long period of time. The intensive phase of the transition took place during a 10-year period starting from the mid 1960's.

The imports of small fibre-glass motorboats from the US started during the 1950's, and the new material became widely used in the domestic manufacturing of small boats during the 1960's. On the other hand, the *Vene*-magazine quotes a well-known builder in 1970 arguing that wood will remain competitive in building large boats of over seven meters in length . In the early seventies, the annual sales catalogue of *Vene*-magazine still included a number of relative large boats made out of solid wood or marine plywood. However, if judged by the catalogue, by the mid 1970's no commercially available new wooden construction existed aside of a few rowing boat models.

6 The second round for wood: evolving ways of thinking, speaking and acting around wooden boats

6.1 Introduction

By the end of the 1970's the gradual substitution of fibre-glass had virtually abolished wood as a material in building hulls or deck-structures for commercially available boats. On the basis of the annual sales catalogue of the Vene-magazine, one could argue that the situation has not really changed; wooden boats remain outside the commercial catalogues. I suggest, however, that it is not fruitful to look at the phenomenon as a reversal of the 1960's and 1970's. Wooden boats are not (merely) becoming more competitive against fibre-glass boats, albeit this is the aim of the commercially interested constituents of 'the new culture of wooden boating' (Skogström, 1994). Rather, I claim that new practices have evolved around the old boats, old designs and in more general around wood as a particular material. Wooden boats have become highly meaningful objects rather than being merely the cheapest way to start a boating or sailing hobby. Hence, there is a diversified practice of wooden boating, in which one can distinguish different and even opposing genres: those who build and use replicas from the Viking era, those who sail vernacular copies from the late 19th century, those who are committed to the restoration of existing old boats from the 20th century and those who commission and build new wooden boats.

6.2 Replication of local history

The new terminology, which has been adopted along with the particularisation of the objects, helps to conceive of the changes in the practices of wooden boating. Eric Laurier (1998) distinguishes *replication* and *restoration* as relevant, culturally-oriented approaches to maritime history. According to him, replication refers to re-building of old designs and the remaking of past history, whereas restoration refers to the practice of conservation or rebuilding of existing objects of maritime history.

The rebuilding of wooden boats according to old drawings or models took on during the 1970's first in the Åland Islands, in the archipelago between south-western Finland and Sweden. This region was and still is an active site for building replicas both in the scale of commercial trade vessels used within the Baltic Sea and the small-scale vernacular vessels for fishing and local trade. An Åland-based association for vernacular boats began its activities in 1968. By 1975, when the association was officially registered, the members had built three new boats according to old vernacular designs (Ålands Skötbåtsförening 2004). The *Vene* magazine published its first description of replica–building activities in 1978(9).

The association in Åland also initiated the building of the galleon Albanus, the first larger Finnish replica of the wooden sailing ships, which was completed in 1989. Since then, the replication has spread and major constructions have taken place along the Finnish coastline (Hytönen, 2004). Many of the building projects are based on voluntary work and the activity appears to be a way to connect to local history, to get a sense of a place as Hytönen argues, and to maintain traditional skills. Indeed, for example a commentator and practitioner in the Finnish archipelago states, that *'The interest in old vernacular boats and the replicas is social, it is a way to be a local resident. We are happy that the younger generation has also recently become interested in the old boats.'* (male).

6.3 The mission to preserve maritime history

Restoration practices do not replicate history, but rather claim that it cannot and should not be replicated. It is the original and unique objects that have the immeasurable value and it is the patina of them, which make them particular historical objects. Thus, restoration practices are concerned with maintaining or constructing a strain of originality in the objects and seek to carry on or reconstruct the history of the unique objects (Laurier, 1998).

Some of the vessels are claimed to be of historical value, especially the old racing yachts, and consequently they are subject to fine-graded and rather stringent restoration principles. For example, a historian and museum chief writes about the Int5m-class in a manner that emphasises traditional materials and methods '*Converting a canvas-deck to a teak-deck is perhaps a matter of maintenance. But is it a good enough reason to alter the weight balance and radically change the overall appearance of the yacht. The pious yacht-owner of course chooses to stay with the original solution.'* (Nordlund, 2004a, translation from Swedish by the author). Another description of

different types of reasoning is given at the website of a 6mr-yacht named Maybe IV[112]:

In the beginning of the nineties May Be IV was thoroughly renovated with ten lowest planks changed and most of the frames repaired. Everything in the hull was built as close to the original as possible with oregon planking on oak and ash frames attached with silicone bronze screws, the steel frames and floors being repaired and hot dipped as originally etc. Above the deck everything is modern to make tough racing possible, a Proctor rig with Navtec rods, Harken hardware, WB sails of dyneema and dacron, spectra for running rigging.

Restoration and renovation practices cohere under the mission of preserving maritime heritage. The export of wooden yawls from the early 20th century had received interest already in 1974 in the *Vene* magazine. In 1994, the National Board of Antiquities established a register for the existing large historical vessels and a fund for their restoration. At the same time, the historical dry-dock at the UNESCO site of the Sea Fortress in Helsinki was dedicated to the restoration and winter storage of these vessels. The Maritime Museum of Finland, which operates under the National Board of Antiquities, has also acquired examples of widespread leisure boats classes as well as some unique boats. These national efforts parallel an international focus on maritime history. The first European Maritime Heritage Conference was held in 1992 and the fourth congress issued the so-called Barcelona Charter in 2002 (Hytönen, 2004), which *'set out a Code of Good Practice for owners and operators of traditional vessels along the lines of the Athens Charter drafted by architects and museum technicians in 1931 (as amended in Venice in 1964) to give guidance on the restoration of historic monuments'*.[113]

However, restoration and preservation concerns are not confined to the museum institution, but this orientation has also been increasingly adopted outside it. In 1981, the significant owner of a major daily newspaper presented a restoration project of an old motorboat, which had been used by presidents of Finland from 1929 to the 1970's. Later, in 1986, Vene-magazine published the first report of a thorough renovation of an old SK-yacht – a type of a project that had ten years before been doomed senseless in the same magazine. This project was not legitimised by a glorious history or celebrities of the past, but rather celebrated the current practitioners. Altogether, it seems that the preservation and the restoration of existing maritime history, regardless of the uniqueness and size of the vessels, was appreciated and made sense to a wide array of constituents by the end of the 1980's.

Regardless of the preservation approach chosen, there is a striking difference between the contemporary practice and the era from which many of these material fetishes originate. Vernacular boats were tools to be used and then left ashore to decay; racing yachts were to be short-lived attempts to twist the construction rules and beat the boats of the previous season. Thus, the lifetime of boats were supposed to be short. Contemporary practices, however, celebrate the anniversaries of old boats and claim that

[112] http://www.6mr.fi/DAS/yachts/981119-213345.html
[113] http://www.heritageafloat.org.uk/barcelona.htm

one of the best features of wood as a construction material is the possibility to practically rebuild the boat bit by bit. The notion of the lifespan of a wooden boat, which was still used in Vene magazine in 1984 (2/84), lost meaning.

6.4 Aesthetic superiority

Wooden boats were not valued merely as unique historical objects. After the introduction of fibre-glass as a dominant boat-building material in the late 1960's, it did not take long for the boating discourse to allude that the *aesthetic qualities* of wooden boats are superior to fibre-glass.

The claim of superior aesthetic qualities was first attached to the race yachts. However, towards the 1990's, wood as a material received increasing interest and positive evaluations. The contemporary practices also celebrate tactile properties of wood. Not only the looks, but the feeling of wooden boating is superior to the fibre-glass era. As Skogström (1994, 47, translation from Finnish by the author) spells out, *'the smell of wood, the looks and the warmness and the sounds of water touching it, emphasise the joy of building and owning wooden boats'*.

6.5 A spiritual orientation

Putting aside the most technical parts of the arguments for competitiveness of wooden boats, most of the orientations towards wooden boating seem to suggest new ways of being in the world and valuing it. Whether it is a connection to local history via the replicas, the missionary restoration projects of grand yachts, the aesthetic appreciation of wooden boats, the tactile contact with the material and a state of flow while doing wooden boating, or the environmental friendliness of wooden material, they all imply a new way of being and appreciating.

The experienced builders are celebrated as specially gifted master craftsmen who create, carve and force boats out of difficult, living material. They are, typically, men who (are thought to) have a special, deep understanding of wood material, trees and nature as a whole. It is not only that they posses such skills. The language of emotions suggests that designers, builders and dedicated owners convey their life forces to the boats: boats are frequently claimed to have been build and maintained with *love*.

It comes then as no surprise that boats are suggested to be alive. Ownerships are described as relationships or companionships; boats are thought to deserve good maintenance and at point of sales, dedicated new owners. Boats are described as carrying the features of their designers (Whynott, 1999) and owners (Nordlund, 2004b). And to take the issue further, boats are thought to be able to sense their environment, to sense in beforehand a big wave from a small wave and to speak to each others during the long dark winters in the boatsheds (Whynott, 1999). Thus, on her website, Silene, a 6mr-yacht explains herself:[114]

> Independent of any race success my old hull has always been taken a good care. A few years ago I had all my keel bolts checked and re-zinced, my wooden keel

[114] http://www.6mr.fi/DAS/yachts/981119-125927.html

> was inspected, found healthy and impregnated, and I got a new rudder, lighter than before. Four boards on each side of my under-water planking were replaced and a number of spars were also repaired. Every year my bilge has been impregnated with a sweetest natural linseed oil and all varnished parts have been looked after, not forgetting my dear rig and sails. Sometimes I truly feel that I am getting younger year after year. I hope, however, that I can keep my classic beauty.

6.6 The invited epoxy revolution

During the recession of the early 1990 it had become commonplace to wonder about the incapability of Finns to develop high-value products out of the domestic supply of wood material. Consequently, wood as a material was living a strong renaissance during the early 1990 in Finland. A technology program 'Nordic Wood 'was launched in 1993 and followed by more programs, Nordic wood II and Wood Wisdom, in the course of the 1990's. Wood-construction was added to academic architecture curricula in mid 1990's. The producers of wooden raw material and semi-finished products organised design competitions and disseminated information through specific organizations. Finally, to attract public interest in wood, the year 1996 was declared the Year of Wood.

Wooden boats received also specific, albeit more modest interest. A committee was set in 1992 to evaluate the state of boat-building and to consider educational measures to promote this new, potential field of high value-added mechanical wood processing. The committee sought ways to connect with the new era of wooden boat-building, which had started in the US in the 1970's. In short, it sought to establish a new culture of wooden boating in Finland.

The committee suggested that the dispersed training initiatives, which were in place in the beginning of 1990's, need to be co-ordinated and that the education must gain depth to accomplish the aim – the modernisation of wooden boat. Traditional local knowledge and the inter-generational mechanisms of transferring such knowledge do not suffice to catch up with the international development and to establish a competitive boat-building industry in Finland, it was suggested (Skogström, 1994 p. 46). As the most concrete measure, the report suggested that one of the available textbooks on wooden boat-building be translated into Finnish.

Many of the suggested measures were realised, even with haste. A polytechnic started to offer a two-year program on wooden boat-building in the fall of 1993. Few years later, the program was extended to a four-year program, which includes teaching the traditional skills of the craft but also entrepreneurial skills and languages. The polytechnic has also employed an American teacher starting from 1994. At the same time, the first Finnish students to study abroad went to boatbuilding schools in Maine. In 1995, a Norwegian handbook of practical boat-building was translated into Finnish to serve as a course book. Thus, this new educational curricula, which was established around wooden boat-building in early 1990's, has been active in importing new construction methods and designs from abroad, especially from the US.

The new culture to be created depended on few central tenets. According to Skogström (1994), the most important thing was to build new boats that demonstrate the breakthroughs in the available technology. The previous

public opinion was regarded as outdated and wrong in many respects, but most of all it was the assumption that wooden boats are troublesome to maintain and not water-tight which was called into question. It soon became common wisdom that it is possible to make competitive, easy-to-maintain and yet unique boats out of wood with the aid on the modern gluing technology, mainly with various epoxy-resins.

A second and related tenet was that wooden boats should be understood as handicraft. Put into such a frame, it was possible for Skogström to claim that wood is a competitive material and that indeed it is cheaper to make unique boats of wood than of fibre-glass. Thirdly, boats belong in the same category as furniture and log-houses, which, together with other wood products, undergo constant development and communicate the technological competence of the essentially wood-based economy of Finland. At the time when Finland was about to join the European union, the committee report further argued that such wooden objects constitute a unique contribution of Finland to Europe.

Many of the tenets of the new practice were in strong contrast with the prior practices. For example, the replication practice embraced tool-like, rough and traditional models if not leaking per se, and the restoration practices were conservative and suspicious about new materials. Thus, while the pursuits to create a culture of wooden boating relied on the established particular status of wooden boats, they paradoxically undermined it by promoting the use of new technologies and the vision of a competitive wooden boat industry. This far these attempts have been rather fruitless; the professional boat-builders mainly conduct renovations and build traditional boats with rather traditional methods and materials.

7 Sites for sharing ideas and practicing wooden boating; the infrastructure of practicing

Practices are collective and shared structures, which orient individual action. Hence apart from describing shared orientations that have become available, there is another and related important issue, which should be addressed. That is the ways of developing understandings, sharing knowledge, adopting and teaching novices, acknowledging expertise and negotiating the criteria for the efficient and the proper within the practice.

The boatyards, where the boats are stored side-by-side for the wintertime, are sites of dense interaction. In these yards, tools, methods and materials are discussed, tested and disputed. However, interaction and sharing is perhaps at its densest at the point of changes in ownership. Dedicated owners explain in detail how the boat has been taken care of and also make lists of what needs to be done. In short, together with the boat they hand over a project and an orientation. The changes in ownership occur relatively often and thus the sharing of knowledge both in the interaction and through the object itself is highly relevant.

The use of the boats also implies social contacts either in races or in other gatherings. The vernacular boats have many local races, which fill the few summer weekends, each having local constituencies (Hytönen, 2004). The first national association for wooden sailboats was established in 1984 and an annual race for wooden sailboats has been organised since 1985. In 1996, a new active association for all kinds of wooden vessels started its activity and currently has 370 members. As many of these boats are motorboats, they

do not race, but socialise as squadrons. Since 2001, the association for small crafts has organised an international competition for rowable sailing boats.

The same associations organise events also in the winter-time to deliberately distribute and share knowledge and ideas of boats and sea-fare. Sometimes the advocating takes rather strident forms; for example, the chairman of the largest wooden boat association writes that *the mission of the association is to fight wrong beliefs and procedures*. (Nordlund K., 2004).

The Internet has changed the way the practice is available to outsiders and the way the practitioners interact among themselves. Within the practicing itself, at least two changes seem to have taken place. Firstly, the private Internet pages document and represent the hobby in such minute and subjective detail that one can claim that the practice is indeed also performed and reproduced on the web-pages. The competence of a practitioner is increasingly evaluated on web-pages. Guest books are filled with mutual support and praise, and for individual practitioners, the status of their website is important. The second Internet-related development is that the community of practitioners of wooden boating is now interactive not only at the physical sites of practicing, but through issue- or problem-oriented discussions on the web. The dedicated Internet discussion page 'puuvene.net' has over 3500 clustered messages from the two years that the forum has been available. In other words, the infrastructure of discussing the efficient and the proper has itself become much more efficient.

The proliferating literature on wooden boating addresses the technical questions of building and maintaining wooden boats (for example Broch 1995, Larsson 2002). However, such literature also addresses the philosophy of wooden boating and teaches how to live with and appreciate wooden boats, or 'The Art of loving and taking care of wooden boats' as Malmborg and Husberg (1998) have titled their book.

Dedicated magazines form another literature genre. The magazine *Puuvene* was established in 1995 by a practitioner and enthusiast, who had prior expertise in publishing. The circulation of *Puuvene* has remained around 1300. Just as the other wooden boats magazines such Wooden Boat (US) established in 1974 and Classic Boat (UK) established in 1987, Puuvene has published and distributed images of wooden boating in a particular and favourable light. Provided the leverage of photos in imaging and understanding wooden boats, Wooden Boat magazine (4/2004) advises how to take good quality pictures of your boat; *Use 35mm slide. Take the pictures in the morning or in the evening to avoid ambient light and to produce sharp contrasts. Keep the background simple and/or scenic. Preferably take photos without people in them.*

Finally, the boat-building schools are nexuses for accumulating and sharing practical knowledge about boat-building. They echo the international tones in wooden boating and are the source of the reformist forces, while at the same time facilitating the traditional orientation – restoration and replication – by collecting and maintaining drawing archives and documenting oral knowledge about boats. Two vocational schools have continued to provide education in wooden boat-building in Finland practically through the whole transition period. In addition, there are numerous new vocational schools and a polytechnic offering education for the profession of wooden boat-building. However, what might be even more

significant in terms of institutionalising the practice of wooden boating, are the short courses offered to dedicated hobbyists. These courses vary in length. Some may be for few evenings, some for a weekend or a week. There are also courses for one semester or two semesters for those who embark on the aspiration to build a boat of their own.

Wooden boating has become available in contemporary Finland through processes of integration, aesthetization and professionalization. I have argued that there is a distinct technological path out of which wooden boating emerges, namely the transition from wood to fibre-glass as a boat-building material. However, the development is not as simple as that. Wooden boats have been aestheticized by referring to sensory data and the emotions involved in handling these objects. Furthermore, boats have been personified, and this process has allocated these objects a voice and given them legitimacy as worthy objects. Finally, boats respond to the wide-spread aspiration of crafts-identities and the countering of extensive division of labour in contemporary societies. Boat-builder is a professional identity with plenty of demand in the media as well in the private aspirations of improved quality of life.

Hence, boats have become the anchors and organizers of human lives around which individuals build grounded and convincing projects and though which they resist the market imperatives of harried and vain participation in the overwhelming possibilities of contemporary societies. However, boats also frequently fail. In some cases, the grip of the practice loosens and it fails to convince the involved individuals. Boats and practitioners just drift apart. On the other hand, the departure can result out of overwhelmingly convincing claims and in the burn-out of practitioners under the heavy toil and the lengthy list of things to do. My interpretation on boating is thus that they both provide escapes from pervasive ideology of busyness and the merit of increased consumption, but also make busyness and require consumption in a more local setting. Practices like wooden boating thus localize, and indeed anchor consumption.

8 Discussion

I have in this paper first considered the tendency of pursuits on eco-efficient innovation to produce instrumental rationality. I noted that the ideas of service-orientation and product-service-system bear a close resemblance to work of household economist. In both traditions, everyday life is approached with an ideal of rational decision-making and goal-directed instrumental behaviour. On the other hand, I have suggested that the legitimacy of sustainable consumption as a field of research and policy-making depends on its ability to pursue both an agenda of eco-efficient technological innovations and the sustainability of consumption as contentment.

With the case on wooden boating, I have sought to highlight a process of integration – perhaps also innovation – along which individuals have crafted, articulated and found themselves with a new a specific relation with boats. However, the boating story can be used a case of a more general phenomenon. What is involved is aesthetization of consumption and cultivation of non-human agency. Boats start to act and even ‘speak’ in the constellations in which humans immerse themselves in purposeful play

around and with material objects. However, playfulness should not misguide one to think that wooden boating is not 'real'. Quite on the contrary, the process has resulted in a socially recognized and legitimized way of spending time, expensing money, and thinking, appreciating and desiring material objects. Such positions would not be available for individuals without a collective process of integration. The 'negative' results, the strain and the burn-out that the phenomenon results in, are equally real.

Is wooden boating then an innovation on sustainable consumption? Quite obviously something new has emerged, but the process has not been a result of dedicated promotion. In fact those with promotional interests have been rather unsuccessful. It is also difficult to answer whether wooden boating is efficient? A transition to fibre-glass might save natural resources and reduce pollution in the end, not to speak of saving labour. However, the criteria for sustainable consumption innovations have to be more versatile. One would need to ask whether wooden boating contributes to sustainable living and dwelling in the materially stuffed world. I have elsewhere (Jalas 2002 and 2005) suggested that one might simply focus on whether wooden boating, for example, requires more natural resources per a unit of time of boating.

Where does such a suggestion leave the purposeful policies on sustainable consumption? Does the promoting of technologies necessary imply a rationalizing view on everyday life and undermine sufficiency? I shall not hesitate to answer no. There are distant technologies such as alternative energy sources or fuel efficient combustion engines that hardly reorganize everyday life as such. But there are certainly innovations that hit closer to everyday life like the organizational innovations of ownership and use of durable consumer goods. In the case of boating, I could have equally well elaborated on the proliferating business of boat rental and chartering as eco-efficient functional sales. Wooden boating, however, conveys a radically different view on innovations of sustainable consumption.

Can innovations such as wooden boating be promoted and supported by any deliberate policy measures? Or is the purposeful striving necessarily directed towards more efficiency oriented innovations? Upon this question it is informative to view the promotion of local foodstuff and culinary enjoyment by the slowfood movement (see Parkings 2004). In their web-pages they argue that

> Through its understanding of gastronomy with relation to politics, agriculture and the environment Slow Food has become an active player in agriculture and ecology. Slow Food links pleasure and food with awareness and responsibility. The association's activities seek to defend biodiversity in our food supply, spread the education of taste, and link producers of excellent foods to consumers through events and initiatives.[115]

The statement focuses on key resources of meaningful and joyful action around food. It is the availability of ingredients, the possession of relevant skills and the proper ways of understanding of and thinking about food that contribute a viable practice and culture of food. Furthermore the promoters of slowfood view the availability of such resources as a political question. The case of wooden boating is very similar to culinary food. Both require specific ingredients and repetitious integration by the practitioners; both

[115] (http://www.slowfood.com/eng/sf_cose/sf_cose_mission.lasso, accessed 5.1.2006)

relay critically on proper ways of understanding the relevant action. Both are *integrative innovations* as opposed to disintegrative innovations of the ideas of functional sales and service-orientation.

However, from research point of view, there is an even a more crucial aspect. Both systems-description use sensory knowledge of everyday activity and entail emotional states. Critical research on sustainable consumption should hence encompass not only propositional and verbal descriptions of consumption action, but also be able to enter the activity of everyday life through sensory and emotional understandings.

Such a requirement challenges the involved academic disciplines and research methods. Sensory and emotional knowledge is hardly available through quantitative methods or through interviews for that matter. Rather, ethnographic, participatory methods are called for. These calls are not novel. For example, Cohen and Murphy (2001) and Dolan (2002) have argued for correcting a disciplinary bias within sustainable consumption research. However, my point has mainly been to demonstrate with a single case an alternative approach to the sustainability of everyday life. What has become evident is that innovation research on sustainable consumption requires both the spanning of the system boundaries and the use alternative research approaches and epistemologies within the extended boundaries. Furthermore, there are little doubt that the promotion of technological eco-efficient innovations and the more distant documentation of sustainable ways of living and dwelling back-fire on each other rather obtrusively. Yet, the legitimacy of sustainable consumption as a research and policy field requires the delegate pursuing both of the tracks at the same time and deliberate arbitrating between them.

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Chapter 39 Full-system resource efficiency: critique, formalism, 'distributive efficiency', 'functional surface'

Shifting the emphasis of resource-flow analysis from impacts to 'use-efficiency'

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1 Summary

Measuring resource efficiency of human resource-transforming systems (economies, cities, households etc) has to date moved beyond demonstrably limited financial cost-benefit analysis, to fuller project, resource (or material) flow analysis (RFA). RFA couples a biophysically-based assessment of assessing units of 'environmental impact', I, per units of resource extracted, R, I/R (such as environmental footprinting), with a financial indicator of units of monetary growth per unit of resource used, R/Y, as an indicator of resource productivity, i.e. welfare increase per unit of input. R/Y is taken to indicate 'resource productivity of production' at the firm level, and the 'dematerialisation' of society at the aggregate, economy-wide level. These two indices, combined, are presumed to amount to an indicator of societal 'resource efficiency' I/Y.

However, the current RFA programme has a number of misemphases, distortions and information gaps. The main shortcomings of the programme are:

- the status of impacts is, ultimately, subject to knowledge irresolvabilities and thus focus on the I/R ratio is a misplaced emphasis;
- the R/Y indicator is an imprecise, indeed distorted, indicator of actual physical resource productivity, and a vague indicator of overall dematerialisation of society;
- and finally, RFA currently is missing a good deal of information, including physical resource productivity assessment, actual welfare delivery assessment; perhaps above all the RFA package contains no indicator of 'use efficiency', i.e. how intensively

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each unit of production is used (a separate question from how much welfare it generates when it is used).

It seems proper that any full-system resource efficiency (FRE) indicator would indicate, assuming that it is able to assess impacts of resource use in some way, would indeed attempt to assess actual physical resource productivity, actual welfare delivery, and use efficiency in one package. Certainly, this fully-empirical and system-wide approach was in the minds of the pioneers of the RFA approach (e.g. Geddes, 1895), and thus the focus on impacts and monetary indicators seems to be a deviation from this goal.

This paper proposes a resolved formalism and analysis for the overall resource efficiency indicator, echoing related analysis in Daly (96), in Femia, Hinterberger, Luks (99), and Jacobs (91) which:

- critiques the current formulation of the RFA programme;
- introduces a formalism for a full-system resource efficiency (FRE) measure, which explicitly includes a physical resource productivity, and welfare intensity parameters, and deprecates attention to the impact intensity parameter;
- introduces a formalism for defining and method for introducing a 'use-efficiency' (formally defining it as *distributive efficiency*. a measure of the allocation to actual use of available *functional surface*, the total value available from a unit of production) as a parameter in the full-system resource efficiency measure;
- clarifies the basic concepts involved in defining distributive efficiency (formally separating *functionality* (as abstractly objective, incommensurable, and physically embedded in the objects of production), *value* (as contextual, available for use, and limited in terms of simultaneous and sequential capacity) and *welfare* (as subjective, and thus largely incommensurable and incomparable).

Using this formalism the paper reviews considerations for operationalising the new parameter of distributive efficiency.

More simply expressed, the paper starts from the question: in life-cycle analysis and related research, of /what/ is the 'functional service unit' a unit (speaking in conceptual and non-project-specific terms), and how is such a unit generalisable to systemic resource efficiency analysis?

2 Introduction

It is pragmatically clear that the resource intensity, the aggregate flow of resources, of human society at any level of analysis is a key part of the problem of excessive environmental impact. Particularly in respect of the claim of resource overconsumption, there has been since the 1970s a trend to focus on the sheer physical intensity, resource throughput, of human industrial systems and industrialised societies. This whole movement we will call resource-flow analysis (RFA). (Much literature refers to 'material flow analysis'; but given a fuller analysis may include information, money, finished goods in distinction to mere resources, energy and so forth - which are distinct from mere matter - use of the term 'resources' is more appropriate.)

The overall character of the RFA trend has been to measure aggregate resource flows, some toxic flows, and to increase the information specificity and policy applicability of these data sets. Two of the most popular and

developed research programmes in the RFA tradition are life-cycle analysis (including life-cycle impact assessment) and eco-footprinting. Increasingly these physical assessments of impact are being coupled with financial assessment of monetary value-added.

More specially, the raw information that is currently provided by the study of resource flows, to date, amounts to the following:

- aggregate resource intensity, measured as weight flows, of human systems (e.g. Matthews et al, 2000);
- differentiated impact characteristics for separate flows (e.g. US Life-Cycle Inventory Database, http:/www.nrel.gov/lciref);
- disaggregated (inter-sectoral physical input-output, PIOT) flow studies revealing supply-chain dynamics (e.g. Suh, 2004);
- disaggregated monetary input-output (MIOT) studies revealing value-based responsibility (e.g. Duchin 2004).

The dominant force of these raw statistics has been to provide an increasingly accurate and complete portrait of the the impact intensity of any given society (or, at various levels of disaggregation region, city, industry, product etc). The emerging information content, with the application of MIOT and aggregate-level financial-resource correlations, is the actual ratio of monetary value-creation to impact. This new source of information is important, because it is clearly the case that sheer reductions in resource flows would be unforseeable if such reductions eliminated all the value generation associated with them. Reductions in resource use must be coupled with maintenance of the value achieved through the use of resources - assuming sensibly, that is, that reductions in value offered to society are not likely to be acceptable.

This then is the state-of-the-art in RFA. The European Commissions current round of consultations and methodological projects present three optimisation parameters as capturing the information content coming out of RFA, and offering targets for intervention: resource efficiency, which measures the ratio of impact to resource use; resource productivity, which measures the ratio of resource use to GDP/monetary output; and eco-efficiency, which combines these two indicators to assess the ratio of environmental impact to GDP/monetary output. Formally, the expressions for these parameters, where I is impact, R is resource flow, and Y is GDP/monetary output, are therefore:

resource efficiency = I/R

resource productivity = R/Y

eco-efficiency = (I/R x R/Y) = I/Y

Given that these terms are usually used differently (the organisation that first used it, the World Business Council for Sustainable Development, uses it to describe ‘resource productivity’, i.e. R/Y), we will reterm these parameters for clarity as follows: the I/R will be termed the *impact intensity* of resource consumption, R/Y will be clarified as *monetary resource productivity*, and the combined indicator or R/Y will go under the more usual, general term *resource efficiency* of resource consumption; most often we will use the specific indicator as a ratio, to ensure clarity. Indeed the term resource efficiency will be used to describe both the general challenge of improving the use of resources from an environmental sustainability perspective, and in a more technical use the set of ratios of efficiency of

production, use, consumption and so forth which are the essence of the overall challenge.

The monetary resource productivity, R/Y, indicator is actually employed at two levels of analysis. At the firm or sector level, it is used as an indicator of sheer resource productivity, the amount of production in monetary terms producers can extract from resources. At the national, aggregate level there is an emerging trend to use R/Y to characterise and assess the state of 'relative dematerialisation' of a society: if the aggregate resource productivity ratio goes down for an economy, it is said that that society is (relatively) dematerialising (more accurately, that it is dematerialising per unit of monetary value). While this relative dematerialisation statistic is routinely laid alongside rising 'absolute (de)materialisation' (i.e. absolute resource intensity) trends, which show stable or rising (but either way, unsustainable) levels of resource use, it is seen as a good thing in itself, implying, apparently that the marginal trend of economic development is towards less resource-intensive consumption.

3 RFA: Problems and Gaps

However, we claim that this formulation of the RFA package is flawed on a number of grounds; there are three main problems.

Firstly, the impact intensity, I/R ratio, is subject to significant parameters of irresolvability, and becomes a major, misguided source of attention for researchers and policy makers.

Secondly, the R/Y ratio which is a presumed indicator of resource productivity does not in fact accurately pinpoint efficiency gains in the production of value from a given set of resources at the firm level, and is in fact a misleading and perhaps perverse indicator at the aggregate 'relative dematerialisation' level.

Thirdly, significant information gaps in analysis (including lack of (or non-inclusion of) indicators for physical resource productivity, geographic/cultural context, spatial/social-institutional of actual use of commodities, social distribution of wealth, and actual utility derived from use consumption) ensure that a major physical optimisation parameter, to improve the 'use efficiency' of resource production and consumption, that offers great opportunity for policy, is entirely absent from the analysis.

In response to these problems, the paper provides an alternative formalisation of the optimisation parameters available to RFA practitioners. The problems are dealt with in detail as follows.

3.1 1. Misplaced emphasis on impacts

It is clear that for at least two reasons, there is good grounds to differentiate, as described above, the actual impact profile of different resource flows, as separate from their sheer weight. Firstly, different flows have different impacts, and reducing all flows equally - or indeed low impact intensity flows before high impact intensity flows - is not an optimised approach to reducing environmental impact. Secondly, even where flows are the same in weight and type, different management scenarios for both extraction and management may have entirely different impact intensities. Untreated waste products released to to the environment may have huge impacts and associated costs - which may be entirely avoided (indeed even turned into revenues) through proper treatment and management. For these

reasons, it appears that the impact intensity, I/R, ratio is indeed a suitable target for optimisation. We may say, in fact, that the extent to which RFA is about management the impact intensity of flows, it is entirely congruous with the impact management character of conventional environmental concerns (which, historically, have been geared to managing pollution, managing natural resource extraction, and managing nature conservation without regard to the dynamics of overall resource consumption).

It would be wrong, indeed absurd, to suggest that where, cost-effectively, the I/R ratio can be optimised - either by substitution of flows, or better extraction/waste management regimes - that it should not be. But there are three sets of reasons why the I/R ratio is in fact not a secure basis on which to predicate the importance or future of RFA studies and related policy, and a misplaced emphasis of RFA research at the current time. Indeed, these reasons suggest that RFA breaks with the tradition of impact management, and introduces the importance of sheer resource intensity management as a largely separate challenge. As we shall see, attention to management impacts rather than focussing more directly on the sheer throughput of resources of whatever type, may itself be misguided and in any case is certainly distracting attention from the real parameters of efficient resource consumption inside society itself.

These three sets of reasons - for why impact intensity cannot be a final guide to resource efficiency - are as follows. Firstly, when calculating impacts some assessment has to be made as to what the inherent character of the natural system is, against which baseline impacts are measured. Fundamentally, this assessment is, necessarily and without final resolution ever possible, contestable - social scientists call an unresolvable debating point essentially contestable - between what may be called anthropic and non-anthropic standpoints. We will call this the impact baseline problem. From the anthropocentric standpoint, the baseline of normality, against which impacts are calculated, is the resource yield of physical and energy products, waste sinks and dissipation functions, and system-management services (such as nutrient cycling, climate regulation, and ecosystemic resilience), and amenity and aesthetic benefits of whatever sort. If an activity depletes these yields in any way, it has an impact. However, from a non-anthropic perspective, there are many other factors that may be considered in assessing the baseline against which impact is calculated, and indeed the resource yields listed above may not be considered so important. Outside an anthropic viewpoint, it is arguable that all species have a right to continued existence, and therefore all ecosystems, including those that are not required either directly for biotic harvesting, or indirectly for waste dissipation, system-service provision, or amenity benefits. To think otherwise is to adopt an anthropocentric worldview, for which justification is required - and which is not in any case universally shared. Currently, it is the case that impact baselines are a fudge between antrhopic and non-antrhopic versions, with a tendency towards the anthopic version. But to attempt to plan economic activity - which is what impact intensity management facilitiated by RFA proposes to do - on the basis of assessing impacts ultimately requires resolution of this conundrum, and this is not possible to arrive at.

The second reason to deprecate an overly central role for the I/R ratio, that is the impact intensity indicator, is what may be called uncertainty of the

technology interface. Very obviously, part of any management scenario (variability of which provides grounds for *focussing* on and optimising the I/R ratio) is technology: good technologies will radically reduce the impact intensity of resource consumption, and bad technologies will increase it. However, leaving aside the non-trivial question of how valid it is to assume continuous levels of technical innovation (i.e. assuming that innovation is continuous), the technology interface is not a uniformly positive or entirely predictable contributor to the I/R metric. Firstly, reliance on technology, even technology that exists, assumes that mass production of the technology is economically viable, dispersal of technology economically viable and politically acceptable, and that management of the technology is feasible in all relevant cases. Without these three in place, even good technology is of no benefit to the optimisation of the I/R ratio. Indeed, in the case of misapplication through bad management - for example pollution remediating chemicals which are wrongly released - good technology may turn out to be a negative contributor to impact. Secondly, and perhaps more seriously, the long-term impacts of certain technologies remain unknown. This is especially problematic in instances where a technology is considered necessary to mitigate impacts of a resource consumption practice that is considered particularly harmful in principle. A good example of this is carbon sequestration, whether by forests or carbon-reinjection. Neither of these technologies, which are considered highly necessary to reduce impacts of a human system heavily reliant on fossil energy, have a remotely secure future profile. Another example is the release of chemicals with no currently known impact, but which may have a high localised impact either at some point - either in synergy with others yet to be released, or past a certain threshold of accumulation. Thus for these reasons - the problem of exploiting, promoting and managing technologies which exist, and the problem of post-release impacts - the technology interface incorporates a number of uncertainties which are not unresolvable for the same reason as the impact baseline problem (which is essentially contested due to irreconcileable standpoints), but which are unresolvable through lack of available information.

The third issue which problematises the usefulness of the I/R ratio, is the issue of natural thresholds, and in fact underlies both the impact baseline and technology interface problem. Natural systems and their behaviour is clearly dynamic: yields of biotic resources, the absorption and dissipation dynamics, and the system-maintenance properties of the natural environment are all subject to tolerances of impact which are not known, and are not likely to be known without catastrophic ‘experiments’ of system collapse. Even assuming that we have somehow resolved the impact baseline problem (i.e. we agree the status of the natural environment that must be protected from further impact), or the technology interface problem (i.e. we know which technologies are exploitable in space, time and society and their localised impact-per-unit is considered known), the dynamic properties of the natural environment will still remain largely unknown. Even assuming for example that the impact of a given chemical in terms of a dose-response curve on a local natural environment is understood, there is still too little environmental science knowledge - chiefly ecological knowledge - to assume that apparently predictable behaviour along the curve of dose-response, in the context of that local system, will not trigger major disruption in associated

but unstudied systems. More specifically, if a given farm chemical is considered not to disrupt predator-prey relationships in the target environment, it may that even the level of disruption occasioned causes secondary impacts which were otherwise unpredictable. What is at question in the threshold problem is not, then, the precise functioning in all instances of different impact categories, but the actual structure and character of the natural environment base which they are impacting. Or we may also say that *any* presumed resolution of the impact baseline problem, which assumes an anthropic definition of the natural environment to be protected from impact may accidentally exclude from consideration (and thereby sponsor the overimpacting) of key thresholds embedded in that part of the natural world considered irrelevant.

This is a research challenge of a colossal magnitude, and for a full understanding requires vast integration and advance of entire science disciplines - from ecology, through soil science, to climatology and so forth. This problem may not be unresolvable for either being essentially contestable or inherent uncertainty - but it is for the forseeable future problematised by a vast lack of reliable information, and indeed lack of trusted research paths and methods.

These three problems - the impact baseline, the technology interface, and the threshold problems - suggest that, despite the obvious usefulness of the I/R relationship when considering resource flow composition and extraction/waste management policy, the I/R ratio is a misplaced emphasis when trying to optimise the overall resource efficiency of society. Attention to these three problems, and their seriousness, does not eliminate the I/R and actual impact assessment efforts from the RFA stable of interests, but it forces a certain conclusion onto the table: if rates of consumption rise faster than societies abilities to resolve these questions satisfactorily, then we must move from an impact intensity management paradigm to an resource intensity reduction paradigm. As paradigm shifts go, this is not so very cosmic. But it does imply a significant shift of attention away from impact intensity issues and reinvigorated commitment to the resource intensity problem per se. More prosaically, we may credibly say in passing we have grounds for arguing a partial (historical, conceptual and operational) discontinuity of the consumption problem from the classic features and requirements of the environmental problem as a whole.

What is the upshot of this analysis for the future of RFA? Simply put, the contexts - flow substitution, and extraction/waste management - where impact assessment is relevant must be more closely targeted, and for the rest it must be assumed (by whatever measure is used) the correlation of impacts with a given level of resource is linear or superlinear, and that reduction of R, rather than management of the I/R ratio, is the proper focus of attention.

3.2 2. Problems with the R/Y indicator

The second misplaced emphasis in the current approach to RFA is the emphasis on monetary indicators in so called resource-productivity assessment. Specifically put, the R/Y indicator is a highly problematic indicator: it does not reveal actual resource productivity at the micro level, and gives a misleading indicator of dematerialisation at the macro level. The problem can be best understood if we look at microeconomic and macroeconomic levels separately.

At the micro level, the indicator or R/Y - generally accepted as a resource productivity indicator - is liable to massive distortion if the market context of the industry assessed is itself distorted. This is well-understood in neoclassical market-equilibirum-focussed economics, but the R/Y indicator as deployed is not presented in the context of these distortions. For example, any industry which benefits from market distortions - including (to list a but a few) public subsidies, market protection from international trade (e.g. tariffs), uncosted externalities (e.g. extraction/of pollution to a global resource base), monopoloy/cartel practice, barriers to market entry, information gaps and asymmetries, etc - will present a profitability performance which disguises its true resource productivity.

Even at the micro level, there are two further sets of reasons which account for the the reason why R/Y is not a powerful indicator of resource productivity at the micro level. Firstly, reductions of the R/Y ratio, thus apparent improvements in resource productivity, may in fact have nothing to do with actual resource productivity, and may simple be results of standard profit-maximising practice. Profits accrue, in any version of a production function, from the optimisation of all inputs to production, and thus evidently an increase in profits from a stable level of resource inputs does not imply necessarily that those resources have been used more efficient: labour or capital may have been (and in most current instances of R/Y optimisation in fact are) used more cost-effectively. One particular, and very common, way in which the R/Y statistic may falsify - even assuming an efficient market - the picture of resource productivity it appears to offer, is through sourcing of cheap labour from overseas. National use of resources for a given country may stay be stable, and profits may rise: but in many instances this is not an indication of more efficient production, it is an indication of cheap overseas labour and cheap technological capital creating a better financial return (and indeed, in fact, may disguise less resource productive production). Thus for these factor substitution reasons, the R/Y indicator is not a reliable indicator of direct resource productivity performance.

Secondly, even assuming an efficient market, and assuming that R/Y optimisation is focussed on better exploitation of the resource input (rather than achieved by factor substitution), there is a good reason why R/Y is not a very powerful indicator of fundamental resource productivity. This is because the basis of market efficiency, competitive efficiency, only ensures optimisation of resource use on a given technological basis, and does not necessarily deliver step-change in physical efficiency of production. This is so because if, to reach a entirely new level of increased resource productivity - which in many instances we know to be possible technologically - a significant new investment is required, or productive down-time is required for retooling or redesign of plant or reskilling of labour, there is a major, empirical barrier to any attempt to reach that level: the possibility that the industry in question will be outcompeted in a down-time period, or otherwise outcompeted in attempting to bring its new products to market either through having an excess burden of debt, or through being unable to market a new product (that may require some changes on the part of consumers). Obviously, step-changes in efficiency have been achieved historically, but this is often a result of unique factors, for example dominant market position by a particular industry or government intervention and

support, and is not the normal outcome of competitive markets in which step-changes in factor efficiency are as likely to be penalised as rewarded. Since it is, in fact, competitive efficiency which is measured by R/Y (since profits accrue in relation to sales over and above competitors), and since competitive efficiency only normally rewards optimisation of resource productivity at a given level of technology, we may thus say, is not a measure of optimum resource productivity. (If it is doubted that competitive efficiency is not an indicator of actual resource productivity, the question that would need to be answered is how a permanent future of value-increases from competition can be forseen: if competition was maximising all factor values already, then its usefulness would soon die out.)

Shifting from the micro level of use of R/Y, which is used to assess resource productivity of specific production activities and sectors, to the macro level which is used to assess overall resource productivity of a society, we can see that the R/Y metric is again not ideally suited to assessing actual increases in resource productivity. There are three senses in which this is the case.

Firstly, as is well understood, the R/Y indicator is not a direct demonstrator of actual dematerialisation of the economy: if economic growth is very rapid, and the growth of resource use slightly less rapid, the R/Y ratio is 'improving' even while overall resource use is going up. So the desirability of resource productivity is ambivalent without an underlying portrait of actual resource use. Secondly, the assumption that R/Y improvements, i.e. more wealth for the same amount of resources, (even assuming perfect markets) mean a shift away from products to services, the 'dematerialisation' hypothesis at the macro level, is also problematic. The 'shift to services', can mean either that what was previously consumed in a product context is shifting to a service model of delivery (so called product-service systems shift, or PSS shift), or it can mean a shift to a service economy in which the a greater portion of GDP is services (a service-economy transition or SET). R/Y does not tell us directly which of these is the case, and in fact is more likely to indicate the latter, i.e. the SET version. The SET is not itself an indicator of greater resource productivity, because it may simply mean that product sales have stabilised and now consumers are spending on services. This implies neither a shift in product-use behaviour, nor in production-technology efficiency: it simply means consumers are buying more services. And though per unit of monetary value that means less resource consumption, this more resource productive service consumption would be simply sitting atop less resource-productive product consumption which has in no way changed - and indeed, may not inherently as efficient as it might (for reasons outlined above). (Indeed, the aggregate use of the R/Y indicator to show the increase of the service component of the economy, may actually mask a shift to PSS behind a broader SET phenomenon, and perversely penalise the shift to PSS. This would happen if, by requiring less resources overall through better allocation of products to a group of consumers (e.g. in a car-sharing scheme) a PSS scheme brought in less revenue than an alternative private ownership scheme: but the assessment was made on the basis of actual use of cars (which would imply comparable impacts for each use). We will review this situation below.)

Thirdly, and more subtly, the macro improvements in the R/Y indicator may be indicating simply a preference for premium-cost goods, such as oil-

paintings and SUVs, which per unit of resource input deliver greater profits to producers than other products. This type of expenditure contributes to sustainable consumption of resources, but only indirectly, in that it the premium paid for to obtain these goods cannot be spent on more consumption; but this is a cold comfort in the case of such things as SUVs, and in any case a misleading of what we want to determine which is actually increased efficiency of material production (actually more products from less resources; not just more expensive products from the same resources).

We may also note in passing that the R/Y indicator, if used only at the micro level is properly limited to producer efficiency, but if used to describe resource productivity rather than just dematerialisation at the macro level, ought to somehow incorporate the 'resource productivity' of consumption also. But this is a concept not at all formalised in scientific study to date - as we will see.

3.3 3. Missing social and physical information

The third set of reasons why current practice in resource flow analysis is not capturing appropriate information and has limits on application is its almost complete overlooking of large terrains of empirically-based information and analysis in the physical and social spheres.

The first of these is actual welfare derived from consumption of goods and services. This is perhaps the strongest - and yet least easy to formalise - of any criticism of the use of monetary indicators to determine the optimality of resource use by a human system. With increasing vigour and frequency, social science and psychology are coming up with critiques (Jackson 2004) of the assumption that goods apparently willingly purchased are necessarily direct contributors to welfare of consumers. Positional consumption to demonstrate wealth, identity-forming consumption for group membership, socialised consumption required by a society or culture, induced consumption from advertising and marketing, and similar *non-autonomous consumption* phenomena all point to an unstable or unpredictable relationship, at least in modern consumer society, between product consumption and welfare. Perhaps more seriously, and less studied, is the difference between preference consumption and priority consumption. We may say that if society creates life contexts for consumers which require expenditures to achieve a mere baseline of welfare, these are *priority consumption* expenditures, which are not derived from autonomous preferences and search for welfare. Such things as cars for commuting to jobs only available far away from home, cleaning and health products for polluted living environments, expenditures on home and personal security, and so forth - these are priority expenditures, in clear distinction to real *preference consumption* expenditures (e.g. food, holidays, etc). This distinction is harder to determine since, while obvious objectively, in the minds and judgements of many consumers the two forms seamlessly interweave and are not separable: it is harder to claim that a priority consumption expenditure is non-autonomous. Anyway, for these two reasons - either non-autonomous consumption or priority consumption in replacement of truly autonomous, preference-led consumption - purchases of goods and services do not fully reflect actual welfare achieved. The result of this is that even if all other indicators - R, I, Y, and so forth - are well managed the actual outcome in terms of welfare is not guaranteed. More

specifically, improvements in R/Y may be increasing the resource productivity of production and of society as a whole, but it is not necessarily increasing the overall resource efficiency of production and consumption.

From another perspective, R/Y is also not necessarily increasing total welfare. Even if we allowed that monetary flows were indicators of welfare, aggregate growth of the economy does not indicate that wealth (and thus welfare, assuming that correlation) distribution is in any way equal or fair. Indeed, measures of wealth disparity - for example the ratio of the standard salary of the lowest paid groups in society to that of the highest paid - seem to be indicating widening disparities in distribution of wealth. Assuming that welfare increase for the smaller rich groups may indeed be happening, but also that this does not compensate for reductions in welfare across much wider parts of the population, suggests that aggregate R/Y indicators again are not reliable indicators of overall resource efficiency.

These two comments suggest the need for a more rigorous set of social and psychological indicators of actual welfare achieved in consumption, which would allow us a better handle on whether resource efficiency is actually being achieved. In addition to these social indicators, there are more physical and spatial data sets which would be useful added to the RFA package in order to determine resource efficiency better.

The first of these gaps is a reliable measure of physical resource productivity, without any money indicator. We have identified above that R/Y is not a trustworthy indicator at the micro or macro level of resource productivity, and thus the option is to make more out of the inter-sectoral (inter-industry etc) input-output data on the physical level. The ratio of resources to production, R/P, assessed in terms of weight for any productive part of the economy is a baseline indicator of physical resource productivity. The reason that this is not very helpful in itself is that it is not easy to define comparability of products: for two producers making apparently equivalent timber products e.g. floorboards, one may produce many more floorboards for the same input of timber - but those floorboards may be of a much lower quality. This is to say that by merely holding either the input or output of weight constant and comparing productivity, the equivalence in value terms is not considered. Clearly, the actual value of products needs to be included but ideally, given the critiques above, there would be some way of assessing true physical resource productivity without relying on a monetary guide, since pragmatically this physical idea is at the heart of the resource productivity concept. (See below for suggestions.)

The second data gap on the physical and spatial side of analysis is the geographic and cultural context of production and consumption. Assuming that technology and skill levels are equivalent across countries, the difference in material intensity of consumption between two societies may be to do with geographic and social context, rather than any feature of production and consumption, and thus the resource efficiency assessment of that society may need to be corrected for this. Geographically, cold countries will properly need more energy per person (and per unit of economic value) to achieve acceptable levels of warmth; the inverse is true for hot countries and their consumption of energy for air-conditioning and refrigeration. Socially, even assuming that no allowance is made for cultural factors (for example, some countries may have a cultural preference for resource-intensive cooking and dietary practices), countries may have different

pollution (e.g. heavy metals in soil) or other legacy environmental problems (e.g. compacted soils) to deal with in using resource efficiently: this will mean that resource efficiency is lowered apparently for that system, but only because of unconsidered burdens on that system's use of resources which are incomparable with other countries. Therefore, these sorts of geographic and social information suggest that resource efficiency measures may need to be corrected for actual geographic and social context.

The third data gap in physical terms is the actual spatial and social-organisation arrangements of both production and consumption as it occurs, in so far as they are relevant for an assessment of resource efficiency. The spatial layout of consumption - the layout and interrelation of factories, farms, fisheries, forests, cities, buildings, roads, homes, parks, gardens, and all other physical features of a human system - is not normally included in RFA, nor are the social-organisational arrangements and context of production and consumption (e.g. ownership, purchasing, sharing, use, disposal institutions and behaviours).

What we want from this layer of data is information on the 'use efficiency' of all units of production. (I use the term 'use efficiency' in colons, to indicate the pragmatic and provisional nature of this concept.) It is pragmatically very clear that the resource efficiency of a society ought to be considered low if each commodity produced, even if produced efficiently and even if giving maximum utility when actually used, were not actually used very much. And this, again pragmatically, increasingly seems to be the case in modern consumer societies: but we are not measuring this, still less including it in aggregate RFA metrics. Somehow therefore, intensity of use, a measure of 'use efficiency', needs to be brought into play in the RFA assessment of resource efficiency. The attempt to transfer consumption patterns from products themselves to service-use of those products, i.e. product-service system (PSS) policy, is the policy area dedicated to exploiting this lack of efficiency. But neither RFA studies nor PSS have stabilised a way to account for this information deficit by providing a metric of 'use efficiency'. What we need to know, in generic terms, is how much use is really being made of what is made available by resources - rather than how effectively it is made available and how effectively it is finally used.

The difficulty lies in extracting information that goes beyond the pragmatic, but does not get lost in vast specificities of each feature of spatial and social-institutional arrangements; and yet is sufficiently specific, testable and comparable that it can be in any way combined systematically with the rest of the RFA programme. General comments on the need to zone habitations near amenities and workplaces in cities, and on the desirability of having energy production close to consumption, and linking industries in spatial cycles and clusters are all interesting; but they are simply not systematically applicable nor comparable, and above all not linkable to resource flow analysis contributions to the study of overall resource efficiency.

The problem of deriving information from these domains of data may be traceable to three assumptions common to engineering, social science and economic perspectives on the resource consumption issue. As we shall suggest, there is a genuine problem in analysis in deriving useful information from the spatial and social-institutional data domains, which is to do with social assumptions about the nature of value. We assume value to be

equivalent either to the abstractly objective functionality of physical objects, or to the welfare experienced subjectively by agents, both of which are formally-speaking incommensurable and incomparable.

We will show that is by the challenging of these assumptions that we can derive a new, unique parameter of resource efficiency, providing 'use efficiency' information, linkable to RFA; and which is both generalisable to many of the domains of spatial and social-organisational data, and yet which yields an analytically stable heuristic method, and indeed an operationally robust policy-development pathway.

4 RFA: New formalism and paramters

4.1 Review of RFA shortcomings

The current RFA programme, as we have now seen, has a variety of shortcomings:

The emphasis on impact, even while facilitating the substitution of high-impact flows and promoting better management of extraction and waste, is misguided due the irresolvable nature of the impact baseline, technology interface, and threshold problems.

The reliance on the R/Y ratio as an indicator of resource productivity at the micro level, and of resource productivity and dematerialisation at the macro level, is problematic in many ways. At the micro level, market distortions, factor substitution, and competitive efficiency not delivering step-change resource efficiency prevent R/Y from exposing real resource productivity. At the macro level, even assuming other distortions are not in play, R/Y is only a measure of relative dematerialisation which, if absolute materialisation is unchanged, seems to have limited value. Further, R/Y at the macro level is as likely to be a measurement of either a broader service-economy transition phenomenon or a shift to premium goods, which are neither evidence respectively any actual lifestyle dematerialisation by a shift to PSS consumption practice or of physical efficiency-based dematerialisation.

We have also seen, finally, how there are major social, physical, spatial and social-organisation gaps in the information package provided by RFA. These include lack of rigour in assessing the direct correlation of resource consumption and actual welfare (a link which is compromised through non-autonomous and priority-driven consumption behaviours), no assessment of wealth distributional inequalities, lack of robust physical resource productivity data or methods, lack of geographical and social-contextual data, and finally lack of spatial organisation and social-institutional data.

It would be an interesting and important study to assess where these shortcomings arose, and why, given that many of them are quite obvious, the RFA programme can be considered secure as it currently stands. This paper is not the place for that however, and thus we may simply summarise desiderata in reforming the RFA paradigm in these terms.

1. A shift of emphasis from impact intensity management to resource intensity reduction, and a general acceptance that the R/I ratio, if ever finally calculable, amounts almost certainly to a linear or superlinear correlation;

2. A move away from the distortions of monetary indices in resource productivity analysis;

3. An inclusion and development of parameter accounting robustly for physical resource productivity;

4. A useable, and versatile, parameter accounting for the actual use characteristics of production in the spatial and social-institutional domain;

5. A tractable parameter accounting for the ratio of commodity consumption to actual welfare;

6. A means to link these various measures into a single assessment of full-system resource efficiency;

7. Some correction of resource efficiency assessment on the basis of social distributional inequalities, and geographic and social-contextual factors.

Taking these desiderata into account, we may now represent the relevant variables of a RFA approach to consumption, in a revised resource efficiency (RRE) measure as follows:

Where

R = resource intensity (aggregated physical indicator of flows/impacts);

P = units of production-consumption (physical indicator);

U = actual welfare (indicator to be determined);

H = any human resource-transforming system (at any level of analysis or scale);

R/P = physical resource productivity parameter;

P/U = welfare intensity parameter.

the assessment of resource efficiency, RE, for H is expressed as follows:

RRE = R/P x P/U.

With this formulation - indeed formalisation - of resource efficiency, we may note that we have taken steps to account for at least four of the desiderata listed above: I has effectively been subsumed under R; monetary indicators are excluded; there is an parameter for physical resource productivity (R/P), and a parameter for the link between consumption and actual welfare (P/U). Clearly, this is highly schematic, and therefore the formalism itself is no guarantee of being able to actually use these variables and parameters in practice. This paper does not propose to demonstrate the overall viability of this formalisation, and it will focus above all on operationalising a third, missing parameter to account for ‘use efficiency’ in the spatial and social-institutional domain, which will introduce a new terrain for optimisation of overall resource efficiency. As follows however, we will simply propose some conjectural approaches to making the two parameters above operationally viable,

If we wish to operationalise the physical resource productivity parameter, somehow the problem of non-comparability of production needs to be surmounted, so that the physical efficiency of different production processes can be assessed on an agreed baseline of equivalent value. An inelegant way of attempting this would be to draw up lists of products agreed to be equivalent by consumers, experts and industry and assess the relative physical efficiency of these in comparison to each other; another would be to create criteria of comparability (e.g. performance characteristics) and then compare the physical resource productivity of products which equally met these criteria.

If we wish to operationalise the welfare intensity parameter objectively, somehow we need to characterise welfare achieved by consumption in some way other than asking consumers for their experience, since as we have

mentioned above, this is likely to be incommensurable with other experiences. One way of doing this might be to assess welfare from consumption in measure to the amount of time they spend autonomously doing the consumption act in question, and another way might be assess welfare intensity on the basis of amount of resources (time, effort, money, opportunity) they invest of would wish to invest in learning skills to perform the consumption act in question. (Note that while these proxy indicators may have offer an objective way to assess welfare intensity of consumption, without either using monetary indicators or subjective assessment, and seem to overcome some of the non-autonomous consumption problems, they do not in fact overcome the problem of the priority-preference differentiation. That is, it will still not be obvious to assess in the choices made by consumers, even using these indicators, whether their consumption is genuinely preference-based or driven by systemic priorities not of their choosing.)

4.2 Capturing the elusive 'use efficiency' parameter

We have noted above that the essential challenge of seeking a stable indicator of 'use intensity' of resource consumption is one of working out *how much* use is being made of what has been made available - but not getting caught up on how effectively things are made available nor how effectively they are actually used. But we get stuck on working out what it is that has been made. We know it is or 'value' in some form, but how do we manipulate this concept concepts without the standard fall back to a monetary index? How do we assess the efficiency of distribution of value, once it has been produced, to the uses that require it?

The problem devolves to the way we view value. Value is, we assume, something either an abstract property physically embedded in an object as functionality, or something delivered to consumers as welfare. We may consider that the physical resource productivity parameter an indicator of how few resources have been required to deliver a particular functionality, and the welfare intensity parameter is an indicator of how how well welfare is achieved for each unit of consumption. But these variables, functionality and welfare, are themselves considered not very yielding to further analysis, let alone measurement: functionality inherent in a product is a demonstrable but highly abstract sort of information, and welfare experienced by consumers is a demonstrable but highly subjective sort of information, neither of which yield in any way readily or stably to objective assessment - commensurable, comparable - that might be used in an RFA study of the 'use efficiency' of resource consumption by a human system.

Indeed, when we look at attempts to enhance use efficiency of society's consumption of resources, the methodology gets stuck on one of two dilemmas which reflects this bi-polar conception of value. If we suppose that use efficiency is captured by the concept of sharing, on the basis that value is physically embedded in products, the optimisation parameter we choose to measure the maximisation of the distribution of this functionality is the ratio of people to products /services, something we might call the 'sharing efficiency' of production: the more people per unit of production, the more 'sharing' is taking place. After an moment's apparent usefulness, this indicator is seen to be an obvious nonsense, because an arbitrarily high number of persons per product, which would give a an extremely 'sharing

efficiency' rate, is clearly undesirable and unworkable: some more people per car may seem like a good idea, but a huge number clearly is not.

Alternatively, if we think use efficiency is captured by the amount of 'service' delivered by each product or service, we soon are forced to equate service delivered with welfare experienced, and thus to work out how much welfare is delivered by each product or service: thereby we simply find our way back to the classic problem of quantifying and comparing subjective welfare. The conventional workaround here is to use a monetary proxy and to assess the amount of 'service' delivered by products by use of the R/Y ratio: but we have already demonstrated the problems of the monetary indicator.

In fact, in between these two inaccessible sets of information, the physical functionality of objects and the subject welfare experience of consumers, there is a domain of information that *is* accessible: a measure of the value *available to be accessed*, and the proportion of that value which was *actually accessed* for consumption. This is a very delicate construction since value available to be consumed may seem to equate to functionality inherent in the product, and value accessed for consumption may seem to equate to welfare experienced. But this is not the case, and the differentiation must be maintained. Taking the example of a car:

The *functionality* inherent to a car in physical terms may be described (in simple terms) as the ability to carry passengers and to travel distances: this is what people pay for, and how much this value is worth is determined (through markets) by their ability to pay, competing products on offer, and their other interests. The welfare of a car actually experienced by consumers may be described as the number of convenient, enjoyable journeys to the correct destinations in a good amount of time for the number of passengers wishing to travel and/or luggage requiring transportation.

In the context of this car however, we must now note that the value *available to be accessed* is a more context-specific property than the inherent, physical functionality of the product. The value available to be accessed is actually a combination of the amount (of people/luggage) that the vehicle can carry at any one time and the amount of time the vehicle is available for use. Further, the *value actually accessed* is different from welfare achieved: in that time spent using a car is not necessarily giving welfare (e.g. if directions are wrong or there is a traffic jam). And finally, then, above all it is crucial to note that value available to be accessed and value actually accessed are rarely the same: and that their differential is the indicator of use intensity that we wish to measure.

This then is the essential, delicate character of defining a use intensity indicator to introduce to the RFA programme. First, the abstract functionality of what is produced must be put into empirical context as the amount of actual value available to be accessed; second the actual welfare extracted must be separated from the value merely accessed.

4.3 Formalising distributive efficiency, functional surface, full-system resource efficiency

Let us now formalise these insights for clarity and further manipulation.

1. For clarity, let us characterise in abstract terms all production as *function carriers*: the job of producers is to embed functionality in material inputs, hence the what is produce is a 'carrier of function'.

2. We observe that the abstract functionality of embedded in function carriers is different from the actual value available for access, we may characterise and further clarify this difference by saying that *purchase consumption* (PC) of abstract functionality (the ability to use a car, for example) is not the same as *use consumption* (UC) of actual value accessible (how much the car is available for use). We may therefore further speak, in principle, of the *UC potential* of function carriers: meaning specifically, the actual value available to be accessed.

3. UC potential clearly exists in two forms: actual value accessible at any one time, and amount of time across which that value is accessible. We may call the former synchronic UC (sUC) potential and the latter diachronic UC (dUC) potential. In the case of the car (in a simple analysis) sUC potential is the number of passengers and luggage transportable at any one time, and dUC potential is the amount of time the car is available for use in its lifetime.

4. These two variables of available value may be multiplied and the total presented in graphical terms as an indication of total value available for access - total UC potential. We may call the area described by the product of sUC and dUC *functional surface*, or the *total available value*, of the function carrier. Functional surface, therefore, is the amount of value actually available for access, that is for use consumption, by consumers.

5. For any function carrier, when the available value is actually accessed we may say that the functional surface is distributed or allocated to use consumption.

6. In order to capture a metric of efficiency of use of commodities, the proportion of functional surface of the whole function carrier (FC) to functional surface actually allocated to use consumption (UC), thus FC/UC, may be described as the distributive efficiency (DE) of the function carrier.

7. Note further that the mere allocation of functional surface to use consumption - i.e. the accessing of actual value - is not the same as the achievement of welfare. For any allocation of functional surface, that is for any use consumption act, the actual achievement of welfare is a further question for analysis. As we have noted, cars may be driven the wrong way, or sat in traffic jams: and thus, while their functional surface is being allocated, that is they are being used consumed, welfare is not being accessed.

8. The foregoing analysis demonstrates that what is referred to under the vernacular term ‘value’ has in fact three components: functionality, total value available for use (measured by functional surface), and welfare.

9. We may now characterise more precisely the resource efficiency identity, to include the allocation of functional surface, that is to include a new parameter for use intensity, as identified as necessary.

R/U = R/FC. FC/UC. UC.U

10. We may further characterise and formalise each parameter of the resource efficiency identity: the R/FC parameter, equivalent to the physical resource productivity parameter, will be termed the value addition parameter, and optimisation of it (by reduction of resource inputs per unit of function carriers produced) will be termed quantitative efficiency (QnE); the FC/UC parameter, will be called the value distribution parameter, and optimisation of it (by more complete allocation of the functional surface of the function carrier) will be termed (as above) distributive efficiency (DE);

the UC/U parameter, equivalent to the welfare intensity parameter, will be called the value extraction parameter, and optimisation of it will be termed qualitative efficiency (QlE). We may now present an fully-system resource efficiency (FRE) identity in terms of its three constituent efficiency measures:

FRE = QnE.DE.QlE

11. We may say that any defined combination of material resources, actions, and positive outcomes can be defined as a function carrier, with different emphasis on each element: a piece of fruit is a function carrier largely comprised of material resources, in which the action component is limited, and in which the outcome is simple. For example, we may say that teaching is a function carrier in which material resources are often low in importance, but the actions to achieve a given out come are crucial, and the positive outcomes are complex. We may further say that private house cleaning is a function carrier in which the material, action, and outcome components are relatively balanced.

12. A reasonable criticism, however, of any functional surface assessment of the total value available from production is that this is not strictly an objective indicator. Science wants to work with 'falsifiable' statements which require replicable, and therefore objective, measurements: and therefore, functional surface appears not be acceptable to scientific study. We may characterise functional surface as a contextual indicator of value availability which has to be constructed for each unit of production; it is clear that it seems to stand unstably between apparently objective functionality embedded in products, and the subjective welfare experienced by consumers. But before this critique be allowed to deny the validity of the functional surface concept, we simply need to note that science and policy is already infiltrated, indeed dominated, by a non-objective concept: and this is the monetary/economic growth indicator indicator itself. All that the monetary indicator does is shift attention away from actual welfare to apparent willingness/ability to pay for welfare in a market context. It is not inherently a more 'objective' measure than a functional surface assesment of total value; and indeed is somewhat less objective. Once the parameters of diachronic use consumption potential and synchronic use consumption potential have been established, to provide a general context-of-use for a function carrier, the functional surface thus calculable has a robust empirical character. Price, however, is only meaningful in the context of a specific market at a specific time: take a unit of production out of its market context, and there is simply no truly objective way its calculate monetary value.

4.4 Operationalising distributive efficiency

We have said that in this paper we will not attempt to offer detailed proposals for how to operationalise the R/P (physical resource productivity) parameter, nor the R/U (welfare intensity) parameter from the basic resource efficiency identity, and thus we will not treat further their equivalents from the FRE, i.e. the R/FC (value addition) parameter and the UC/U (value extraction) parameter.

The challenge remaining for this paper is to propose how to operationalise the FC/UC (value distribution) parameter in order to increase the distributive efficiency of resource use.

4.4.1 Defining the function carrier

We have noted above that in order to perceive the functional surface of a function carrier, we must differentiate the abstract functionality from the value actually accessible. In principle this is easy, as we shall see, but in practice this does not take place because production is generally commoditised as products. Products are not understood, either by producers or consumers in terms of actual value available, i.e. functional surface, they are understood in terms - as described above - of abstract functionality and welfare delivered. As such, it is not generally considered the case, either by producers or consumers that there is value to to be distributed. Indeed, value by producers has been added to material during the production process (the efficiency of this being captured by the value addition parameter) and value has been extracted by consumers during the consumption process (the efficiency of this being captured by the value extraction paramater), and the sum of these processes (and thus parameters) is understood, according to the basic resource efficiency identity, to be the limit of resource efficiency.

This is why it is essential, in order to obtain a value distribution parameter, and achieve distributive efficiency, to separate functionality from total value (that is, functional surface) and total value/functional surface from welfare: without doing this, the opportunity to increase distributive efficiency simply does not arise. Presenting the function carrier as a product, which does not exhibit functional surface since value has not been differentiated from functionality or welfare, is therefore the reason why distributive efficiency is not achievable in current modes of production and consumption.

What needs to take place firstly in order to promote DE is that production is reinterpreted in terms of the functional surface it actually supplies, and thus that products are redefined as function carriers; thereafter it is relatively easy to assess the DE of the function carrier, by empirically assessing the allocation to use consumption of the functional surface.

Note that this ‘reinterpretation’ can take place in two ways: it can take place by means of consumers reinterpreting the products they purchase as function carriers (and, if they want to achieve higher DE for their function carriers, they will share them); or it can take place by means of producers reinterpreting what they sell as function carriers (and if they want to achieve higher DE for their function carriers, they will sell services rather than products).

But to achieve such reinterpretation, each method has evident social-institutional barriers. To encourage the operationalisation of distributive efficiency with products already sold to producers, not only is a challenge to the ownership concept required, but significant efforts to overcome the transaction costs of reallocation of available functional surface through sharing are required. To promote distributive efficiency through products before they are sold requires that producers redevelop their business models - or that a new layer of producers is created - to make accessing functional surface, i.e. use consumption of products without ownership, viable; and this requires a shift away from the assumption that product sales are in any way required or optimal for consumer welfare. Arguably, and this is important in determining where the sensible balance of responsibility lies in any bid to increase DE in society, the redefinition of production output from products exhibiting abstract functionality to function carriers exhibiting actual value

in the form of functional surface is easier for producers than for consumers: and as such a major plank of sustainable consumption is taken out of the hands of consumers.

Existing sales of conventional services fit entirely within this formalism. The functional surface of the service can be calculated in the same way as it is for products: indeed, services are arguably simply products presented in the form of function carriers, and all that is required to ensure distributive efficiency is the calculation of the functional surface allocation.

The final question to resolve in establishing the operational viability of the distributive efficiency concept is how properly it fits into a classic RFA framework. To date the element of RFA that deals with product-specific analysis is LCA. Life-cycle analysis utilises a concept of 'functional unit' as the focus of the study, and the unit can be defined in one of three ways: a product itself (e.g. a washing machine), a functional service action (e.g. a complete wash cycle), or a functional outcome (e.g. 5 kg of washed clothes). It is interesting to note that the concept of functional unit has not itself really been studied in conceptual detail in LCA work. Of what conceptual entity is the functional unit supposed to be unit, and how does that conceptual entity fit into engineering, economic, or social studies more generally? On inspection it is clear in fact that the functional unit is a partial development of the function carrier concept presented in this paper, and the difference between the the physical objects of products and functional outcomes, and the contextualised activity of the functional service action, opens out the possibility of developing the functional surface and distributive efficiency concepts. While LCA is currently geared towards impact analysis of any given functional unit, it can be enhanced to work with the distributive efficiency concept if the functional service action is chosen as functional unit, because functional surface, and its allocation, can be asssessed for that.

4.4.2 Justifying application of tax to low DE

Once the distributive efficiency concept is clear, and we may talk about undistributed value, or even simply wasted utility, we may flip the concept over and consider how such waste occasions 'externalities' across the rest of society, and how to penalise them. For every portion of functional surface, of available utility, that is unallocated to use consumption from one function carrier, consumers must themselves go and buy or access such utility for another function carrier: for example, every car-mile that is unallocated to a potential consumer, due to cars lying idle in garages and parking-lots requires another car-mile to be accessed from another car. It is more than arguable therefore that consumers, wasting the potential utility of their commodities, are forcing other consumers to purchase further commodities, and that this is a form of externality which should be penalised through taxing the waste at source (i.e. taxing unallocated functional surface). While it may be argued that this an infringement of the rights of owners (to use their goods as they see fit), the fact that underallocated utility from the commodities available causes overconsumption of commodities is undeniable, and the parallel to classic pollution scenarios is clear: if a polluter, using their own property of a factory, emits polluting waste that causes a third party to have spent money to remediate its reduction of their welfare, that pollution is classed an externality that should be penalised

through tax. There is no reason in principle why the waste of functional surface should be treated differently to any other kind of waste.

4.4.3 Options for increasing DE

The options for increasing distributive efficiency break down in principle, as described above, to business model innovations which shift product sales to service sales, and private consumers reallocating the available value in their own commodities. But variations on each are possible, creating a spectrum of options for development of high distributive efficiency practices: private sharing schemes (e.g. car-pooling), local community joint ownership schemes (e.g. community gardens), commercial sharing schemes (e.g. tool hire), public-private partnerships (e.g. public transport), and public services (e.g. libraries). Here, obviously, the analysis merges with current studies of PSS advances; but what the availability of a functional surface metric allows is more systematic development and modelling of options, and comparability of different systems. For each of these systems, the overall distributive efficiency properties can be studied by the creation and aggregation of functional surface assessments.

4.4.4 Further exploitation of the functional surface/DE concepts

The potency, integration to RFA modelling, and essential correctness of the functional surface/distributive efficiency approach is demonstrated by the flexibility with which the concept can be extended to apparently unrelated ideas in the sphere of resource efficiency. Recycling is captured in RFA studies by presumed reduction of impacts (by the substitution of previously extracted resources for new resources, and avoided waste disposals) but, if we are to deprecate impact assessment as a major feature of resource efficiency assessment (as this paper proposes), we can reinclude recycling by an extension of the functional surface of a function carrier. If a function carrier has an extended portion of functional surface which is allocated only if the resources applied to the function carrier are recycled, remanufactured or otherwise redeployed, we can characterise the recycling of a function carrier in terms of distributive efficiency or not. This approach expedites, perhaps, or at least clarifies the role of extended producer responsibility (EPR) policy: the responsibility for the optimisation of the latter stages of the functional surface. Note that the policy rationale for giving formal and financial responsibility to producers for the ‘waste’ of resources is, when looked at using a functional surface approach, the same rationale as we have proposed here for taxing the ununused functional surface that that consumers themselves are responsible for: it all adds up to unused resources and therefore requirements for new resources.

Most obviously, the application of a functional surface/distributive efficiency perspective to resource efficiency has yielded a convenient way to handle the shift to services from products, and to capture the efficiency boost of doing so. Regarding the information gaps mentioned above in the RFA programme, distributive efficiency fills to some extent the information lack in the area of social-institutional dynamics. But a further application of the functional surface concept allows us to fill part of the other information gap, that of spatial information. If we view a function carrier as having a range of potential alternative functional surfaces, which may not conflict with (or may require only sight modifications in) the scale of the primary functional surface, we may observe a whole new terrain of sub-optimal resource

efficiency. This is obviously an agenda for multifunctionality. For example, if we define a function carrier as a building, and limit is functional surface to the housing of people, a well-inhabited building may appear to have a high distributive efficiency. But if we extend the functional surface of that function carrier to include alternative functions of the building - use of the roof for solar capture or garden space for example - we perceive new opportunities to optimise the allocation of actually available functional surface. If roof space is not used for solar capture, or gardens (and the roof space itself costs no extra), then extra space will have to found elsewhere. Co-generation/CHP is another example of multifunctionality which is a spatial-physical means of optimising functional surface and distributive efficiency from a function carrier.

Generally, the functional surface concept is highly scaleable and modular. Function carriers can be defined at any level of generality, and as long as there is no double counting their functional surface assessments may be coupled with any other distributive efficiency assessments. As an example of scaleability, a function carrier may be defined as a particular private car's available use over one year, or it may be described as the total availability of cars in a city over the same year. As an example of modularity, if one defines the functional surfaces of of all modes of transport in a region across a year, and multiplies their distributive efficiencies together, a composite distributive efficiency is achieved for a whole transport system. Indeed, if suitable processes can be developed to stabilise a functional surface conceptualisation for consumer-facing sectors such as transport, construction (conceptually easier sectors since the functional surface is relatively clear to define), agriculture/food (conceptually harder sector since functional surface is not so clearly defined), and energy (conceptually hard), we may be able to describe in very aggregate terms the overall systemic distributive (in)efficiency which would be a major boost in resource efficiency analysis. It maybe remembered, for the sake of clarity, that to assess the distributive efficiency of these sectors is not and to attempt to characterise their qualitative efficiency (how much welfare they actual deliver per unit of functional surface actually used): no subjective assessments are involved in the assessment of distributive efficiency, and yet distributive efficiency is not the same as quantitative efficiency (the amount of functionality introduced for each unit of physical input).

A final observation regarding the functional surface/distributive efficiency concept is that, with it as a solid and clear basis for discussion, researchers and policy-makers, can much more systematically and rapidly develop concept and policy packages for the transition to use of services. In the transition to services (or indeed in the increase of multifunctionality, or any other expansion of the distributive efficiency concept), a key criterion must be that the switch to different modes of production and consumption are not inherently punitive. We may therefore propose a principle of use consumption parity (UCP) - meaning specifically equivalent access to the same amount of functional surface between different models of production and consumption. (We may also expand that concept to something such as utility parity for both producers and consumers, if we wanted to ensure that producers saw no less revenue, while consumers saw no less welfare, from a shift to services.) Without functional surface as a guide of available and allocated value, any concept of UCP is highly unstable and we are left with

very generalistic or very subjective guides of what counts as 'equivalent' between different modes of consumption.

5 Conclusions

This paper is a bid to correct the misplaced emphases and identify information gaps in the RFA research programme, and in particular a bid to remedy at a high level of generality the lack of information from the spatial and social-institutional domain in order to yield a 'use efficiency' parameter for overall resource efficiency assessment.

Specifically, we have observed how fundamental problems in the assessment of impacts make it sensible to remphasise the role of resource intensity reduction over and above that of impact intensity management, and indeed, thereby, to mark a new human-system-focussed consumption-specific phase in environmental sustainability in distinction to conventional, natural-system-focussed impact-specific efforts. We have observed further how the use of monetary indicators in RFA is very problematic, both in terms of accuracy of measurement and in terms of clarity of what is being indicated (indeed desirability of what is proposed). We have also observed that the RFA programme is significantly limited in terms of key information areas, and as such is incapable of really offering an actual resource efficiency assessment: actual welfare delivery, social distribution of wealth, physical resource productivity measures, geographic and social contexts of consumption, and finally social and spatial intensity of use.

RFA was developed as a research paradigm that was pragmatically geared towards understanding on what humans actually do with resources and how they derive value from them - names such as 'industrial ecology' and 'industrial metabolism' imply this. However, RFA in our view is in danger of being subsumed as a subset of impact studies on the one side, or sidelined as a corrective to standard monetary-economic studies; and in both respects, therefore, losing its essential character as a physical-empirical programme of research, focussing in particular on the dynamics of human systems (and less on the character of natural systems, already well covered in other disciplines). Above all what is lost from view behind these impact and money emphases is a focus on the physical dynamics of resource efficiency, in particular measures of intensively produced commodities are actually used.

What is perhaps ironic, and certainly disappointing, is the contrast in RFA studies between the readiness to proclaim the pragmatic value of the RFA programme, in superiority to other approaches to the environmental crisis, indeed to talk about its great potential as a management tool and policy generator - and the actual specifics of management strategy or policy recommendations (and thus almost complete lack of policy implementation). Missing most of all is clear and compelling policy advice on how systemically to advance the uptake of product-service systems of consumption and other intensifications of the use of commodities. Impact and money emphases, and lack of attention to use intensity, make the resource efficiency claims of RFA actually very weak, and hard to implement in any case.

In mitigation of the problems of the RFA programme, we have observed above that the essential problem confronting RFA in its search for a 'use efficiency' measure is the native concepts of value that society utilises:

either a physical notion of functionality or a subjective experience of welfare. If the former conception is used, use efficiency would appear to be captured by the somewhat absurd ratio of persons per product. If the later conception of value be used, we implicitly need to construct an indicator of welfare achieved per unit of production, which being impossible we replace with a ratio of monetary value per unit of production. This however is not an efficient or reliable indicator of 'use efficiency' as we have shown above.

So, the contribution of this paper starts by formally separating from each other the physical *functionality*, contextually-defined *total available value* (measurable as *functional surface*), and subjective *welfare* associated with any *function carrier*, making it explicit that measurement of the efficiency in the production of functionality, distribution of value, and experience of welfare are different parameters which together to form a *full-system resource efficiency* measure. The exploitation of these concepts relies on separating *purchase consumption*, which is taking into ownership of physical functionality, and *use consumption*, the actual accessing of available value, of a function carrier. The total available value, and thus functional surface, of a function carrier is the product of the *synchronic use consumption potential* of the function carrier (i.e. its capacity to offer value at any one time) and the *diachronic use consumption potential* of the function carrier (i.e. its capacity to offer value across time).

The 'use efficiency' concept that is being grasped at in PSS and dematerialisation work has been now formally defined as the ratio of actual value allocated to use consumption to total value available from a function carrier, or more rigorously as the proportion of allocated functional surface to total functional surface, and termed *distributive efficiency*.

Further, we may now note that the achievement of distributive efficiency radically expands on conventional approaches used to improve 'use efficiency', e.g. attempts to promote sharing and/or increase the service-intensity of production. Rather than sharing, which tends to imply in unspecific and unguided terms more persons per product, the better allocation of functional surface is a much specific recommendation which allows for both sequential intensification of functional surface allocation (e.g. car-sharing schemes with multiple *sequential* users, and limited non-use time), or simultaneous intensification of functional surface allocation (e.g. car-pooling schemes with multiple *simultaneous* users), within the actual limits of available value. Service-intensification as a pragmatic concept is translated into a transparent process of simply increasing the allocation of any function carrier's functional surface; and while this approach adds specificity, it does not rule out flexibility (since functional surface can be better allocated either simultaneously or sequentially, or a combination of both).

A particular benefit of the distributive efficiency approach to improving 'use efficiency' is that the problems of the R/Y indicator are resolved. As we have observed, improvements in the aggregate R/Y indicator could indicate merely more services being consumed in a growth economy, or alternatively more expensive premium products, rather than any shift to actual product-service-system use of products (and thus increased 'use efficiency'); and in any case confusingly bundles up into the presumed 'use efficiency' indicator of R/Y, the production-level resource productivity indicator of R/Y. Distributive efficiency, the ratio of allocated to available functional surface,

does not get lost in these ways. If, for an economy, the R/Y ratio improves over a given period, that is the amount of monetary value created increases as resource use stays stable, we have no way of knowing (even assuming that this effect is not to do with market distortions or factor substitution, or even to do with actual resource productivity of production, at the micro level), if any unit of production is actually being *used* better. The additional value could simply be from the consumption of services (e.g. cinemas) which are inherently lower resource intensity per unit of value, but consumption of which does nothing to improve the 'use intensity' of cars, homes, buildings, land, space, energy, and so forth. However, with the application of the distributive efficiency measure, we actually know - assuming that we have calculated the aggregate distributive efficiency data for an entire economy - whether there is an actual increase in the 'use efficiency' of production.

Given the above, we now note that the distributive efficiency tool is useable for product -specific analysis of possibilities in terms of sharing and the shift-to-services, as well as aggregate level analysis of the overall 'use-efficiency' of human systems. It allows technical modelling of alternative scenarios for the shift to services, and thus supports policy development. It further supports policy, by simplifying the development of secondary concepts such as *use consumption parity*, which can be graphically designated and compared across various models of product service systems. One powerful policy contribution of the functional surface approach is the vivid justification it provides for fiscal or regulatory penalties of low distributive efficiency: it is clear that wasted functional surface implies just as much of a socially externalised cost as does uncosted waste resources at the production stage are an externality.

Indeed, we have observed the extent to which the function carrier/functional surface/distributive efficiency concepts are not only highly scaleable and indeed modular (allowing integrated analysis of different sectors or activities), but flexibly applicable to both highly complex contexts (e.g. energy transmission of all modes) and sectors where 'use efficiency' might be considered hard or unnecessary capture (e.g. education, public amenities, office buildings). It brings public sector analysis clearly into the fold of service-type studies, and is relevant to final consumer consumption and intermediate business consumption.

If we consider the general treatment of the same problem – managing optimally the stock of resources, or handling of the 'service intensity' concept, and so forth – in various abstract treatments such as those found in Daly (96), Jacobs (91), Femia, Hinterberger, and Luks (99) and elsewhere – we see this approach offers a concreteness and manipulabilty which was considered unfeasible in those studies.

Perhaps the best demonstration of the power of this package of concepts is their extension to capture such apparently unrelated ideas as recycling and EPR, and multifunctionality. By extending the synchronic use consumption potential axis of the functional surface graph, secondary functions can be added to the function carrier; by extending the diachronic use consumption potential axis of the functional surface, the capacity for recycling/remanufacturing/reusing the physical components of the function carrier is linked to the main lifetime and value of the product.

Through these various means, this approach to the challenge of including physical and social-institutional information - above all capturing and optimising some kind of 'use efficiency' metric which is, intuitively, obviously required to properly assess resource efficiency, and lies between the physical resource productivity and welfare intensity of resource consumption - is significantly met, at a high level of generalisation, and in a manner fully integrable with the physical resource productivity and welfare intensity parameters.

The fully-system resource efficiency measure described above, if operationalised, and certainly the distributive efficiency measure offer some hope that policy makers, indeed producers and consumers, are more able to observe, measure, penalise and reduce *systemic waste*: the fact of abundant produced value which is never used, and yet is capturable neither by a conventional resource productivity nor a welfare intensity measure and thus lies unmeasured and unconsidered. Certainly, with these corrections, the RFA project can be reset on a fully empirical course, which is what the founders of this tradition, e.g. Geddes, had in mind.

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