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Authors were provided a format and clear instructions for lay-out. Most authors followed these instructions very good, leading to a consistent presentation of most of the individual papers. Due to the large number of papers, the editors were unable to embark on the time consuming process of adjusting any lay-out errors in papers submitted. Papers had to be reproduced here in the lay-out in which they were submitted, and where authors did - or could - not follow our instructions this may have lead to slight inconsistencies in presentation.

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CBL II *Hybrid Design*. Encoding biological principles in sustainable design

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1 Introduction

Nature has always been an inexhaustible source of inspiration for the design of artefacts. Indeed, several scientific and technological progresses have been inspired by the observation of nature. Nature-inspired design, known as biomimetic, aims at design artefacts and devices with logic imitated from living organisms. This has led to the design of innovative self cleaning paint, smart textiles or bio-robotics.

Today, the advent of extraordinary scientific discoveries and technological progresses in the molecular basis of biology along with the summoning technological innovation, offer a unique opportunity to explore and comprehend logic and principles beyond the natural design. Understanding the biological language by which systems are build in nature may open new avenues to design novel artefact which not only copy the biological features, as biomimetic requires, but encode biological logics and principles in their realization and maintenances. This leads to a shift in the paradigm of the biological inspired design. We should ask our self not only 'how nature does it' but rather 'how nature develop it'.

As the discovery of biological language proceeds we shall see artefacts and services designed by encoding biological principles.

This new way to approach design, which is not a mere copy of few function inspired from living organisms but rather a composition by using biological language, may be defined as *hybrid design*. Therefore, *hybrid design* is a new design approach, which products are hybrid because they conjugate biological and technological logics, but also because they tend to identify in their intimate essence object, matter, performances and maintenance.

For instance, encoding biological principles like self-organization, autonomy, redundancy, self-adaptation could offer the new keys for an innovative sustainable design appropriated to "survive" in the techno-biological era.

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The paper is aimed to introduce the *hybrid design* approach illustrating a multidisciplinary methodology, the design strategies and some experimentations.

2 *Hybrid design* approach

2.1 The evolution of bio-inspired design

Many of the most important advancements in the human history have been induced from the observation of natural phenomena and shapes. But it was mainly inside the Modern Era that nature becomes a scientific model, capable to affirm the rationalist project behind the other technical disciplines of the XX century. To the end of the 1800's Oratio Greenough established the theoretical bases of the functionalism in architecture and design, putting in direct connection design and nature techniques. To the end of the '50s of the past century the bio-inspired approach was theorized through the concept of bionic. The term bionic was used for the first time by the US Air Force researcher Jack Ellwood Steele, in 1958. He defined it as the "science of the artificial systems whose functionality is based on the natural ones" (Vincent J. F. V., Mann D. L. 2002).

Bionic science interpreted the natural structures operation like perfect "mechanisms", of rigor and static exactness. However, the imitation of nature like an essentially static model represents the main limitation of the classic bionics.

In the last decades of the XX century important advances in science and technology have led to the development of new tools able to investigate in fine details the biological structure and functions. This has allowed engineers to better understand biological structure and function and use them as inspiration and guidelines for developing technological innovation (Vincent, 1992). Since the '80s, mainly among the communities of material engineering, mechanics and robotics, a new nature-inspired design approach, named biomimetics, was diffused. This new approach, based on a multi-disciplinary platform, proposed to inquire nature and its process, to extract guidelines for the design and creation of innovative artefacts. The first European biomimetic researches centre was founded in the University of Reading by Prof. Julian Vincent After this many other centres have been established and now the biomimetic approach is widely diffused worldwide.

2.2 The *hybrid design*

The evolutionary success of any living organism is founded on a complex orchestration of redundancy, self-adaptation and autonomy that science is just about to recognize and explain. The great progresses gained in the fields of material science and computer science technologies concur today to create artefacts more and more complex, therefore more and more similar to biological systems. Now we are definitely inside the new techno-biological era theorized by Kevin Kelly (Kelly, 1994).

Thanks to the progresses obtained in the last few decades in the most innovative areas of biological sciences, like molecular biology and genetics, the logic and the principles of this complexity are being discovering. Today biologists are becoming able to de-codify the ‘lexicon’ and the ‘grammar’ through which biological information are transmitted.

In the *knowledge era,* bio-inspired design cannot be reduced to interpret the relationship between nature and design in a static and determinist way like the classic bionics.

Hybrid design is a new bio-inspired design approach that aims at the design of innovative products and services by encoding biological complexity. By following this approach, the design culture can be enriched by the intelligence and consistency of the biological processes. In order to reach this objective can be useful to refer to the so called 'sciences of the complexity' and 'contemporary biology' (Langella, 2003). Dupuy defined the 'contemporary biology' the most revolutionary science of the XX century (Dupuy, 1982). He alluded, in particular, to its multi-disciplinary character, that allows to inter-weave thick wefts of relations between the various aspects of the reality.

Inside the "new paradigm of complexity", new concepts were elaborated, by which a new interpretative model of the reality capable of "disclose the complexity without reductions" were proposed (La Rocca, 1997). This paradigm introduces new biological qualities like: self-organization, autonomy, redundancy, self-adaptation, tensegrity. *Hybrid design* aims at the design of innovative products and services which encode these qualities.

2.3 Encoding biological qualities in the design

In the *hybrid design* approach the complex constitute qualities of the biological world can be translated in the design of artefact and services like a sort of "new genetic code". This is possible today thanks to the close connection between science, design and technology.

While other kind of bio-inspired design approaches, like classic bionics, are aimed to emulate shapes, structures and functions from nature to create a faithful replica; *hybrid design* seeks to design solutions and systems that intrinsically recapitulate the basic nature principles but not necessary emulate in shape and function the biological systems.

At the molecular scale nature works with systems of coding and de-coding of messages that concur to specialize the structures in a flexible way. In the artefacts world, the functional specialization tends to be a limit because it means irreversibility, fast obsolescence, unfavourable factors in terms of environmental sustainability (Manzini, 1986).

In nature, thanks to the languages and the complex codes used in exchanging information, and in the derived self-organization processes, specialization means flexibility and reversibility, therefore compatible with varying of user requirements and of external conditions. Transferring this behavioural complexity to the project in the actual scenario, where requirements and conditions change rapidly, opens new paths for an innovative design, that will also be environmentally sustainable.

In this transfer we can not avoid to include cultural, economic and technological factors tightly connected with the design.

In the field of materials science the application of a bio-inspired approach concurs to create *hybrid* materials with unusual characteristic, that go beyond the conventional and recognized categories of materials families such as composites imitating the wood structure, light and elastic honeycomb ceramics, insulating metallic foam. These novel materials are all conceived by a combination between technological innovation and biological knowledge.

2.4 Blending objects, matter and performances

In the *hybrid design* approach the most advanced conquests of material science and of productive technologies meet together with the complexity of the biological process and with the strategies, tools and methods of the design for sustainability. Acquiring the codes and the languages from nature new *hybrid design* tends to the biological systems in their "flexible functionality". New materials become multifunctional complex systems that conjugate the environmental requirements of de-materialization and mono-materiality with the biological qualities of multi-functionality, redundancy and hologram principle.

Functionalised matter tends to melt with the performance and to identify the product, removing the conventional differentiations between object and material and between object and function.

This kind of innovation has involved, for instance, the field of new textile materials and thin flexible films that become complex, sensible, capable of including information and self-maintaining, but over all multi-performance.

Through the application of electroluminescent films, for instance, is possible to create with unique material a multi-performance system that replaces systems constituted by various elements.

Therefore products and services of *hybrid design* are hybrid, not only because they are techno-biological, but also because they have a tendency to identify, in a unique bulk, matter, function and object.

2.5 *Hybrid design* methodology

Hybrid design approach is characterized by inter-disciplinary researches that require the participation of various experts coming from disciplinary areas like design, biology, materials engineering, physics, chemistry, marketing and sociology. In the design process the designer, thanks to its cross-sectional competences, should have a coordination role, to verify integrations between the various competences, the coherence with the design concept and with the market demands and to manage the continuous scale.

To encode biological quality in design the designers have to link, aided by the other actors of design process, the project problem with analogous problem solutions existing in nature.

In many cases technologies and the materials able to transfer strategies, languages and solutions already exist. But they need links, the keys of reading of problems and answers, to become real products.

In *Hybrid design* we have considered six levels of homology relation listed according to an increasing complexity:

1. - architectonic level, in which the homology refers to structure constructed from living organisms like stream bed, animals lairs, spider net;
2. - morphological level, in which we can emulate the morphology of bio-structures like cells, bones, tissue, shells;
3. - biochemical level, in which we can transfer the biochemists mechanisms observed in biological systems like camouflage mechanisms, effect of luminescence, photosynthesis;
4. - functional logic level, in which we imitate the basilar logics of biological systems, like animals mechanisms of thermo-regulation;

5. - behavioural level, that refers to the transfer of behaviours like reactive, or protecting behaviours;
6. - organization level; that constitutes the higher stage in terms of abstraction and complexity that consists in transferring organization strategies of the biological systems like redundancy, adaptation, autonomy, self-organization.

To favourite the connections between various disciplines and the born of intuitions interchange tools are needed. The TRIZ method, carried out in Russia in the '80s to promote and facilitate connections and exchanges of competences between engineering and other disciplines through a database interrogation, was transferred to bio-inspired design by researches of the Centre for Biomimetic and Natural Technologies of University of Bath (CBNT). Their BIOTRIZ is particularly useful to realize projects of fertilization between design and biology (Bogatyreva and Bogatyrev, 2003). The method, born in an engineering ambit, should be extended to the industrial design sector, integrating technical aspects with the contributions of social, cultural, marketing ethical, ecological points of view.

Hybrid design requests at the same time a scientific and humanistic approach. According to these considerations we have elaborated a methodological approach schematized in phases as follows:

1. Individuation of the reference scenario and of the design problems to solve;
2. Definition of the design brief;
3. Elaboration of a list of biological systems useful to solve that specific problems. In this phase the intervention of the biological world is necessary. Therefore the aid of interconnecting tools like the CBNT BIOTRIZ are needed;
4. Definition of the design correspondence between design required characters and biological principles, logics, codes and the strategies. It is important to remember that in this phase more than in the others, the designer cannot leave out of consideration cultural, historical, social and economical dynamics that take part in the specific contest;
5. Definition of the inspired-design concept. It could come also from various biological, even observed at different homological levels;
6. Development of the final design solution as the translation of all the considerations;
7. Engineering, prototype, and eventually patent and production.

Inside the "Design della materia" course of the Bachelor in Industrial Design of the "Seconda Università degli Studi di Napoli" we are actually carrying out a design experimentation to verify the showed approach and methodology.

3 *Hybrid design* and environmental sustainability

3.1 The role of *hybrid design* in the evolution of the *design for sustainability* culture

The topic of environmental sustainability applied to the design culture raises important problematic concerning the doubtful relationship between human activities and natural delicate equilibriums. Following the *hybrid design* approach, solution to these problems should be found in the observation of the natural world and in its developing logics. Through bio-

inspired design, the industrial production can be oriented towards new designing and producing mode, truly compatible with the biological cycles regulating life and environment. Living organisms survive when they are able to establish a balanced equilibrium with their environment. External substances supplies, as well as waste disposal, are not necessary because everything will be re-used and re-integrated into the natural cycles. Natural timing is controlled by this "matter and energy balance". Furs mutation, and foliage correspond to the seasonal rhythms.

Encoding biological logics and principles in design means transfer natural approach to realize and maintain living systems. So we have a shift in the paradigm of the biological inspired design. A designer should ask himself not only `how nature does it' but rather `how nature develops it'. Nature comprises precious examples of life maintenance strategies, principles and logics, besides to structures and morphologies. Therefore, natural systems are more likely to be a reference point for their intrinsic complex dynamics (development) rather than for their physiological function (homeostasis).

Translating nature principles, validated from billion years of experience (Vincent, 1992), into design could allow us to generate products, processes and systems that will be ‘adapted’ to live on the earth. Biological systems are able to manage material and energy resources, required for the various vital functions, in a dynamic and self-adaptive mode.

Every service, object, or systems of objects, can be compared to an organism in which all the elements, having different life cycles, are connected each other by complex relations. Frequently the various elements of a product are characterized from different durability and obsolescence times. The selection of materials to use and, eventually, their design, needs to preview for the various technical elements different life cycles. Prefiguring such cycles is necessary to dedicate the maximum attention to their environmental impact and to their duration, that must be compatible with that previewed one, in relation to the specificities of the employment (Manzini and Vezzoli, 1998).

Today, therefore, the *design for sustainability* should operate at system level in order to obtain more effective advantages imprinting new models of offer and consumption oriented to the achievement of high satisfaction levels with low environmental impact. (Vezzoli, 2004)

Hybrid design applies tools and strategies elaborated inside the ‘design for sustainability’ discipline, but is also oriented to inspire innovation in this field, indicating new solutions and new paths for the research, through, synergic and osmotic relationships.

Frequently in the sector of new material science the research, oriented to obtain high performances, is mainly indifferent to the arguments of environmental impact in their life cycle.

Nature realizes materials often resistant, light and tenacious but, differently from humans, they are produced consuming low quantity of matter and energy and always based to renewable resources. The spider silk, for instance, has a specific strength 5 times greater than steel. This material is produced in the abdomen of the spider at environmental temperature and pressure, from raw materials easy finding like insects, without dangerous emissions and wastes. At the end of the life cycle, then, it is totally

biodegradable. Actually many biomimetic companies, like *Spinox* and the *Nexia*, are trying to carry out new materials inspired to the spider silk.

Are just these the strategies that the design for sustainable culture have to emulate. Biological systems should teach their principles aimed to the autonomy of artefacts in their entire life cycle, in terms of closing energetic cycles of the resources (McDonough W., Braungart M., 2002), of self-repair and self-monitoring qualities.

In the materials selection *hybrid design* proposes a scenario of new materials inspired to the nature in their technical performances but also in that environmental ones too. New high performance and eco-efficient materials: a great chance for the culture of the design. An important opportunity for all those designers who think that to design in a sustainable way doesn't mean to limit themselves using merely traditional and unprocessed materials, renouncing to the conquests of technological innovation.

4 New biological qualities for the design

4.1 Autonomy and self-organization

Thanks to the Maturana and Varela's researches the discipline called 'contemporary biology', has redeemed the autonomy of living organisms establishing that environment does not determine nature of the systems in itself, in its unit and identity. That is, indeed, the same system to select, between all the stimuli and the possible interactions inside the environment, those permissible and those not permissible regarding their own organization (Ceruti 1987).

Many living systems are capable to modifying their own characteristics in function of external factors changing, to survive to them. That is what happens in many self-repair processes of many plants and animals.

Currently many researches are trying to create self-repairing materials at various scales like "bleeding composites". These are composites realized with various matrices, concrete too, including hollow fibres, containing repairing agents like glue. When a crack starts provoke the opening of fibres and the consequent release of the adhesive to immediately close the fracture. The self repair quality concurs to avoid to replace objects or parts of them and, therefore, to use new resources and to dispose those damaged.

Autonomy from cleaning and maintenance are important qualities also from an environmental point of view, because of the reduction of associated emissions to the process of cleaning.

One of the most famous biomimetic patent is the l*otus-effect*, that imitates the self-cleaning property of the lotus leaf (Nelumbo Lucifera), curried out from the researches leaded by Wilhelm Barthlott, director of the Botanical Institute of the University of Bonn, begun in the '70s. Emulating this type of structure the *Ispo* realized *Lotusan*, the first self-cleaning varnish applying *lotus effect* licence, on the market from 1999. Afterwards the same licence has been applied to other products like the self-cleaning coating *Aeroxide*, and the *Pilkington Active* self-cleaning glass that unites the *lotus effect* with the *photoActiv* technology, which, through a photo-catalytic process, activated, by the solar radiation, the decomposition of dirt particles, so that they can more easy been cleaned off.

4.2 Closed cycles

To learn to design from nature means also applying the close cyclic times biological processes. There is a substantial difference between human and nature approach to produce. Humans realize their own artefacts taking raw materials from nature and transforming them to obtain products that, at the end of their life cycle, become not more usable wastes, emissions that are accumulated into the environment. Nature, instead, takes its own raw materials, transforms them and realizes products that grow, reproduce and at the end of their life re-enter into biological cycles reintegrating them. In nature everything is reused or recycled (Benyus, 1997).

The cyclic time concept is connected to the biological time. Natural processes are cyclical shaped, the wastes of some systems become resources for others.

In the selection of the materials to use, designers should considerate their renewably degree. A renewable material is capable to "living again" more times.

The attention to the temporal cyclic of materials induces to use recycled and recyclable materials, materials coming from renewable or biodegradable sources. Biodegradable materials, like PLA-based polymers, should be used in short life cycles products, such as packaging or disposable products. In these cases, the aptitude of material to disperse itself in the environment concurs to avoid the increase of solid waste accumulation in environment.

4.3 The *principle of hologram*. Designing for sustainability from nano to macro

Living organisms are based on a principle defined the *principle of hologram complexity*, which asserts that: not only the part is in all, but there is also all included in the part (Morin and Le Moigne, 1999). An example of this principle is represented by a cell, that is part of the organism, but contains the genetic information of all organism.

According to the biological metaphor, artefacts can be seen like organisms, in which any element participates to a total design strategy applied to the infinites levels from the nanometric dimension to the macroscopic one.

An interesting example that corresponds to this type of approach is constituted from the line of products for swimming, *Fastskin* by *Speedo,* in which the strategy oriented to maximize the swimmer athletic performance is reflected into the fabric microstructure that imitates the shark skin, into the design of the wear differentiated in function of the different anatomic parts and also in the brand design and graphics.

4.4 Redundancy

Biological systems are characterized by redundancy, that help them to survive also to the most unexpected and dangerous events, answering with elements or "apparently superfluous" characteristics, whose existence finds justification just in these cases. Frequently sustainable design strategies are oriented to minimization. Redundancy concept seems, therefore, in contraposition with this kind of approach. But in many circumstances, redundancy constitutes a very effective solution to avoid wastes of resources. For example, the use of various protective film layers on high perishable

materials aid to extend durability of the product retarding substitution with consequent environmental advantages.

4.5 Multifunctionality

Redundancy can also be interpreted in terms of functionality. In nature many elements are multifunctional. Environmental conditions change continually, so biological systems to prompt adapt to external changes require multiple pathway. Some insects, for instance, have six legs, every couple of them has a different function in various activities.

Multifunctional, or functional redundant, can be easily adapted to various applications and, therefore, they are capable to survive longer.

Integrating various functions in a single product offers many environmental advantages because save material and energetic resources necessary to realize the various elements replaced by the multifunctional product.

4.6 Tensegrity

Natural structures follow a logic defined "Minimum energy structures" (Van Hinte and E., Beukers A.,1999). In the design sector this kind of logic becomes a large experimented design strategy, today particularly attractive because of the agreement with the sustainable claim of de-materialization. The honeycomb structure, for instance, is one of the most light and resistant structures in nature. It has been transferred in many sectors to lighten structures of building elements, furniture. Buckminster Fuller used the term tensegrity to represent rigid systems of combined compressive and tensional integrity, exhibited in biology by internal certain cellular architectures and bone muscle-tendon systems (Fuller, 1981). The word derives from a contraction of the terms tension and integrity. The combination between these two concepts determines structures using distributed tension to hold islands of compression. Today the concept of tensegrity is often used in biomedical research to build computational models predicting dynamic behaviours in living cells.

4.7 Chromatic metamorphoses e

Sometimes nature uses colour like a vital organizational strategy. For instance, in camouflaging organisms colour can be used like a survival opportunity.

In many cases the colour variation is not due to a pigment modification but to one particular kind of coloration defined structural colour. With this definition is indicated a visual effect coming from a micro structural changing in the animal skin, as a reaction to solicitation. The specific colour optical phenomenon is named diffraction of Bragg and determines, for instance, the chromatic change of the peacock feather, of the *Morpho* butterfly wings, or of the skin of squid (Fudouzi and Xia, 2004).

It is possible to imagine many different applications for the principle of structural colour, capable to generate variegated colour effect with a unique paint, or coating. It could be an interesting and environmental sustainable opportunity in terms of expressive and linguistic opportunity for designers.

There is another modality that concurs to obtain various colours from an only monochromatic support: the colour-changing materials that change their colour if they are stimulated from a temperature, luminance or electric solicitation. Colour-changing inks are the most common and diffused

application of these materials. Various types of inks exist, for different materials and printing processes.

4.8 The intelligence of the things

Are defined intelligent, or smart, materials and products capable to interact with users and environment. Smart materials change their property responding to various kind of stimuli (mechanic, acoustic, thermal, luminous, electrical. The main objective of smart materials researches is animating matter, commonly inert, with biological capabilities to ` feel' and ` react' (Amato, 2003). Smart materials are endowed with these living qualities inserting sensors and actuators that could be compared to the systems nervous and muscular or to immune systems, capable to react to stimuli to aid living organisms to avoid damages and to survive.

Shape memory polymers and metallic alloys, for instance, are capable to return to the original shape, acquired during production, as a result of a temperature transition. They are used to activate mechanism responding to an increasing of temperature like active solar shading or fire protecting systems

Magnetorheological fluids (MRF) and electrorheological fluids are other kind of smart materials. They are controllable fluids, which viscosity may be changed by the action of external magnetic or electric fields. The increase of external magnetic or electric field strength causes the increase of magnetorheological and electrorheological fluid viscosity.

4.9 Adaptability

To evolve and survive to changeable endogenous or exogenous conditions, living organisms tend to modify themselves trying to adapt to the new environment. Taking from nature this kind of approach is possible to extend the life of products making them adaptable and updatable to the change of environmental context, technological scenario, economic circumstances and socio-cultural user conditions.

Adaptability is one of the main qualities of smart materials, like piezoelectric used, for instance, to make adaptive motors in aero-spatial sector being able to adjust themselves for mismatched tolerance that can occur after mechanical or thermal traumas.

5 Overall conclusion

Researches carried out in the field of biomimetics open an immense scenario of references and opportunities for design like new materials or fabrication processes to transfer.

Nevertheless the most interesting opportunity coming from bio-inspiration would come from translating nature complexity in the design culture, emulating logics and languages from a conceptual point of view.

Hybrid design approach proposes new paths oriented to conceive half biological and artificial products in which eco-compatibility will be the major challenge.

Hybrid design products imitate nature observing it in a dynamic way (development), instead of in its quiescence state. They emulate the whole maintenance approach of living organisms rather then production phases.

To improve in this direction a cooperation between design, science and industry is crucial.

In their fertilizing processes this sectors have to be opened to dialog and to re-interpret their conquests, objectives and limits, finding new common languages and interchange tools.

It could be useful to promote trans-disciplinary initiatives like workshops, design competitions, meetings and researches in order to experiment and verify the infinite opportunities offered by this field.

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CBL II Linking Policy and Practice in Sustainable Production and Consumption

An assessment of the role of NGOs

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1 Introduction

This paper reviews the role of NGOs in work on Sustainable Production and Consumption and how that work impacts on policy and practice. The paper looks at what NGOs have worked to achieve, at what is being delivered and the obstacles being faced.

It will draw on this work to identify lessons for policymakers seeking to engage civil society in changing consumption patterns and make recommendations on how academics and other researchers can co-operate more effectively with civil society and local government.

The basic insights of the paper are drawn from recent studies on stakeholder involvement in the Marrakech Process. These evaluations "from the outside" form the first part of the paper (chapter 3). The second part (Chapter 4) is based on a series of 22 surveys and semi-structured interviews carried out in September 2006 with NGOs from 16 nations in the UNECE region.

The questions that will be addressed in the paper are:

- How effective are NGO's in delivering policy change?
- Do they have a role in infrastructure and of so how significant?
- Do their approaches to engagement (based around environmental concerns) need to change / develop to deal with Sustainable Production and Consumption?

2 Sustainable consumption as a global challenge

Moving towards sustainable consumption will require two developments: First, sustainable consumption requires an increase in the *efficiency of consumption*, which can be reached via technological improvements. Improvements in the eco-efficiency of consumption mean a reduction in resource consumption per consumption unit due to improvements in

production processes or an efficiency friendly design, for example. Often, these improvements are win-win scenarios. Improving the efficiency of consumption can be seen as the necessary prerequisite for achieving sustainable consumption.

However, existing limits to Earth's resources and to its capacity to serve as a sink for pollutants mean that *efficient* consumption can only be a *weak* version of sustainable consumption. As research on the so-called rebound effect has documented, achievements based on efficiency alone are very often overcompensated by a growth in consumption volumes. In consequence, a second development needs to take place to provide a sufficient condition for sustainable consumption: changes in consumption *patterns* and reductions in consumption *levels* in industrialized countries. This sufficient condition requires changes in infrastructures and choices as well as a questioning of the levels and drivers of consumption and can be called *strong* sustainable consumption. (Fuchs/Lorek 2005) UNEP refers to it as the principles of dematerialization and optimisation. (UNEP, 2001)

3 NGO contributions to sustainable consumption – observed from the outside

NGOs are seen to play a strong and active role in the various campaigns to promote sustainable production and consumption. Many NGOs do ask the politically sensitive questions regarding consumptions patterns and levels. Moreover, they contribute to the development of strong sustainable consumption governance by promoting the diffusion of alternative lifestyles and values. (Fuchs/Lorek 2005)

In its study "Consumption Opportunities" UNEP describes the tasks of civil society (NGOs) to support Sustainable Consumption in the following way:

- lobbying, cooperate monitoring, education, and information sharing to support dematerialization as well as
- conscious choosing, conscious using, civic participation, cultural resistance, religious and spiritual development, and local debates to foster optimisation. (UNEP, 2001)

This makes NGOs different from other relevant stakeholders – principally governments, governmental organisations and business – which concentrate on activities towards dematerialisation only as elements of their strategies. (Arndt/Witt 2006a)

Beside the difference in their levels of ambition environmental, development and consumer organisations are seen as being among the few stakeholder groups which direct all or at least most of their activities towards sustainability. (Arndt/Witt 2006a) The activities by NGOs are thus of special importance because of their potential influence on societal values. Arndt/Witt observed that direct influence on consumer is highest from consumer organisations and environmental organisations. Environmental NGOs not only create activating methods of campaigning. What helps them appear reliable at a practical level is that they motivate their own members and employees to shop and travel sustainable and support individual

sustainability commitments that reflect lifestyles rather than shopping habits. (Arndt/Witt 2006b)

3.1 Levels of activities

Sustainable consumption work by NGOs is playing a vital role at every level.

On the local level they run public awareness campaigns, develop practical initiatives and search for better consumption opportunities in collaboration with local governments and local suppliers.

On national level they are active lobbyists influencing regulations and other framework setting for more sustainable consumption and working to phase out unsustainable consumption opportunities.

On the international level NGOs push towards far reaching agreements and documents that encourage framework setting at the national level.

A survey among sustainable consumption entrepreneurs (active on the international level) identified the regional and local initiatives as a success factor for the whole process. These initiatives are seen to influence policy makers from the bottom up. DeWit expect main institutions are more than open to listen to these initiatives especially when the lack if confidence of citizens in official institutions is high. Local and regional initiatives are seen to make a difference and are key to make the change. (De Wit, 2006). The value and impact of local action by NGOs has been assessed in the UK where clear environmental social and economic benefits were noted (Church / Elster 2003).

The different levels still need to establish better possibilities for exchange of information and ideas and to ensure transparency. It is quite likely that the sum of practical behavioural and infrastructure changes at the local and regional level that will make a lasting difference. But also it will be the political processes that ensure that good single examples and cases become common practice and support the development of a common and agreed policy.

3.2 NGOs at the international level

Within the political processes, work on sustainable consumption is still quite informal even if conferences and meetings - like in the Marrakech process - show formal elements. (Batterink, 2006) Politics in a globalizing world generally is no longer characterized by the interaction between states as the primary political actors. Non-state as well as supra-state actors are increasingly acquiring political decision-making capacity and authority, too. In particular new opportunities appear for active and to some extent autonomous roles of IGOs, business, and civil society in the design, implementation, and enforcement of standards and regulations. Scholars speak of “global governance” i.e., global problem-solving and rule-setting that takes place even though a global government does not exist. (Fuchs/Lorek 2005) As there is not one single, stable, central actor the interaction between all of them is strategic and helps build a policy network on the meso level. (Batterink 2006)

As mentioned above, business as well as IGOs and national governments (of industrialized countries) intend to frame sustainable consumption in terms of improvements in efficiency so far. Win-Win scenarios and "picking the low hanging fruits" are dominating the agendas. This is rooted in the weak position sustainable consumption still has in the ranking of business and governments (compared to issues such as growth). And as IGOs depend on image and financial resources from the former ones not too much can be expected from this side. De Wit argues the concept of Sustainable Consumption is still so vague because main players are scared with to clearly identify their opponents. Only the NGOs do not always choose the diplomatic way but name their opponents. NGOs base work on their own convictions and blame their opponents where their convictions run counter the to cultural norm and values, e.g. (De Wit, 2006)

The status of NGOs is based on their image and support as is also the case with policy makers and entrepreneurs. But this is evaluated by their supporters according to other criteria. NGOs have to fulfil their function of controlling and showing their opinions in a watchdog role. So INGOs are seen as the controllers of the progress on one hand but they have failed to put pressure cooperatively on the governments and business on the other. (De Wit, 2006)

A recent study lists six INGO's as the most important ones working on sustainable consumption (De Wit, 2006):

- Consumers International (CI)
- Friends of the Earth (FoE)
- International Coalition for Sustainable Production and Consumption (ICSPAC)
- International Institute for Environment and Development (IIED)
- North American Sustainable Consumption Alliance (NASCA)
- Northern Alliance for Sustainability (ANPED)
- World Wide Fund for Nature (WWF)

Chapter 4 reflects the status of sustainable consumption work and NGO activities from an internal perspective, based on a survey done among ANPED members.

4 NGO work – a self assessment

Since 1991 ANPED has worked to build capacity among Northern civil society organisations through sharing of information, knowledge, and skills and enabled informed and effective democratic participation by civil society in local, national , regional and international decision-making in sustainable development policy and processes.

This overview of NGO perspectives is based on a series of 22 surveys and semi-structured interviews carried out in September 2006 with ANPED member NGOs from 16 nations in the UNECE region.

The aim was to find out:

- How far NGOs saw a focus on Sustainable Production and Consumption as relevant to their work;

- What they understood this to mean;
- How they engaged;
- What might encourage more engagement.

The survey was of a clearly limited sample. All were ANPED members, and ANPED has work on Sustainable Production and Consumption as its' central focus. However even within such a limited sample there were significant variations in understanding, approach to the issues, capacity, and approaches to bringing about change. It is important to note that ANPED is a unique network in that it has an open membership and a democratic make-up. Its' Board and membership is drawn from all parts of the UNECE region and any NGO can apply for membership (new members are agreed at the Annual General Meeting*).* ANPED has a strong internationalist focus and helps people participate in international processes such as the annual meetings of the Commission on Sustainable Development. As such it might be expected to attract groups who are looking to work beyond their normal spheres of operation.

4.1 Self estimation

In fact those surveyed described themselves as working primarily at a national policy level (90%)[1]. Of the remainder 2 worked primarily locally and one internationally.

50% are active in the ANPED SPAC Working Group (ANPED runs a number of semi-formal working groups to facilitate joint working across the region). The other 50% were engaged at different levels (10% said that they simply received information).

45% said that they were involved in or following the Marrakech Process and another 45% said that they know a little and were keen to find out more.

Further analysis of this information suggests a core of surveyed groups who are actively engaged in work around Sustainable Production and Consumption with a long 'tail' of groups who involvement is progressively less: two appears to have no active involvement in SPAC-oriented work. This is explored further in the next section.

4.2 Evaluation of the work of NGOs and Governments

90% of those interviewed saw Sustainable Production and Consumption as a common link for much work on environmental issues, while 10% saw it as "an interesting idea but rather hard to link to customary NGO work":

Further to this groups were asked how far Sustainable Production and Consumption was a focus for their own work:

- 55% of those interviewed see it as a core of or central to their work
- 25% see it as a framework for their work
- 20% see some links with their work

[1] The figures are presented as percentages, round for simplicity to the nearest 5%. Due to multiple answers in some questions the percentages total over 100%.

The NGOs were then asked how far work in their countries has gone around the development of a national action plan for Sustainable Production and Consumption issues (as has been proposed as part of the follow-up to the 2002 WSSD), and on how they as NGOs had been involved in this work.

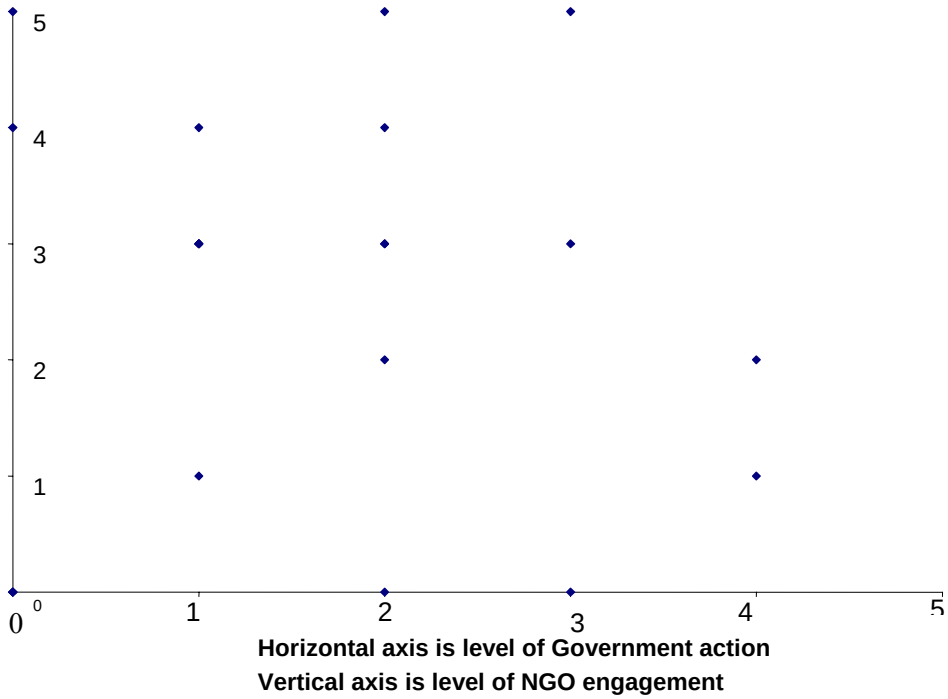
One a score of 0 – 5 (5 being 'a great deal'), the average score was 1.7 for national action, and 2.4 for the engagement of the NGOs.

Table 1: NGO engagement in national work and their assessment of that work

	Levels for each factor for the 22 NGOs surveyed																					
Level of work in country	4	2	0	2	3	2	3	2	1	0	1	0	0	3	0	4	1	2	1	2	1	1
Level of NGO involve-ment	1	2	0	0	3	5	0	3	3	4	4	0	5	5	0	2	3	3	3	4	3	1

The data is mapped below. This shows a scattering which does not point to any great congruence between levels of government and NGO activity.

Table 2: Mapping of Government action against level on NGO engagement



Rather it suggests that NGOs are more active (in their own estimation) even in two instances where they said that there was no significant government activity. It may thus be that this says more about their enthusiasm than it does about outputs and outcomes, but it does also suggest or even confirm that the level of government activity on this remains low.

It might be desirable for future work to utilise other data (from bodies such as the EEA) to arrive at an objective level of activity on these issues by governments (it would be necessary to develop some suitable measures and indicators).

4.3 The linkages between a sustainable consumption perspective and other issues

It became clear that only perhaps two of the NGOs interviewed saw Sustainable Production and Consumption as a key issue in its own right. We therefore asked the NGOs surveyed what issues they saw as being linked to this work. This provided some useful insights, and also suggests what the NGOs see as their main areas of work.

The issues mentioned (there was no prompting and no suggestions made by those surveying) and the percentages mentioning them were:

- Energy 65%
- Chemicals 40%
- Food 40%
- Transport 35%
- Waste 20%
- Water 20%

Also mentioned by fewer than 20% of participants were Health, Housing, Agriculture, Nanotech, Ecological Footprints, Agenda 21, Ecological debt, Forests, and Education.

This suggests that even those NGOs active on the topic still see strong links to more 'traditional' environmental issues, and that if work on Sustainable Production and Consumption is to become more than an academic exercise for small numbers of experts it will have to make links to more mainstream policy debates, most notably around energy and climate change.

4.4 Building the engagement of NGOs

It is arguable that there are three principal roles which NGOs play in delivering change. These are:

- Influencing policy;
- Developing the infrastructure to enable the policy to be implemented;
- Building the engagement of individuals and stakeholders who will then advocate for the policy and help develop the infrastructure.

In terms of work, the infrastructure is being and will be developed in many different ways, principally linked to the individual issues such as energy, food, transport etc. It is unlikely that there will be much practical action that is directly or overtly labelled as being about sustainable production and consumption. It is also notable that very few of the e.g. UK voluntary sector groups funded by their government to work on a Sustainable Consumption-related programme use this phrase in their publicity materials.

NGOs will play a part in infrastructure development but as work on issues such as climate change and sustainable food production moves into the mainstream then that pioneering work will be less important. Developing engagement is also critical but again the mass media may do this more effectively and on a larger scale in many countries.

The key area for NGO engagement is thus likely to be around policy work: this will include moving the agenda forward and perhaps most importantly seeking to ensure that governments stand by what they agree to (e.g. the outcomes of MEAs). It may also include lobbying and advocacy work

4.4.1 The current situation

With this in mind it is instructive to consider what NGOs are doing and what they might do and in turn what would encourage them to more action. The survey asked NGOs what they actually did around Sustainable Production and Consumption (offering a choice of four general activities) and what they would like to do (with more support or advice)

The results were:

- Building engagement of other NGOs 90% do this, 10% would like to
- Work with business 15% do this, 60% would like to
- Work with local government 50% do this, 30% would like to
- Work on national policy 30% do this, 60% would like to

This suggests that NGOs are very happy to talk with each other on Sustainable Production and Consumption but much less keen to engage with business or national governments – the contacts where they might make the most difference. This suggests a significant lack of confidence and capacity and that ANPED as network organisation as well as governments and other interested stakeholders needs to address this issue directly.

The fact that half those interviewed were engaged in some way with local government may be a legacy from Local Agenda 21 style activity but it also offers up some potential new ground around procurement policy. Recent discussions with NGOs at an ANPED meeting suggests that there may be a lack of understanding or the potential for work on procurement in this field (especially in Eastern Europe), but some NGOs are already having an impact on this.

4.4.2 Developing work

These issues had to some extent been anticipated and participants of the survey were asked what support they would like (from ANPED or other agencies). They were offered five choices and were asked whether each was a priority, whether it would be useful or whether it would not be helpful. The results for each are:

	Priority	useful	not helpful
• Basic explanatory materials	60%	25%	15%
• Tool-kit for national / local action	70%	20%	10%
• Guidance on engagement in national policy work	25%	70%	5%
• Information on what happens in other countries	75%	20%	5%
• Regular information on the Marrakech process	80%	15%	5%

It should be stressed that when these points were matched against the levels of action, then there was a notable divide between those engaged in Marrakech and keenest to know more, and those just starting out for whom the basics and tool-kits were priorities.

It is again noticeable that only 25% saw materials to help them engage with national government as a priority.

5 Overall conclusion

NGOs clearly have a role to play in the work on Sustainable Production and Consumption both in terms of the specialist knowledge they can bring and also in terms of their role as representing the voice of civil society. And they are keen to do so. There is no doubt that a growing number of NGOs are getting to groups dealing with Sustainable Production and Consumption issues. Still lack of understanding can be observed about the emerging challenge of the issue. What seems to be necessary is to meet four challenges:

Linking sustainable consumption to the current priorities

In order to further convince local and national NGOs of the relevance of the topic to their current field of work such as energy or food better and more obvious links should be provided by those working on Sustainable Production and Consumption issues. With the knowledge and information available in scientific research this task should be one of adequate communication only. Most NGO work can be connected to a consumption and production component already. It only has to be made visible.

The same seem to be true for and useful for the different stakeholders on the governmental side.

Linking better between global and local

Sustainability and thus sustainable consumption and production needs activities everywhere in society. If there is no coherent linking with the policy agenda then ambitious local projects are no more likely to solve the problems than the high level talk shops in the global context. Coherent

positioning and linking is necessary from local to global and back as well as from global to local and back. Thus timely information about the political processes is as necessary as a valid pool of examples from local initiatives that serve as best practice but also show that the concrete relevance effects of higher level decisions are monitored.

Linking better with other interest groups

At the local and national level and in case to case decisions more openness for exchange and collaboration with business and governmental organisations would be useful.

At the international level the adoption of new political strategies by the relevant NGOs is the challenge. Given the current alignment of interests to limit activities on win-win, improved coalition building of NGOs with academia and developing countries are expected to provide some basis for political effectiveness. Moreover, as part of their strategy, such coalitions should start a political debate about the location within IGOs of the work on sustainable consumption. Even if NGOs and academic research depend increasingly on public and financial support such coalitions are likely to remain the only potentially significant driving force for strong sustainable consumption governance.

Acing more strategically

In the increasing use of governance approaches instead of governmental guidance and leadership much decision making depends on factors such as powerful individuals or "windows of opportunities" e.g. during natural catastrophes or the right balance of majorities in decision making bodies. NGOs (as well as the other actors) should learn from the positive aspects of this and be prepared with positive contributions to feed in as soon as such situations appear.

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CBL II Sustainable Consumption as a Process

The Role of Local Context

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1 Introduction

One of the core tasks towards sustainable development is to change unsustainable consumption patterns, and to strengthen both more sustainable behaviour, and consumption decisions. Eberle and Brohmann (2004) define sustainable consumption as a more ecological but also socially premised way of buying and using goods and services. Individual and societal consumptive behaviour is immersed (embedded) in daily routines and is influenced by a variety of context factors such as specific lifestyles, neighbourhood, favoured peer groups, etc. (Shove and Warde, 1998; Empacher, 2003).

In this chapter, we discuss strategies that yet go further in taking into account the "immersion" (embeddedness) of consumptive behaviour in specific social and technical contexts ("settings") and the changes they undergo within participatory neighbourhood/city quarter development. We see participatory local development as an instance of reflexive governance in so far as it depart from conventional steering models which assume an external steering actor who follows defined goals that can be imposed on 'target consumers' with help of the right instruments.

The strategies we discuss instead regard consumption practices as part of larger social contexts ('the communal action space' and respective settings) which cannot be fully controlled, but change according to their own specific conditions and dynamics. Moreover, steering goals are not clear-cut, but include ambivalences because of trade-offs, for example between social integration functions, economic costs and ecological burden of specific consumption practices. Finally, these strategies acknowledge the impossibility (and undesirability) of central control over the behaviour of large numbers of networked individuals and, therefore, put a focus on social *interaction* as a means of influencing individual practices.

We discuss the process of sustainable consumption by means of a two-parted case study in Germany which presents an attempt to adopt a reflexive strategy in two specifically selected city quarters (Fritsche et al., 2002). The city quarters both concentrated on the communal action space as the behavioural setting and decision building arena, while the residents were

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actively participating in the process of building their residential environment. The approaches take into account the full spectrum of options to initiate and consolidate more sustainable customer behaviour and the assumption of responsibility in the communal context.

2 Conceptual framework

There is broad consensus among experts that implementation of more sustainable consumption behaviour – i.e. behaviour focused on low environmental and resource impact – requires not only corresponding awareness among consumers, but also changed social and economic structures.

It is evident that the available tools for supporting more sustainable consumption need further development. Besides the questions of awareness and of social and economic framework conditions, attention has focused for some years on the issue of how to stimulate and consolidate changed – in the sense of sustainability-oriented – behaviour (Brohmann and Eberle, 2006). Various theoretical approaches have been applied to explain the failure or the success of efforts to motivate behavioural changes.

Issues related to sustainable consumption patterns and their implementation concern the levels of:

- Stimulating patterns of action and behaviour, and thus changing previous patterns;
- Influencing or steering processes through which consumption patterns are formed; and
- Stabilizing sustainable behavior in everyday routines, and ensuring that producers provide corresponding products and services.

Yet, a comprehensive transdisciplinary approach seeking to involve stakeholders and to integrate the various disciplines and decision-making levels is in an early stage of development.

2.1 The need area approach

Studies of various research groups carried out in the last decade on 'need areas'[1] like housing, energy, waste management, and food indicate that conventional problem-solving strategies fail when sustainable consumption is concerned. Evidence for this can be found in growing land-use for housing, increasing residential energy use (despite efficient applications), high shares of bulky rubbish in residential wastes, and the still small market share of organic food. Seemingly, influencing individuals by "conventional" means (information, monetary incentives, regulatory prescriptions etc.) in order to steer their consumption patterns towards more sustainable ones are not effective (Wilhite, 2001; Karmasin, 1997; Gawel, 1996).

Little experience exists on alternative strategies of consumptive information and motivation, i.e. so-called *social marketing* strategies, sustainability marketing, and participatory assessment approaches (e.g. bottom-up development of indicator systems). These strategies use the social and communal context of residents as a base for sustainability marketing.

[1] The need area approach was introduced to allow an integrated view on different action fields in everyday life – especially under the requirement of material flow analysis (see Grießhammer 1999)

These approaches cover core ideas of reflexive governance such as iterative common goal setting, participation, and integrative knowledge production.

Research-wise, the most elaborated need area in the context of sustainability marketing is the food sector (Belz, 2003). Furthermore, there is experience with socio-ecological decision-making processes in the area of energy efficiency and housing (Brohmann and Cames, 2002), where the instrument of campaigning information is supported by local and regional communication platforms.

Building on the theoretical derivation of environmental behaviour ("Umwelthandlungsmodell", Prose and Hübner, 1996; Prose et al., 2000) and community identity (Puddifoot, 1995), the strengthening of the readiness to change behaviour in the communal setting is discussed. The communal setting offers identification, orientation and a highly motivating situation by means of communal „spirit".

Consumption behaviour is influenced by cultural values (e.g., fashion, prestige, ideas of quality of life) and norms (e.g., standards of cleanliness), as Shove (1997) has shown. Socio-technical systems and infrastructure (e.g. energy and water provision) also play an important role, as they determine consumption patterns (van Vliet, 2002).

Municipalities have a core role in shaping sustainable consumption, as they provide infrastructures like recycling bins, and cultural or social facilities (and partially housing), and because they represent a setting in which citizens can interactively influence political framework conditions, e.g. construction codes, land-use and zoning rules, etc.

2.2 The systemic perspective

Sustainable behaviour in the communal setting involves different individual and collective actors which need to be addressed and coordinated in such a way that participatory (and even mutual) action could arise. To understand interactive strategy development on the community level (i.e. how the different actors are or should be coordinated in order to transform in direction of a sustainable development), one can look at the actors from different levels of the system, as Bronfenbrenner's (1979) ecological perspective on (individual) development suggests (Bruppacher 2001).

Bronfenbrenner (1979, p. 22) describes the environment of developing human beings as a "complex of nested, interconnected systems". Development is not only affected by the immediate settings in which the person lives, but also by linkages between different settings that a person is part of. Even settings that a person never enters, but in which events occur that affect the person's immediate environment, influence the individual development.

Sustainable behaviour can therefore be investigated on the level of different systems, for example on the level of the household as a microsystem. The relation of a family to an organisation of whom one is a member, but not the rest of the family, is a mesosystem. For other family members, the organisation is an exosystem. The individual, the household and the community can be investigated under the perspective of a macrosystem in searching for mechanisms which are similar for *all* levels (see Bruppacher, 2001). Bronfenbrenner's systemic perspective on human development may, therefore, be a useful model to reflect behaviour within its

context, taking into account mutual influences between the different levels of action.

A high degree of satisfaction with the residential situation, in combination with the establishment of social links in the quarter, is one of the most important motivational anchors providing orientation and stabilization for sustainable lifestyles (Brohmann, 2003) and environmentally responsible behaviour (Bruppacher and Ulli-Beer 2001).

The concept of lifestyle orientation views – as does the concept of social environmental action – social recognition by the immediate social environment as a *key determinant* of consumption patterns. In that regard, recent findings of neighbourly housing and consumption research are of particular interest[2] (Gruner, 2000; Hinding and Klingner, 2000).

2.3 Community identity as a requirement for sustainable consumer strategies

One of the preconditions for citizen involvement, which is fundamental to iterative participatory goal formulation as well as to interactive strategy development, is the commitment of individuals to contribute to a given community. This commitment is again shaped by people's perception of and attitude towards this community. A multidimensional model of "community identity" was introduced by Puddifoot (1995 and 1996) to map citizen's relationship with respect to their municipality[3]. According to Puddifoot, community identity is shaped by both territorial and socio-cultural relations.

To determine the commitment of a person towards its community, not only the own perception and evaluation is important, but also what a person thinks of the perception and evaluation *of others*. If one thinks, for example the community should develop in a more sustainable direction, but others do not agree with this, this person will probably not be motivated to act.

[2] On aspects of consumer behaviour and neighbourhood cohesion cf. above all the report on "Housing and sustainability" [Wohnen und Nachhaltigkeit] produced by the research project "The importance of residential groups for the emergence of sustainable consumption patterns" [Die Bedeutung von Wohngruppen für die Bildung nachhaltiger Konsummuster] carried out with support from the German Ministry for Education and Research (Harloff et al., 2000.)

[3] Puddifoot's term "community" refers to political communities rather than to communities in terms of subcultures of a society. The model integrates several concepts that aim to explain valuation of and involvement in a community by psychological processes of identification. The six describing elements are: "locus", "distinctiveness", "identification", "orientation", "evaluation of quality of community life", and "evaluation of community functioning".

	Territorial	Social/cultural relations
E3 Identification	D6 Residents' perceptions of their own affiliation / belonging / emotional connectedness to location.	D7 Residents' perceptions of their own affiliation / belonging / emotional connectedness to social / cultural groupings / forms.
	D8 Residents' perceptions of others' affiliation / belonging / emotional connectedness to location.	D9 Residents' perceptions of others' affiliation / belonging / emotional connectedness to social / cultural groupings / forms.
	D10 Residents' own reasons for identification (or not) with the community.	
E4 Orientation	D11 Residents' own orientation to their community.	

Table 1: Two of the Elements (E3 to E4) and dimensions (D6-D11) of community identity after Puddifoot (Bruppacher, 2001, p. 29)

The model of community identity is constructed as a broad framework. Depending on interests and research questions, the empirical transformation focuses on different elements. Orientation, identification and evaluation are considered helpful to understand the mechanism of community identity building. The commitment of a person to get involved in interactive strategy development should be higher for people with a high orientation towards the community (e.g. people who intend to stay there).

Therefore, a community identity which has been participatory developed through various iterative processes can be assumed to be a very strong motive anchor for behavioural change of everyday routines. People involved feel much more self-assured and act with a firm orientation (D 11) and capacity to assess own decisions for the future.

3 Sustainable consumption processes on inner-city conversion sites

Within the context of a research project which was supported by the German Ministry for Education and Research, two new brownfield urban districts (city quarters) were studied which, on former military sites, aim to implement construction (rehabilitation) and housing with a high level of sustainability. Both cases also dealt with individual consumption (buying organic and regional food), social networking (day care, common cooking) and cultural identity (leisure time, art performances, continuing education). All activities were organized by groups of citizens – only supported by a coordinating agent who functions as an intermediary between different local interests and actions. Therefore, in these projects of urban development, local steps of action towards sustainable consumption comprise elements of reflexive governance.

The specific processes which were applied to the formulation of goals, analysis of problem-setting and implementation of development plans reflected the uncertainty of knowledge on problems by integration of users, and various other perspectives in problem-analysis and by adaptive solutions and anticipation.

In its spatial and territorial as well as social and cultural form, the city district – the quarter – is a point of crystallization around which identification with a city and its surrounding region can emerge (Brohmann, 2003). The conditions and qualities of built environments and open spaces, together with the opportunities they provide for residents to shape and appropriate them, determine the quality and orientation of sustainability processes within communities.

One city quarter is Vauban in Freiburg (in the German State of Baden-Württemberg), the other Vorstadt Nord in Neuruppin (in the State of Brandenburg).

3.1 Participatory goal formulation

It was a part of the project's research methodology to be extremely careful in ensuring timely integration and participation of stakeholders, in order to capture in an "authentic" manner the conceptions and wishes citizens have regarding the development of their future neighbourhood, and for their own situation in life. The project sought to survey – and discuss with stakeholders and residents – the guiding objectives that prevail among the various actor groups with regard to more sustainable future development paths. In various working groups conducted by members of the scientific team and the intermediaries, the identified "local" goals and first ideas of categories and criteria for valuing options (indicators) were discussed with focus groups of citizens and future residents. To this end, citizens as well as planners, politicians and representatives of various initiatives, were questioned about their former and current guiding visions with regard to life in the quarters. Different survey methods were applied. The project was able to evaluate 329 questionnaires and 58 personal interviews.

In a next step carried out with the support of stakeholders, the objectives and guiding visions identified by the surveys were translated into indicators appropriate to the specific settings, in order to be able to characterize and evaluate the development of city quarters. This indicator-finding and definition process with its stakeholder involvement was a very successful experience of participatory goal formulation, and local decision-support.

A questionnaire conducted in parallel among residents found a high degree of consensus concerning goals and objectives for the status and development of the respective city quarters.

A schematic view of the participatory goal formulation process is given in the following figure.

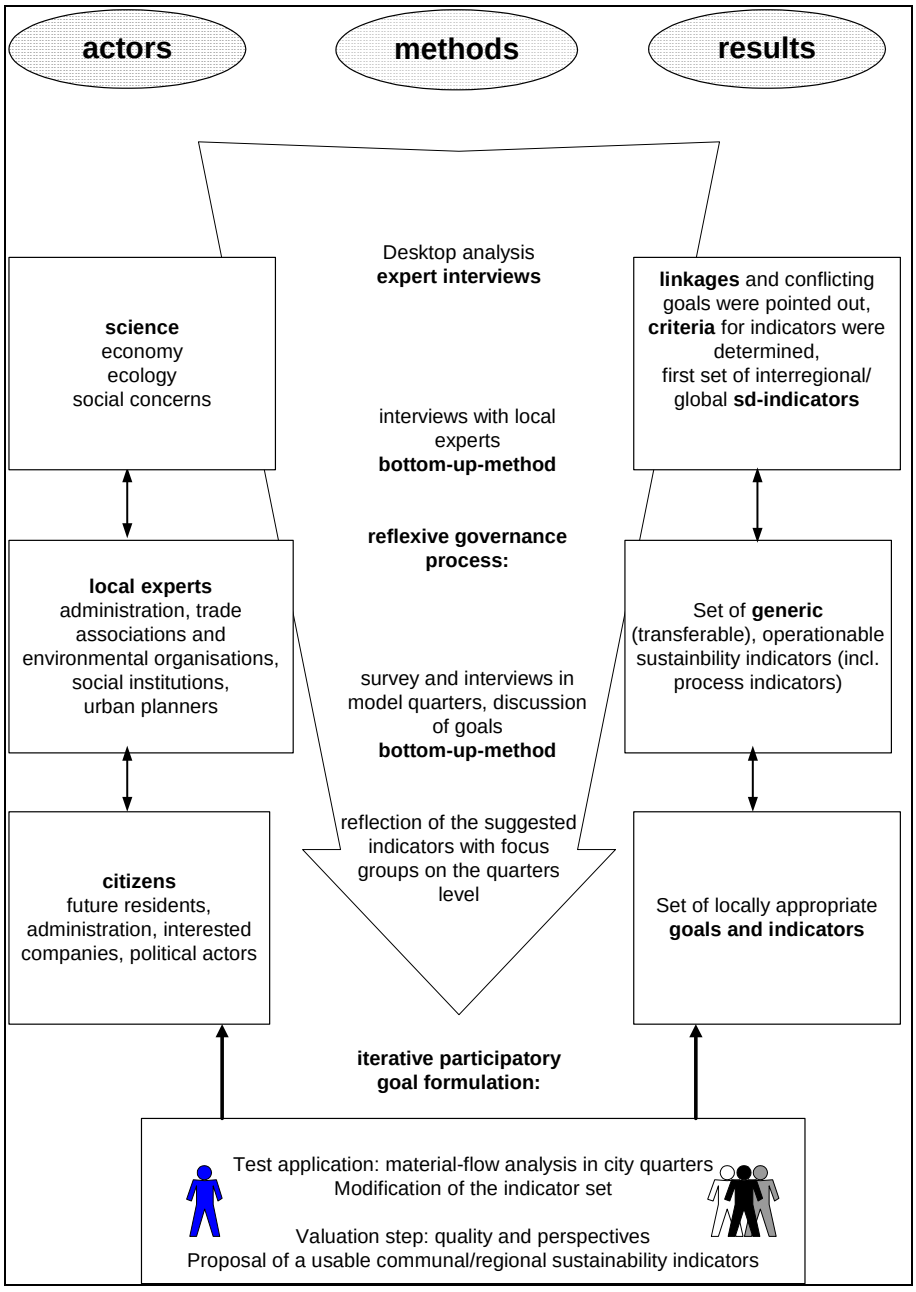

Figure 1: Participatory goal formulation

In Freiburg-Vauban the opportunities to shape local development and the good social work in the district ranked highest among the positive attributes surveyed. In both districts residents identify particularly with the physical form and guiding vision of a green city quarter, with the strict environmental criteria applied to the construction and restoration of the buildings and with the vision of a more regional and organic food supply.

In view of the high level of awareness and interest among residents with regard to regional food and ecological building materials, the impacts of these two issue areas were examined in more detail by means of a material flow analysis. Here, the residents were identified and addressed on the one

hand in their role as consumers, and on the other hand in their role as residents, which allowed integrated knowledge production. This relates to, for instance, satisfaction and preferences with regard to shopping and everyday chores, but also to the use of leisure opportunities, social and cultural facilities, green open spaces and squares.

3.2 Network mediators - intermediaries

The local activities of exchange, shaping and solidifying social structure need support by a reliable agent in whom all participants have confidence (Oswalt 2002). Through the agent, or intermediary, interests can be channelled and focused beyond individual expressions into "communal" priorities. The agent provides motivational input and promotes integration through the provision of orientation and "trusted" information for new residents and interested investors. Intermediaries also can succeed in "interfacing" between the local citizenship and municipal (or private) utilities regarding infrastructure investments, as both cases have shown with respect to local heat supply. In addition, intermediaries can "bundle" individuals to exert a more effective market "pull" – this was a key element in the Freiburg-Vauban case of car-sharing, and "car-free" housing projects, as well as in the food cooperative which "bundled" the individual demands for organic food of its member households.

Cooperation approaches and cooperation goals require, at least during a transitional period, a certain degree of support by institutions such as an intermediary.

The provision of platforms and events (connecting cultural and social work, culture café, involvement of city departments, workshops) is a driving force for vibrant exchange, discourse and sustainable consumption, as evidence in both city quarters suggests.

In Freiburg-Vauban, citizens were able to ensure the preservation and restoration of the communal centre through the strong commitment of individual groups and of their intermediate, the so-called Forum Vauban.

A further important task of intermediaries in both city quarters is to secure quality standards that have to be attained, and to provide motivation for cooperation (advice for investors, construction groups, planners and architects, cooking cooperative). In the future, it will be possible to monitor and provide feedback on goal attainment by means of indicators.

In a first step, identification with the city quarter and its regional setting is established by opportunities to participate and "have a share" in decisions relating to "our" residential environment. Commitment is expressed through long-term decisions such as those relating to the shaping of the residential environment, and to construction and housing, as well as through everyday short-term decisions relating to consumption of goods (self-organised market), or provision of mobility.

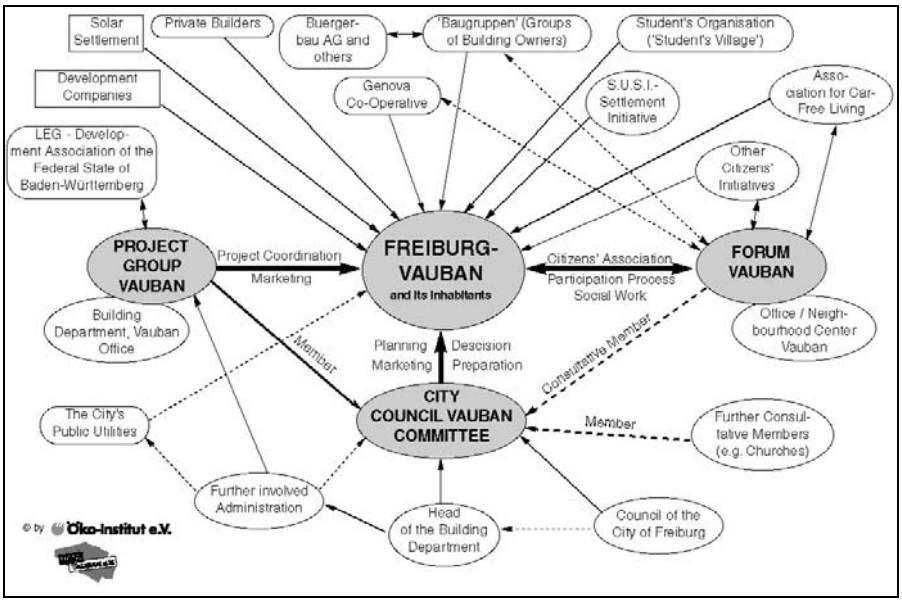

Figure 2: Actors Network Freiburg-Vauban

In the further course of the research project, residents of the city quarter Vorstadt-Nord in Neuruppin set up their own local council in order to be able to express their interests vis-à-vis the city administration more effectively.

4 Overall conclusion

It was demonstrated that the communal setting, as a system in which goals are formulated, may well serve as a small-scale "laboratory" for sustainable consumption processes. The communal context is favourable to realising sustainable behaviour in terms of opportunities to act (offering infrastructure, network assistance, neighbourhood or social orientation). Because action becomes possible and results are visible in a manageable context of a city quarter, the participating actors have a direct reward for their efforts which motivates to cooperate further. The visibility of results of "joint" action makes it easier to continuously formulate next goals and steps regarding more sustainable lifestyles, and to adapt measures and instruments according to the present situation. (Sustainable) behaviour needs social support to become stable against erosive forces of indifference. Forerunners or model persons at the level of local peer groups are helpful when a specific "new" behaviour should be initiated or implemented as a long term change. Their personal reputation is a strong motivating factor. Key framework conditions are the initiation and mediation of voluntary actions by intermediaries, which allow to organise and concentrate efforts to achieve ambitious goals such as the construction of sustainable new city quarters, or the radical change of behavioural routines.

Furthermore, coordination and cooperation of different actors can be used to create a setting in which members of a community or an organisation can feel "safe" to practice sustainable behaviour that is "outside" of widely

accepted social norms. On the other hand, sustainable behaviour must "pay", i.e. in the everyday world no one will pursue an abstract (purely "idealistic") concept of regional/local sustainability. The concept needs translation, and individual, measurable gains from alternatives must be possible. Such gains can take many different forms, and can be associated with elements like social recognition, financial benefit, time savings, security, health and many more.

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CBL II Community Currencies and the New Economics

A New Tool For Sustainable Consumption?

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1 Introduction

Sustainable consumption is gaining currency as an environmental policy objective, requiring widespread changes in behaviour at all levels of society to reduce the environmental impacts of consumption (DEFRA, 2003). While new international environmental governance institutions are growing upwards from state to global scale to tackle system-wide environmental issues, there is an increasing focus upon smaller-scale governance and citizen action at various sub-national levels, from local government to grassroots community groups and individuals (DEFRA, 2005; HM Government, 2005; Seyfang, 2003a). New tools are needed to develop and enact these agendas within communities; this paper examines one such initiative, namely community currencies, and assesses its potential role in promoting sustainable consumption.

There is a growing policy emphasis on the role of motivated individuals to exercise consumer sovereignty and transform markets through the minutiae of daily purchasing decisions. However a sociological analysis of consumption suggests that the scope of individuals and groups to change their behaviour is limited by existing social infrastructure and institutions – systems of provision – which 'lock in' consumers into particular patterns of consumption (Levett et al, 2003; Maniates, 2003; Sanne, 2002). 'Systems of provision' are vertical commodity chains (comprising production, marketing, distribution, retail and consumption in social and cultural context) which mediate between and link 'a particular pattern of production with a particular pattern of consumption' (Fine and Leopold, 1993:4). Within the 'new economics' literature, sustainable consumption is understood to require fundamental changes in lifestyles, economic and social systems to seek increases in quality of life rather than material consumption (Jackson, 2004). It therefore demands a deeper understanding of the systems of provision which mediate consumption patterns, in order to transform these elements of

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social infrastructure at a fundamental level (van Vliet et al, 2005; Southerton et al, 2004).

Community currencies – local exchange systems using new types of money - have been widely advocated within this literature as a means of achieving these goals, and of articulating an alternative social infrastructure which enables and incentivises particular types of exchange relationships and consumption patterns (Douthwaite, 1996; Robertson, 1999; Boyle, 2003; Lietaer, 2001; Ekins, 1986). While previous research has examined the role of community currencies as providers of informal employment for the socially excluded (Seyfang 2001c, 2004c; Williams et al, 2001), as community-building tools (Williams, 1996; Seyfang, 2004b), as grassroots responses to globalisation (Pacione, 1999; Tibbett, 1997) and as alternative economic spaces (North, 2006; Lee, 1999; Leyshon et al, 2003), their environmental implications have rarely been investigated (Seyfang, 2001a is one exception). This paper addresses that gap in the literature by presenting the first review of community currencies as tools for achieving sustainable consumption, so opening up a new avenue of inquiry. It thereby makes a timely and original contribution to the debate on environmental governance by discussing the role and potential of community currencies to develop new institutions which enable individuals and groups to change their behaviour patterns.

It achieves this by first setting out the rationale for the new economics model of sustainable consumption, and the role within that for community currencies. From the new economics theory, a multi-criteria qualitative evaluation tool is developed to assess the effectiveness of initiatives at achieving sustainable consumption. In a preliminary comparative analysis, this is applied to three distinct types of community currency (Local Exchange Trading Schemes (LETS), time banks, and the previously unresearched Nu Spaarpas green savings scheme) which are described and evaluated according to the criteria outlined. Finally, the findings of this analysis suggest possible ways forward for community-based sustainable consumption, and these are discussed, together with appropriate policy recommendations.

2 Sustainable Consumption and the New Economics

Responsibility for environmental decision-making in its widest sense is shifting from central government to new sets of actors and institutions, at a range of scales (Adger et al, 2003; Jasanoff and Martello, 2004). Over the last 15 years, 'sustainable consumption' has become a core issue on the international environmental agenda (UNCED, 1992; OECD, 2002), and in 2003, the UK Government announced its strategy for sustainable consumption and production – which it defines as "continuous economic and social progress that respects the limits of the Earth's ecosystems, and meets the needs and aspirations of everyone for a better quality of life, now and for future generations to come" (DEFRA, 2003:10). In practice, this emphasises decoupling economic growth from environmental degradation, to be achieved through a range of market-based measures, and calling on informed and motivated citizens to use their consumer sovereignty to

transform markets by demanding improved environmental and social aspects of production and product design (ibid).

Critics of this approach point to a number of significant factors which they claim limit the effectiveness and scope of such a strategy. These are: that it relies upon market signalling, which in turn is based upon pricing regimes which systematically externalise social and environmental costs and benefits; that it fails to consolidate (in policy) improvements made over time, leaving them vulnerable to changes in consumer attention and concern; that it makes only consumer markets available to transformation, while significant consumption from producer industries, and institutional consumption through the public sector are immune to sustainable consumerism; that it neglects the social meanings and context of consumption which compete for influence with environmental motivation; that it affords the right to influence the market solely on those able to participate in that market; that it pits individuals against globally powerful corporations in an inequitable struggle; and most significantly, that it fails to see the social infrastructure and institutions which constrain choice to that available within current systems of provision (Maniates, 2003; Sanne, 2002; Seyfang, 2004a, 2005; Southerton et al, 2004; Levett et al, 2003; Holdsworth, 2003; Burgess et al, 2003).

Given that current systems of provision prevent significant changes in consumption patterns, what can be done to overcome this limitation? Alternative systems of provision, with associated social and economic institutions and infrastructure, require a foundation in alternative values, development goals, motivations and definitions of wealth (Leyshon et al, 2004). Advocates draw out the political economy of, and richer sociological meanings attached to consumption and point to collective institutions as the source of potential change (Maniates, 2003; Fine and Leopold, 1993). Such an alternative theoretical approach to environmental governance and sustainable consumption is proposed by a broad body of thought known collectively as the 'new economics' (Ekins, 1986; Henderson, 1995; Daly and Cobb, 1990).

The new economics is an environmental philosophical and political movement founded on a belief that economics cannot be divorced from its foundations in environmental and social contexts, and that sustainability requires a realigning of development priorities away from the primary goal of economic growth (Jackson, 2004). Although its traditions go back much further (Lutz, 1999), the UK's New Economics Foundation (a self-styled 'think-and-do-tank) was founded in 1986 to promote these ideas in research and policy (Ekins, 1986). It proposes that environmental wealth, and the value of the labour of social reproduction which sustains communities and families, must be recognised, accounted for, and protected in order to strengthen inclusive, resilient communities and so support the market economy which rests upon this bedrock; this requires a redefinition of 'work' to value the unpaid work in society alongside formal employment, and a recognition that the realm of economic activity is not as commodified as has generally been presumed (Robertson, 1999; Gibson-Graham, 1996; Leyshon et al, 2003; Williams, 2005). It also stresses the benefits of

decentralised social and economic organisation and local self-reliance in order to protect local environments and economies from the negative impacts of globalisation (Jacobs, 1984; Schumacher, 1993), proposing an 'evolution from today's international economy to an ecologically sustainable, decentralizing, multi-level one-world economic system' (Robertson, 1999:6) or what is known today as the 'new localism' (Filkin et al., 2000). It is an equity-based understanding of environmental governance, drawing on 'ecological footprinting' indicators. These define and visualise environmental injustice in terms of the inequitable distribution of 'ecological space' (the footprint of resources and pollution-absorbing capacity) taken up by individuals, cities and countries; this inequity requires a reduction in the scale of material consumption among the affluent advanced economies (Wackernagel and Rees, 1996). It calls for a new 'ecological citizenship' of humanity as a whole, one which expands across borders (as does environmental change) and which recognises the political implications of private decisions and so defines everyday activities of consumption as potentially citizenly work (Dobson, 2003).

A new economics strategy for sustainable consumption would therefore embody the following five priorities:

Localisation: strengthening local economies can occur through increasing the economic multiplier (the number of times money changes hands before leaving an area), which in turn occurs as a by-product of import-substitution or local provisioning.

Reducing Ecological Footprints: cutting material consumption and waste levels can be achieved by through recycling, changing consumption patterns to cut demand, sharing facilities and resources, etc.

Community-building: sustainable communities are robust, resilient, inclusive and diverse. Overcoming social exclusion, nurturing social capital, and developing active citizenship within participative communities are key aspects of this.

Collective action: this covers both acting collectively to influence decisions and deliver services, and also addressing questions of institutional consumption.

Building new social institutions: creating new social and economic institutions – alternative systems of provision - which are based upon different conceptions of wealth, progress, value, etc, and through these allow people to behave as ecological citizens.

This set of indicators form the basis of a multi-criteria evaluation tool for sustainable consumption. This new evaluation tool is applied in a preliminary way in this paper to community currencies, a set of initiatives put forward by proponents of the new economics which are claimed to promote sustainable consumption. Before considering the initiatives to be evaluated, the rationale for community currencies will first be reviewed.

3 Community Currencies: A Tool For Sustainable Consumption?

The new economics approach to sustainable consumption requires the development of new tools to put into practice the goals outlined above. One initiative which has been proposed is 'community currencies', the generic term for a wealth of contemporary alternative exchange systems which exist alongside mainstream money, and which have been springing up in developed and developing countries since the 1990s as a response to social, economic and environmental needs. The key to understanding the role and function of community currencies is to view all money systems as socially constructed infrastructure: the design of exchange mechanisms builds in particular purposes and characteristics to each type of money, which in turn promotes particular types of behaviour. Lietaer states "Money matters. The way money is created and administered in a given society makes a deep impression on values and relationships within that society. More specifically, the *type* of currency used in a society encourages – or discourages – specific emotions or behaviour patterns" (Lietaer, 2001: 4). Mainstream money is a system which prioritises a narrowly defined range of economic activities, in isolation from social and environmental contexts, and so inhibits sustainable consumption. Therefore new systems of exchange need to be invented, specifically designed to serve different ends by taking a 'whole systems' approach to the economy-society-environment context of economic activity. While these may be less efficient from a purely economic viewpoint, they are actually *more* rational when one incorporates environmental and social factors into the equations (Greco, 1994; Boyle, 2002; Seyfang, 2000; Lietaer, 2001). Dodd (1994) proposes that the five essential characteristics of monetary networks are: accountancy, regulation, reflexivity, sociality and spatiality; a study by Lee et al (2004) maps out a range of community currencies against these criteria and finds that the alternative monetary networks each have those characteristics to different degrees and in different forms, and furthermore they differ from the mainstream monetary network in each of the five dimensions.

Alternative money systems are not new; efforts to reform, replace and redesign money have a long and rich history around the world as a tool to support local economies in times of recession (when conventional money is worthless or in short supply), and it is only in recent decades that the notion of having an exclusive national currency became the norm (Seyfang, 2000; Tibbett, 1997; Douthwaite, 1996; Boyle, 2002). In recent times they have emerged in both developed and developing countries as community responses to the economic, social and environmental pressures of globalisation and economic restructuring, and the social embeddedness of economic relations has become a more significant objective (Seyfang, 2001b). For example, community currencies have arisen in Mexico, Uruguay, Senegal, Thailand, Japan (Demeulenaere, 2004), and in Argentina, alternative money systems traded in barter markets and conceived as a 'solidarity economy' by local environmentalists became real lifelines for much of the population during the national economic crisis in 2001-2 (Pearson, 2003).

4 Examining Community Currencies

This section reviews experience with three distinct types of community currency, each designed for a different purpose. It considers their characteristics and potential in terms of the five indicators of sustainable consumption defined above. The three community currencies discussed are: Local Exchange Trading Schemes (LETS) which aims to rebuild local economies; Time Banks which promote civic engagement and mutual self-help; and NU-Spaarpas, a 'green savings' currency which incentivises environmental lifestyle changes. Within the constraints of this paper, the findings (summarised in Table 1) are necessarily generalised and preliminary, offering an overview of the different models, but they lay the foundation for a new mode of analysis of community currencies.

4.1 A Green Local Economy: Local Exchange Trading Schemes (LETS)

The most common type of community currency in the UK is LETS, Local Exchange Trading Schemes. A LETS is a virtual currency to enable members to exchange goods and services without using cash, using local credits instead. Members of a LETS list their 'wants' and 'offers' in a local directory then contact each other and arrange their trades, recording credits and debits with the system accountant. No interest is charged or paid, so there is no incentive to hoard credits, and exchange becomes the primary objective (Lang, 1994; Croall, 1997). Most LETS are small, voluntary organisations run by local activists, but they have increasingly been championed (and sometimes funded) by local authorities under the aegis of Local Agenda 21 as a tool for local economic renewal, community building and environmental sustainability. LETS was first established in the UK in 1985, and has since grown to about 300 schemes in operation at present, with an estimated 22,000 people involved and an annual turnover equivalent of £1.4million (Williams et al, 2001).

The *localisation* impacts of LETS are evident in its design: this local money system was designed as a response to global restructuring, specifically to provide an abundant medium of exchange for a community to trade amongst itself, which circulates locally and cannot leave the area – so boosting the local multiplier (Douthwaite, 1996). Research has shown that LETS deliver small, but significant, economic benefits to members, providing new opportunities for informal employment and gaining skills, and enabling *localised* economic activity to take place that would not otherwise have occurred, and prompting some import-substitution (Williams et al, 2001; Seyfang, 2001c). Some LETS have evolved to issue local currency notes, enabling the currency to spread further in the area – even through local businesses in some areas. There is some evidence that LETS can help people to *reduce their environmental footprint*. They promote local suppliers of food and other goods, reducing 'food miles' and the hidden costs of international transport associated with the conventional economy; they promote shared resources among members of a community, and so cut individual consumption, for example lift-sharing, hiring equipment and facilities; and they encourage recycling of goods, as members find a market for their unwanted items (Seyfang, 2001a). The *social and community-*

building impacts of LETS are very significant, as are intended to build community and create 'convivial' economies, embedded in local social relations. Research has found that they build social networks, generate friendships and boost personal confidence, in addition to being socially inclusive: they offer interest-free credit to financially excluded groups (Williams et al, 2001; Seyfang, 2001c). Despite this strong community-building ethos, LETS is an individualistic tool, and does not presently appear to have any potential to influence *collective or institutional consumption*. Finally, LETS is constituted as a complementary money system, and attempts to *redefine the institutions* of exchange in the following ways: some LETS operate on a principle of increased wage equality (though this is not a requirement); the medium of exchange is abundant rather than scarce; and the money is locally bounded (North, 2006; Lee et al, 2004).

However, despite this potential, LETS have remained small and marginal in economic terms, due to a number of internal and external factors limiting their growth: there are large 'skills gaps' making it difficult to access staple goods and services through LETS; they tend to operate in 'green niches', attracting people who agree with the principle but have little time to participate, and indirectly excluding others; and government regulations deter benefit-recipients from participating by counting LETS earnings as equivalent to cash income (Seyfang, 2001a, c; Williams et al, 2001).

4.2 Spending Time Building Sustainable Communities: Time Banks

The second wave of community currencies in the UK is 'time banks', which are based on the US time dollar model developed by Edgar Cahn, and aim to rebuild supportive community networks of reciprocal self-help, particularly in deprived neighbourhoods. A time bank is a volunteering exchange, with a central broker to coordinate members activities. Everyone's time is worth the same – one time credit per hour – regardless of the service provided. Participants earn credits by helping others, and spend credits receiving help themselves (Cahn, 2000). The first UK time bank was set up in 1998, and in 2002 there were 36 active time banks, with 2196 participants in total, and nearly 64,000 hours exchanged (Seyfang and Smith, 2002).

The services provided on a time bank – neighbourly support such as dog-walking, gardening, small DIY tasks etc – tend to be locally-based by definition. But there is no net *localisation* effect, as the time bank creates new local networks and opportunities for exchange, and does not substitute for imports. *Reducing environmental impact* is not necessarily a key aspect of time banking, but nevertheless it is being used to promote more sustainable consumption and environmental governance in a variety of ways. In north London for example, residents of an inner city estate will soon be able to earn time credits for recycling their household waste, and spend them on attending training courses or refurbished computers. Another London time bank rewards members with low-energy lightbulbs. Participation in groups which make local environmental decisions could also be rewarded. As indicated above, the primary rationale for time banking is *community-building*, and the projects are successful at developing social capital and new

supportive networks. They attract members of the most socially-excluded groups in society (those who normally volunteer least), and are often introduced into marginalised areas where building trust and neighbourliness is a challenge which the conventional economy cannot meet. For socially excluded individuals and communities, whose skills are accorded no value in the mainstream economy, the opportunity to be valued and rewarded for one's input into community activity and for helping neighbours, is enormously empowering.

There is also a *collective action* aspect to time banking. In addition to the 'community time bank' model, time banks can also be used as a 'co-production' tool to encourage people to become involved in the delivery of public services which require the active participation of service users in order to be successful, for example health, education, waste management, local democracy, etc (Cahn, 2000) and "co-production is a framework with the potential for institutions … to achieve the elusive goal of fundamental and systemic change" (Burns, 2004). By rewarding and encouraging civic engagement, time banks could invigorate active citizenship. Finally, the most significant benefit of time banking, for many participants, is the opportunity to redefine what is considered 'valuable', in other words: *creating new institutions* of wealth, value and work (Seyfang, 2004b,c). The radical of valuing all labour (or time) equally seeks to explicitly recognise and value the unpaid time that people spend maintaining their neighbourhoods and caring for others. Thus voluntary work is rewarded and so incentivised (rather than squeezed out by the conventional economic system which accords it no value and so undermines social cohesion) thereby ensuring that vital socially reproductive work is valued and carried out (Seyfang, 2006). Time banks represent a new infrastructure of income distribution for society, where income is not dependent upon one's value to, and activity in the formal economy, but rather upon work – broadly defined (Boyle, 2004; Seyfang, 2006).

Time banks aim to overcome the 'green niche' limitations of LETS by being based in mainstream institutions (health centres, schools, libraries), paying coordinators for development and support work, and most importantly, for brokering transactions between participants (Seyfang, 2002), but they still face obstacles in achieving their potential. These are: large 'skills gaps' in projects which again presents a limited range of services available; short-term funding mitigates against projects which take a long time to become established (annual project costs were estimated to be £27,300 in 2002); reciprocity is slow to materialise due to reluctance of participants to ask for help; and while the unemployed are officially encouraged to participate in time banking, those in receipt of disability benefits face particular obstacles from the benefit system (Seyfang, 2003b, 2004b,c; Seyfang and Smith, 2002).

4.3 Rewarding Sustainable Consumption: Nu Spaarpas

The Nu Spaarpas (NU) scheme is a 'green loyalty point' currency which has recently been piloted in the Netherlands and has been unresearched until now. This currency is designed to promote environmentally-friendly

consumer behaviour, and operates like a reward card (Bibbings, 2004). 'Green points' are earned when city residents separate their waste for recycling, use public transport, or shop locally, for example, and they can be redeemed for public transport tickets or discounts on sustainable products - in other words, promoting sustainable consumption using carrots rather than sticks (Holdsworth and Boyle, 2004). The points circulate in a closed-loop system, and card scanners in participating shops feed data into a central set of accounts. The initiative was a partnership between local government, local businesses, and non-governmental organisations – specifically Barataria, a sustainability consultancy organisation. NU was introduced in the city of Rotterdam in the Netherlands in May 2002, and by the pilot's end in October 2003, 10,000 households had the card, over 100 shops were participating, and 1.5 million points had been issued (van Sambeek and Kampers, 2004: 77).

Given that NU is a specific-purpose monetary tool designed to promote sustainable consumption, it is unsurprising that *localisation* and *reducing environmental footprints* are key outcomes of the initiative. As well as rewarding purchases from locally-owned businesses, extra points can be earned by purchasing 'green' or 'ethical' produce (such as organic food, fairly traded goods, recycled products, rental, repairs etc) at a range of participating local stores. The points are redeemed for discounts off more sustainable consumer goods, public transport passes, or cinema tickets (in other words, spare capacity in existing provision which incurs no additional costs), or donated to charity. Thus there are incentives to change consumption behaviour when both earning and spending the points, and private businesses benefit at the same time as public goals are met. However, in contrast with the other two cases examined here, there are no specific *community-building* impacts of NU: it is an individualistic mechanism, coming into play when individuals make consumption decisions (though it is socially inclusive, as points can be earned without financial expenditure). Despite this, it does have a role to play in channelling *collective action* through the public sector. NU was founded by Rotterdam Municipal Authority and prompted by several government objectives: reducing the volume of waste entering landfill, promoting public transport use, and generally raising environmental awareness and the practice of sustainable consumption. NU therefore has a direct impact on the provision of public transport, as well as waste separation facilities. Lastly, NU *creates new institutions* of exchange. If the market effectively incentivises unsustainable consumption (by externalising social and environmental costs), then NU is a prototype system which reverses those hidden subsidies by rewarding more sustainable behaviour, simply altering the relative prices of sustainable versus unsustainable goods. It anticipates the internalisation of social and environmental costs and sends appropriate price signals, and is easily understood by a public accustomed to savings points: "the NU card scheme can present itself as a reliable channel for sustainability, and also offers low-threshold information that the consumer needs at time of purchase" (van Sambeek and Kampers, 2004: 77).

Of the three alternative money systems examined here, NU is the most 'mainstream', as it exists comfortably alongside conventional money in

regular everyday transactions. The pilot NU project adopted a high-profile, professional marketing approach to raising public awareness of the scheme, and cost €2 million to establish and run for the trial period; there are plans to make the card scheme self-sustaining financially, through charging clients (eg government) for meeting their objectives using the scheme (van Sambeek and Kampers, 2004). The main barriers to success faced during the project related to the experimental nature of the pilot, and to developing the project as it evolved – creating publicity material that successfully attracted participants, persuading retailers to take part and install the card scanners, etc.

5 Conclusions And Policy Implications

Community currencies have been put forward as a new tool to promote sustainable consumption, but until now there has been no appraisal of their ability to deliver this goal. An innovative evaluation framework was derived from the 'new economics' literature which stipulated that sustainable consumption embodies the following characteristics: localisation, reducing ecological footprints, community-building, collective action, and building new social institutions. Three different community currency types (LETS, Time Banks and NU) were described and their effectiveness and potential in enabling more sustainable consumption patterns was assessed against this set of indicators. The findings of this preliminary analysis (shown in Table 1 above) indicate that each model of community currency successfully achieves some, but not all, of the criteria for sustainable consumption. This is due to the different purposes for which each currency was designed (ie whether there were primarily economic, social or environmental objectives). For example, LETS and time banks deliver large social and community benefits, but NU is focused instead on market transactions; meanwhile NU is specifically aimed at reducing environmental footprints through incentivising recycling and public transport use, while LETS and time banks only partially achieve environmental objectives as a by-product of other goals.

However, there is one indicator of sustainable consumption which each of the community currencies delivers: they are all fledgling attempts to build new social and economic infrastructure founded upon different values to mainstream systems of provision. They create new incentives, structures and institutions within which society transacts, so re-orienting it towards new sustainability goals. Indeed, they are prized channels for the expression of values which are squeezed out of the conventional economy. To achieve this, they: provide a medium of exchange which operate alongside national currency to provide new opportunities for economic and social activity; they are place-specific, retaining roots in local communities, and they circulate within a given area and do not drain away, boosting local self-reliance; they can correct the misleading market signals offered by the conventional economy, allowing the internalisation of social and environmental costs and benefits; and finally, they recapture 'work' from the formal economy and place it at the centre of a 'whole systems' approach to the economy, valuing and rewarding the unpaid work of social reproduction and so nurturing the development of social capital, cohesive communities and active citizenship.

Furthermore, the three types of community currency are found to be complementary to each other: between them they succeed at achieving all the criteria for success, and so it might be argued that an effective sustainable consumption strategy requires a diverse range of alternative exchange mechanisms, each designed to target different areas of the development agenda. They demonstrate that the existence of plural monetary infrastructures is possible, and is effective at enabling more sustainable consumption patterns, albeit on a small scale. In so doing, they point to possible future developments which might take these principles and evolve them into something embedded within daily life for millions of people, transforming society's behaviour, either by scaling up of existing projects, or alternatively by reproducing small-scale operations at the local level, creating a web of interacting local currencies. The scale issues of community currencies are a subject for further research. These examples are suitable for local applications; other types of currency could similarly be designed for other scales of circulation and function, resulting a multi-tiered variety of currencies, each designed for their role. For example, an international currency for global trade could co-exist with national currencies suited to taxation and public spending on infrastructure, sub-national regional currencies to promote economic development, and local economic and social currencies (Seyfang, 2000; Boyle, 2003; Robertson, 1999; Lietaer, 2001).

While the scale of these examples is presently small, they have demonstrated that they do achieve their objectives and have the potential to achieve much more if scaled up and mainstreamed. But community currencies are not a blanket cure-all for sustainability. Their individual success is dependent upon being adapted to the particular local situations, social contexts and objectives of the initiatives, and while generalised models are available, they should be fine-tuned to the location and objective they are targeted at. In addition, while the grassroots, bottom-up self-help origins of some community currencies (notably LETS) provides much enthusiasm and vitality, which may become lost if incorporated into top-down policymaking agendas, it is also possible to view the current manifestations of community currencies as experimental prototypes for future multi-currency developments. In this case, the less positive aspects of bottom-up organising (existing in a niche, volunteer burn-out, unintentional exclusion) might be mitigated by incorporating elements of a more mainstream, high-profile top-down approach. Time banks, for instance, are implemented in more of a top-down manner, and have penetrated groups in society normally considered marginal and isolated from community-building efforts, but they retain sensitivity to local situations and seek to be as locally-rooted as possible (for instance by employing time brokers already known and trusted in the locality, and by multiplying as small groups, rather than seeking to scale up).

Therefore a number of policy changes are required in order for the initiatives to overcome the barriers they currently face, for this evolution to occur as organically as possible. First, secure long-term funding is the greatest need identified to allow each of these projects to develop and grow over sustained periods, attracting broader cross-sections of members and

becoming more established in society at large. Second, governments need to recognise the benefits delivered by participation in community currencies as being valuable for local economies, communities and environments. Community currencies benefit those on the margins of society – those on low incomes and outside the labour market for whatever reason; it is perverse that current state benefit regulations penalise those very groups from participating, and they need to be changed to reflect this. Third, government should embrace the possibilities offered by community currencies to deliver public services more effectively and achieve policy objectives across a range of areas – community capacity-building, poverty-alleviation, waste management, public transport provision, health and welfare - using alternative exchange systems as a tool to access places, social groups and motivations beyond the reach of the conventional economy.

The new evaluation framework used in this study offers enormous potential for further research and refinement, to aid the understanding and development of new tools for sustainable consumption. The identification of a set of indicators has highlighted precisely how some initiatives score better than others, in different areas, and allows policymakers to work with a simple checklist of factors to consider. In particular, a set of more detailed examinations of a range of case study initiatives – including community currencies - will facilitate the wider adoption of the evaluation tool in assessing progress towards sustainable consumption. A key characteristic of resilience and adaptability is diversity. The challenges facing us across the globe demand action both to mitigate, and adapt to environmental, social and economic change. Arguably, a diverse range of systems of provision, extending beyond the confines of current mainstream institutions and into increasingly self-reliant and empowered communities, will prove the best defence against external shocks. The policy challenge now is to support those fledgling initiatives seeking to build new institutions for environmental governance, and enable them to grow, thrive and propagate. Supporting alternative development goals and values alongside the familiar market infrastructure is the key to a diverse, robust economy within which sustainable consumption can be an effective process of change.

Table 1: Evaluating Community Currencies As A Tool For Sustainable Consumption: Key Findings

Sustainable Consumption Indicator	LETS	Time Banks	NU
Localisation	Economic tool, locally-bounded money to boost local multiplier, employment and self-reliance.	Community self-help is primarily locally-based anyway, so no net localisation.	Rewards buying from local businesses.
Reducing Ecological Footprint	Some evidence of reducing resource use: sharing facilities, recycling, localisation cuts transport costs (eg food miles).	Time banking concentrates on services, not material consumption. Some developments in rewarding recycling etc.	Incentivises recycling, public transport, local, organic and fair trade products and energy efficiency.
Community-building	Large social and community benefits, boosting social cohesion and inclusion.	Very large social and community benefits: boosting social inclusion and social capital.	Individualistic tool. But inclusive (not dependent upon spending money).
Collective Action	Individualistic rather than collective action tool. Promoted by local government to mitigate poverty and unemployment.	Promoted by central government to build capacity in voluntary sector and deliver public services. Could be basis for 'co-production' model of public service provision, and reward active citizenship.	Individualistic tool, but promoted by local government. Influences public sector action in transport and waste.
New Social Institutions	Some egalitarian measures eg minimising wage disparities. Capacity to value non-marketed work. Abundant medium of exchange. Localised monetary design.	Central principle of valuing all types of work equally, rewarding unpaid community efforts. Reciprocity and mutuality.	Points system adjusts relative prices to incentivise sustainable consumption. Anticipates internalisation of social and environmental costs and benefits.

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CBL II Changes in consumption and production patterns in countries of transition economies: Lithuanian case study

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1 Introduction

Serious interest to sustainability of consumption and production was paid already in the main documents of Rio World Summit on Sustainable Development (1992). Principle eight of Rio Declaration defines that "to achieve sustainable development and a higher quality of life for all peoples, States should reduce and eliminate unsustainable patterns of production and consumption". Unsustainable production and consumption were considered as a major cause of the continued deterioration of the global environment in "Agenda 21" and States were requested to develop domestic policy frameworks to encourage a shift to more sustainable patterns of production and consumption.

However, as it was noticed in the UN report to the Johannesburg WSSD (2002), despite serious achievements throughout the decade after Rio, progress towards the goals established in "Agenda 21" has been much slower than anticipated and in some respects situation became worse than 10 years ago. Gap in implementation was considered as the most urgent problem, and it was emphasized that this gap was especially obvious in the lack of major changes in efficiency of consumption and production. In 2003 European Council identified sustainable consumption and production as one of the key priorities for the EU in the follow up of the Johannesburg WSSD.

Analysing possible changes in consumption and production patterns, two categories of countries are usually distinguished – developed countries and developing countries. The improvement of life quality, simultaneously respecting the limited resources and carrying capacity of natural systems, and diminishing of consumption are considered as the most promising options for developed countries. Combination of traditional style of life with advanced Western technologies in order to achieve better quality of life without exceeding acceptable level of consumption is recommended for developing countries (Tukker et al., 2006).

A third group of countries with very specific features of their development appeared at the very beginning of 1990's, after the collapse of

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former Soviet block and were named as countries with transition economies. Changes in political system and transition from the centrally planned to a free market economy caused an inevitable economic and social decline (Randla et al., 2002, Cherp et al., 2003). As a consequence of an essentially reduced production, consumption of natural resources and environmental pollution decreased respectively (Lang, 2003, Juknys et al., 2005).

Since the middle of the 1990's the economy in the most countries with transition economies has started to recover. More rapid positive economic changes are taking place in the countries which have chosen the way of cardinal reforms, so-called "shock therapy", instead of slow institutional changes (Randla et al., 2002, Juknys et al., 2005), and most of these countries have already joined European Union. However, level and patterns of consumption and production in newly accepted East-European EU countries is still much different from the old EU member states. Society of newly accepted countries tends to consider western lifestyle with high material consumption as the main indicator of better quality of life and big efforts will be needed to balance necessity of improved life quality with sustainability of consumption and production.

The main aim of this paper is to analyze consumption and production trends in Lithuania after reestablishment of country independence.

2 Data and method issues

Data of Lithuanian Statistical Department and Statistical Office of the European Union (Eurostat) are used for this study. Production trends are presented as GDP in USA dollars, at constant 1995 prices, using purchasing power parities (PPP). Constant prices are used to compare real GDP over a period of years and to remove influence of inflation. PPP are used to remove effects of the different levels of prices in different countries. Final energy consumption is presented in oil equivalent and used as the main indicator of consumed resources.

Consumption for production is considered as primary consumption and direct household consumption as a final consumption. Taking into account that measures and decisions necessary to reduce primary and final consumption are different, such distinction is useful for analysis of the main consumption trends.

For the final household consumption analysis direct energy, electricity and water consumption is discussed in this paper. Changes in household incomes, household consumption expenditure and household durable goods are evaluated as well.

In some cases average data of EU_{15} countries are presented for the comparison. The year 1990 has been chosen as a base year and data of this year were equaled to 100 % for more evident time series analyses and comparison of the data.

3 Results and discussion

The main trends in production and in consumption for production are analysed in this section first of all and data on changes in eco-efficiency

(eco-intensity) are presented. Changes in direct household consumption are analysed in the second subsection.

3.1 Consumption for production

Taking into account very fast current growth of Lithuanian economy, decoupling of environmental impact from economy growth should be considered as one of the most important tasks from the point of sustainability. Indicators of eco-efficiency are of particular importance to evaluate sustainability and reflect the level of dematerialization and the course of decoupling of use of natural resources from economic growth. Amount of production and services per unit of consumed natural resources is usually considered as the main indicator of eco-efficiency (Gee and Moll, 1998; Randla et al, 2002). Very often the inverse of eco-efficiency – eco-intensity (energy intensity, material intensity) is used as indicator of sustainability (Sun, 2000; Miskinis, 2002).

Quantative indicators of eco-efficiency appear to be useful tool for formulating concrete development goals for sustainable development strategies (Hinterberg et al., 1997). Increase in eco-efficiency of economy (decrease in eco-intensity) and decoupling of environmental impact from economy growth should be considered as absolutely necessary though insufficient condition of sustainable development.

The economy of Lithuania was very strongly integrated into general economy of former Soviet Union, and cardinal changes from one sided East oriented command economy to balanced West – East market economy resulted in deep transitional decline. Very deep economy depression took place during first half of past decade, and GDP in 1995 was by 40% less to compare with 1990. However, even during this period, when the most intensive economic depression took place, consumption of energy resources for production decreased much more rapidly than GDP and an essential decrease in energy intensity was registered (Miskinis, 2002).

Along with accelerating growth of Lithuanian economy, only slight increase in final energy consumption was registered in Lithuania from the second part of the past decade and final energy intensity was reduced over 2.5 times during 1990-2004 year period. Current energy intensity in Lithuanian economy exceeds this indicator for EU_{15} countries only by 19%. Transition to the market economy and its restructuring, modernization of technologies, and increased prices of energy resources should be considered as the main reasons of these positive from the point of sustainability changes (Juknys et al., 2005).

The industry sector has suffered the deepest depression at the beginning of transition period and amount of industrial production decreased almost threefold during 1990 – 1995 year period. Changes in production as created GDP, energy consumption and water consumption in the industry sector are presented in Figure 1. As it seen from presented data, no favourable from the point of eco-efficiency changes were registered in the industry sector during the first half of past decade and consumption of energy and water resources decreased approximately at the same rate as GDP.

However, from the year 1996, when recovery of Lithuanian industry sector has started, decoupling of production growth from resources consumption has started as well (Fig. 1). Especially fast growth of industry

sector was registered during last years and annual growth in created GDP consisted approximately 12% on average. Only slight increase in energy consumption can be noticed (Fig. 1) at the end of investigated period and approximately 2.3 and 3 times reduction in energy and water intensity respectively took place during last ten years.

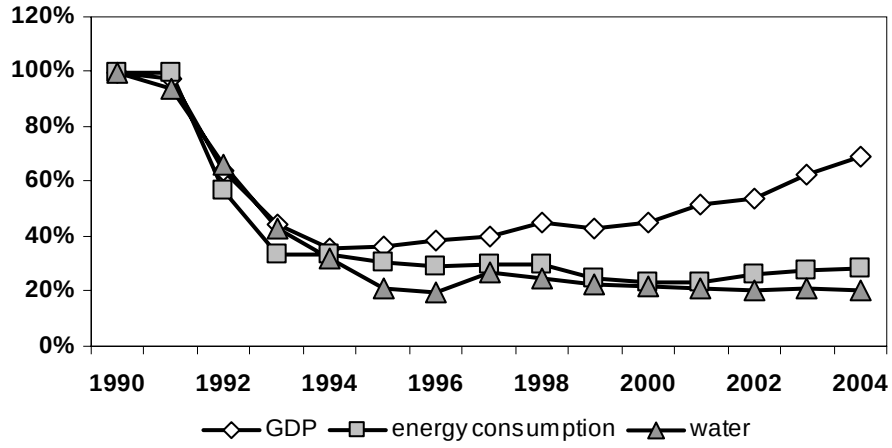

Figure 1: GDP, energy and water consumption in industry sector

Implementation of modern technologies, increase in number of enterprises implementing cleaner production measures, ISO 14001 standards and shift to less resource consuming industry branches have led this sector to more sustainable consumption patterns.

3.2 Household consumption

Changes in direct household consumption (final consumption) are very different from changes in consumption for production and services (primary consumption) and are not so promising from the point of sustainability.

Trends in the household energy and water consumption are analysed first of all (Fig. 2). Only changes in water consumption were rather similar for both – household and production needs and almost fourfold reduction in water consumption during investigated period was registered in both cases (Fig. 1 and 2). An essential increase in water resource and maintenance prices, and improved water accounting system were the main reasons for such significant reduction in household water consumption and recent water consumption per capita is lower considered sanitation norms amounting to 80 litres per capita per day. From 2000 this indicator remains quite stable and possibly should increase at least to sanitation norm (120 litres) along with growing economy and household incomes.

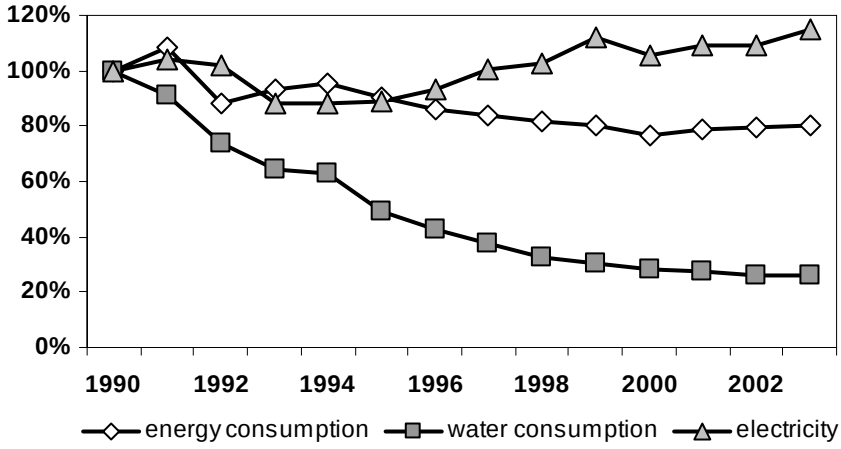

Figure 2: Energy and water consumption trends in household sector

Decrease in energy consumption in household sector during the 1990–2003 year period is far less significant of that for production (Fig. 2). It is interesting to note, that even in the beginning of 1990's household sector reacted relatively slightly and only in the year 1992, during energetic blockade from the Russian side, household energy consumption was reduced by 20% to compare with the year1991. Some increase in household energy consumption in order to re-establish normal temperature in the dwellings was characteristic for next two years. Gradual decrease in household energy consumption has started from the year 1995 and current direct energy consumption consist about 80% to compare with the very beginning of transition period (Dagiliute, 2006). Improvement in thermal behaviour of houses and household heating systems are the main reasons of these positive changes.

Despite of some progress, energy intensity in household sector still is very high. About 70% of Lithuanian citizens still live in soviet fashioned block houses and thermal energy consumption on average is about 200 kJ per degree for square meter per day and it exceeds the required energy amount in most EU_{15} countries about 2-2.5 times. A large part of the centralized heating infrastructure is out-dated and energy losses in heat distribution networks are very high. Renovation of block–houses and improvement of their thermal behaviour, modernization of thermal units, and renovation of heat supply networks creates an opportunities to reduce household energy consumption essentially. To achieve twofold reduction in household thermal energy consumption up to the year 2020 is foreseen in Lithuanian strategy for sustainable development (Juknys, 2006).

Household electricity consumption is on the gradual increase from the year 1995, and 30% increase in household electricity consumption was registered during 1995-2004 years period (Fig. 2). Fast increase in home appliances, electronic and communication tools could be considered as the main reasons of this unsustainable trend. Seven times increase in music systems, two times – in video recorders and 1.5 times increase in TV-sets was registered in Lithuania during 1996 -2004 year period. As it was already mentioned, society of newly accepted countries tends to consider western

lifestyle of high material consumption as the main indicator of the better quality of life.

The presumption that material consumption is equal to quality of life is characteristic for old EU members as well (Tukker et al., 2006), however the main difference between old and majority of newly accepted EU members is that in most old EU member states individual material consumption saturation is almost reached and overall household consumption grows much slower.

Changes in disposable incomes and consumption expenditure from the year 1996, when recovery of Lithuanian economy and rather fast growth in GDP has started, are presented in Figure 3. It is necessary to note, that even in the beginning of period, when very fast GDP growth (6-8% annually) has started, very slow growth of individual incomes and expenditure was characteristic for Lithuania up to the year 2003. Only during last two years of investigated period individual incomes and expenditure grows almost in the same rate as GDP.

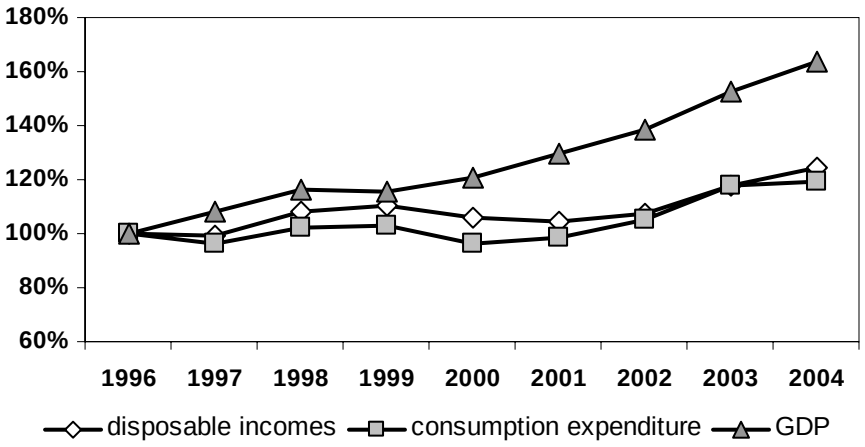

Figure 3: Changes in disposable incomes, consumption expenditure and GDP per capita during 1996 – 2004 years period

Other specific feature of household consumption trends in Lithuania is such phenomenon, that consumption expenditure grew up faster than incomes during last five years of investigated period. Leasing, credits and other borrowing options are becoming more and more popular in Lithuania and accelerates consumption growth. Taking into account, that household consumption expenditure in Lithuania is still about 3 times lower than in EU_{15} countries on average, fast further growth in household consumption should be expected and this trend creates an essential threat to sustainability of Lithuania's development. An essential attention not only to the behaviour of consumers, but to the analysis of special producers' actions taken to satisfy their interests and to stimulate individual consumption is absolutely necessary in order to limit growth in household consumption (Sanne, 2002).

Conclusion can be made, that big efforts will be needed to achieve reconsideration of value system and shift to the more environmental friendly lifestyle of newly accepted Eastern EU member states.

4 Overall conclusions

An essential progress to more efficient consumption of energy and other natural resources in different economy sectors (primary consumption) were achieved during investigated 1990 - 2004 years period. Analysis of economic and environmental changes has shown that even in the beginning of transition period, when the most intensive economic depression took place, the consumption of natural resources and environmental pollution decreased much more rapidly than GDP. In the second part of transition period, when economic growth has started, consumption of resources was decoupled from economic growth and final energy intensity was reduced almost three times during analyzed 15 years period.

Changes in household (final) consumption are not so promising from the point of sustainability. Taking into account different economic situation in old and new EU member states and comparatively low level of final consumption in most newly accepted East-European EU countries, as well as general public opinion to consider western lifestyle with high material consumption as the main indicator of the better quality of life, an essential increase in final consumption should be expected in the nearest future. Fast increase in disposable incomes and consumption expenditures (7–8% annually) was already registered in Lithuania during last several years.

Conversion to western household consumption patterns threatens the sustainability of development in Lithuania and other newly accepted East - European EU member states. Considerable joint efforts will be needed for reconsideration of value system and shift to more environmental friendly and less consuming way of development.

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PSS Decoupling is Dead: Long Live Eco-Productivity!

The feasibility of decoupling resource use from economic growth for two example resources, and the value of decoupling as a concept

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1 Introduction

The SCP agenda includes a strong emphasis on the decoupling of environmental impacts from economic growth. Relative decoupling of resource use from economic growth is said to occur when resource use grows at a lower rate than economic growth: absolute decoupling occurs when resource use declines while economic growth continues.

So how feasible is decoupling at product/service level? And, equally importantly, how useful is decoupling as a concept? In the context of the observed relative decoupling of resource use from economic growth across the whole EU economy over recent years, this paper addresses decoupling through two example European resource types – a non-renewable and a renewable one (aluminium and forest products). Based on a study carried out by Entec UK Ltd for the European Commission in support of the Thematic Strategy on the Sustainable use of Natural Resources, the paper presents conclusions about decoupling in these resource sectors, about the methods that can be used to evaluate decoupling and about the concept of decoupling itself. Recommendations for future actions are also presented.

The decoupling of resource use from economic growth ideally refers to the delinking of total resource use in each of the two sectors studied (including the use of fossil fuels and ancillary materials) from the gross value added to the economy by the sector.

2 The Main Conclusions from the Study

2.1 Policy, Economic and Environmental Context

The study rated semi-quantitatively a number of policies – mainly at EU level, but some at national level – that are influencing environmental impacts at particular life cycle stages in the aluminium and forest products sectors. The conclusion is that environmental improvements can be encouraged most effectively through a combination of regulatory and incentive policies - the "stick and carrot" approach. There are already examples of both types of

policy in the aluminium and forest products sectors in Europe, e.g. the IPPC regulations in the aluminium sector and the use of certification for forest products.

The EU has a major world role in both the manufacture and consumption of aluminium and forest products. For example the EU produces about 10% of the world's primary aluminium, but consumes about 20%. The EU is more self-sufficient in the forest products sector with 90% of roundwood consumption met by domestic removals.

Both products made from aluminium and those made from forest products are responsible for significant environmental impacts. The study reviewed the main sources of environmental impacts (e.g. global warming, acidification, stratospheric ozone depletion, etc.), across the life cycle of products from the two sectors.

2.2 Life Cycle Assessment Review

Life cycle assessments were reviewed for three representative and common products in each sector: aluminium components in cars; aluminium cans; aluminium window frames; wooden window frames; newspaper; and carton board. The study included all the main impacts in its review, but focused in greater detail on global warming potential (GWP).

The energy mix (i.e. the split between renewable and non-renewable energy) used in manufacturing a product has a major effect on the environmental impacts of the product during its manufacturing stage. The proportion of material in a product that is of recycled origin is another factor that can have a major effect on environmental impacts at the manufacturing stage. For example, producing aluminium from scrap uses only about 5% of the energy needed to produce primary aluminium.

The material manufacturing impacts of products in the two sectors are a relatively small proportion of the total life cycle impacts. An approximate estimation of the total life cycle GWP impacts of aluminium, based on an extrapolation of data for the specific products addressed, showed that they are an order of magnitude more than those impacts from manufacturing the aluminium alone. This is largely because a high proportion of aluminium products have a long lifetime and many consume energy during use. Similarly the total life cycle GWP impacts of forest products are two orders of magnitude more than the impacts from material manufacturing alone (i.e. forestry), reflecting the relatively low GWP impacts of the manufacturing stage.

2.3 Eco-efficiency and Material Flow Analysis

The decoupling of resource use from economic growth for an individual sector, as opposed to the whole economy, is best measured using resource productivity, which is gross value added (GVA) divided by resources consumed (measured by DMC - direct material consumption). Decoupling is being achieved when resource productivity is increasing. Decoupling is said to be relative if resource use is also increasing, and absolute when resource use is declining, provided value added is growing. Absolute decoupling has no meaning when value added is decreasing – this is one of its weaknesses as a concept. The actual measure of decoupling of resource use from

economic growth can be called the "growth rate of resource productivity" (abbreviated to GRORP).

A methodology was developed for assessing the decoupling of resource use from economic growth in an industrial sector, by calculating GRORP. It has been applied only up to the stage of material production but, in principle, it is equally valid in more complex analyses involving later stages in the supply chain. However, the data are not available to do this. The methodology considers as resources only the main raw materials and not the fuel and ancillary materials used.

GRORP in the EU15 from 1995 to 2000 was calculated for the primary aluminium sector and for the forest products sector (the manufacture of wood, cork, pulp, paper and their products) – as shown in Figures 1 and 2 respectively below.

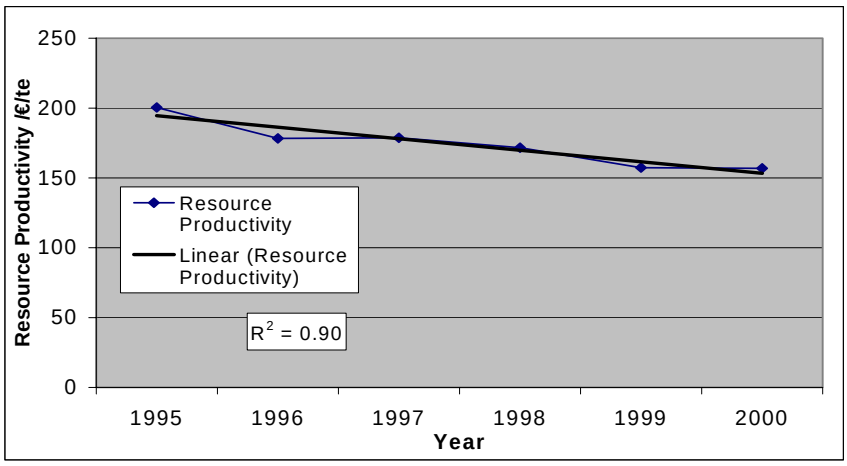

Figure 1: Resource productivity for primary aluminium production for EU15

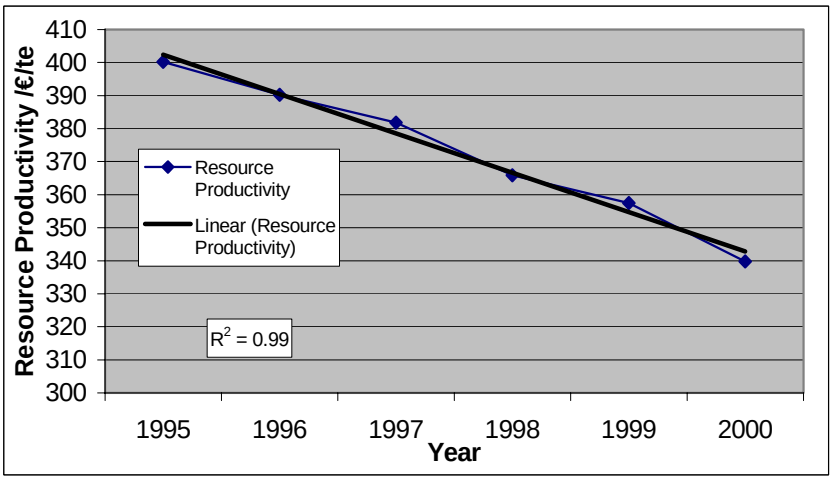

Figure 2: Resource productivity for the forest products sector for EU15

The figures show a decline in resource productivity for the aluminium sector of 4.6%/year (GRORP = –4.6%/year) and for the forest products sector of 3.2%/year (GRORP = –3.2%/year). This appears to suggest that there was no decoupling of resource use from economic growth in these sectors over that period. However, there are several limitations to these results in terms of both reliability and representativeness. Issues of reliability include the relatively short timescale covered, the potential understatement of production due to non-disclosure of data, and the dependence of GVA on highly variable price data. Issues of representativeness include the fact that only the material commodity is accounted for as a resource (e.g. fuel consumption is not taken into account), that the data refer only to material manufacturing whereas most of the life-cycle impacts of products occur after this stage (as described in 2.2 above), and that no account is taken of resources used prior to import.

A valuable way of considering resource productivity is as specific GVA multiplied by resource efficiency (specific GVA is GVA per unit of production output, and resource efficiency is the production output per unit of DMC). Resource efficiency was calculated for primary aluminium manufacture from 1995 to 2001 and for the forest products sector from 1995 to 2000. Both increased at about 1%/year. For both sectors, the difference between the falling resource productivity and the slowly rising resource efficiency is explained by the fact that GVA per unit of production fell during the period, as a result of declining prices.

Scarcity is not a significant issue for aluminium as life expectancy for bauxite is predicted to be about 300 years if world annual growth in production continues at 2.9%. New forest growth exceeds the annual cut by a large margin in the enlarged EU and domestic supply exceeds demand; the sustainable yield is not therefore considered to be under threat.

Primary aluminium production in the EU is projected to double by 2030, (i.e. to increase by 100%). Secondary production is expected to show a 170% increase. Projections for consumption of forest products (for the EU/EFTA) suggest increases by 2030 of 26% for sawn wood, 63% for wood-based panels, and 87% for paper and board.

2.4 Technological and Managerial Options

A review of the technological and managerial options with potential to improve resource productivity at different points in the life cycle of products highlighted the value of increasing the level of recycling, increasing the lifetime of products, and increasing the proportion of energy consumed during product manufacture and use that comes from renewable sources.

2.5 The Feasibility of Achieving Decoupling

The study identified a number of limitations and weaknesses in the measurement of decoupling in the aluminium and forest products sectors. These include a lack of reliable data, the unrepresentativeness of the results, the ability only to account for the sector's commodity material (and not energy and other raw materials), and not covering the whole life cycle of the products in the sectors.

A key question is whether the decoupling of resource use from economic growth best addresses the environmental issues of concern in the EU. A

number of limitations were identified in this regard, including: measuring decoupling on the basis of economic growth or value-added rather than a physical unit of actual service; concentrating on resource use measured in units of mass rather than measuring environmental impacts directly; the lack of targets as to the level of decoupling that is actually required; and not addressing the fundamental issues of eco-productivity and the absolute carrying capacity of the environment. Some of these issues have since been taken into account in the Commission's Thematic Strategy on the Sustainable use of Natural Resources and the renewed EU Sustainable Development Strategy of 2006.

In principle, it appears feasible under a business as usual scenario for both the aluminium manufacturing sector and the forest products sector to maintain a small ongoing improvement in their resource productivity and thereby to achieve ongoing relative decoupling of resource use from economic growth. This is based on the sectors maintaining the same level of resource efficiency growth as they did from 1995 to 2000, while reversing the fall in GVA caused by falling prices.

However, in line with both sectors' growth forecasts, it is likely that total resource consumption, as measured by DMC, will continue to rise in both sectors. Therefore achieving absolute decoupling of resource use from economic growth seems less likely for both sectors.

3 The Main Recommendations from the Study

3.1 Understanding Decoupling in the Whole EU Economy

More research is needed to understand why the resource productivity of the whole economy of the EU has been rising (with a GRORP of 1.8%/year between 1995 and 2000 for the EU15), and in particular:

- How much of this decoupling is due to changes in the structure of the economy (e.g. the move towards a service-based economy)?
- How much represents an export of environmental impacts that we are no longer counting?
- How much of the improved resource productivity is due to increasing GVA per unit and how much to increasing resource efficiency?

3.2 Development of Indicators

A range of eco-efficiency indicators meeting different criteria should be developed, not just one aggregated indicator. Indicators should include hidden and foreign flows, as well as all materials associated with the main commodity material (notably fossil fuels). This will require the use of TMC (total material consumption) rather than DMC (direct material consumption).

Generic and simplified LCA data should be developed and made available publicly. Resource use data obtained through material flow analysis (MFA) will be essential for estimating environmental impacts using these generic LCAs. Aggregation of resource use data should still be used for limited purposes such as macro or whole-economy MFA.

Productivity-based indicators (i.e. those based on GVA) should be further developed. However, indicators based on physical outputs such as production or service units (e.g. vehicle miles travelled) should also be developed as they avoid the issue of price fluctuations.

3.3 Data Collection and Provision

Improvements are needed in the reliability of material flow data. There is a need to address the limitations posed by data non-disclosure rules and legislation could be introduced or amended to require certain types of manufacturing companies in the product supply chain to submit annual material flow accounts. Recycling accounts should be made within material flow accounts, which should include data on post-consumer-recycle (PCR) amounts. This may require addressing the codes currently existing in the NACE/Prodcom classification, which do not adequately identify scrap or waste.

3.4 Technological and Managerial Options Specifically for Aluminium and Forest Products

The technological and managerial recommendations for the aluminium and forest products sectors (including production and consumption of all finished products) are made subject to further assessment through cost-benefit analysis. Both sectors should continue to increase the proportion of renewable energy used, both for the manufacture of the products, and by the products in use.

In the aluminium sector, recycling rates should be increased (particularly for disposable packaging and construction products). The substitution of other materials by aluminium should be considered in the many applications where the use of aluminium can reduce a product's environmental impacts in use (e.g. in transport). All primary aluminium processes should aim to use the best available technologies to increase energy efficiency and optimise processes to reduce emissions.

In the forest products sector, over-packaging of products should be addressed and there is scope for improving the collection and recycling of paper waste. All biomass waste from pulp and paper making processes should be subject to recycling or energy recovery, and the wood fabrication sector should phase out its use of volatile organic compounds. Clean technologies and closed loop water recycling should also be implemented.

3.5 Policy Options Specifically for Aluminium and Forest Products

The policy options for the aluminium and forest products sectors are made subject to a detailed assessment of the need for such policies. The potential for an increased role for the use of voluntary agreements in increasing the application of best practice to improve resource efficiency should be explored with the sectors. Detailed consideration should also be given to the secondary impacts of future policies, e.g. the potential shift in consumer demand between products of different resource groups.

Legislation should be considered to set national recycling and/or recovery rate targets for key end-of-life aluminium and forest products, and

to set minimum time limits for product durability. Consideration should be given to minimising the municipal incineration of aluminium, and to setting overall energy efficiency targets for aluminium and paper production. Legislation should also be considered to ensure uptake of best practice techniques associated with decoupling, e.g. timber certification.

Best practice should be disseminated to producers on how to improve resource efficiency through reduced material use, extending product life, using energy efficiently and designing for recycling. Public information campaigns should be used to encourage consumer choice towards the purchase of more resource efficient material/product types.

3.6 Final Comments: the Concept of Decoupling

Once one part of a train has been decoupled from another part, the train remains decoupled until it is recoupled again. In a similar way, the concept of decoupling can give the impression that a business or sector could strive for, and attain, decoupling (either relative or absolute) and then remain decoupled with no further effort. But in fact the dynamic nature of decoupling (it means increasing eco-productivity) makes this impossible. Only continual step-changes in eco-productivity can maintain ongoing decoupling.

Ideally, policy would recognise the ultimate objective of reaching sustainable levels of eco-productivity, in preference to concentrating on the concept of decoupling. Such a focus on eco-productivity (and other eco-efficiency indicators) would require the following key priorities:

- measuring current levels of eco-productivity (overall in the economy, in individual sectors, etc.);
- establishing eco-productivity targets (by identifying the required level of economic growth and the carrying capacity of the environment);
- adopting policy for achieving the eco-productivity targets.

In practice, however, it is complex and often not feasible to establish the carrying capacity of the environment and thus to derive eco-productivity targets. Striving for decreasing environmental impacts in a growing economy (which is absolute decoupling) is therefore a valuable practical approach which does not require the carrying capacity of the environment to be established first.

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PSS Product-Service-Systems in Public Procurement in Austria

Trend: Increasing

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1 Introduction

The research project "product-service-systems in public procurement" identifies factors that support or hinder the establishment of product-service-systems in public institutions in Austria and determines examples of best practice. Besides, strategies and recommendations are developed to overcome these barriers. The project aims to support the implementation of product-service-systems expecting that the change of perspective – from products to the function of products – offers solutions that may reduce the environmental pollution (vgl. z. B. Windsperger et al. 2006; Tisch, Weller 2006).

To achieve the research-goals we will follow the following procedure: Firstly, in-depth interviews with those responsible for the public procurement and with companies that offer product-service-systems are held. Secondly, the results of these interviews are used to develop two questionnaires, one to be sent to 2.500 Austrian public procurers and the other to 250 companies. Thirdly, strategies and recommendations are developed by analyzing product-service-systems that have been successfully implemented. These strategies and recommendations are discussed with public procurers and companies that offer product-service-systems. In 2007, the results will be published in the booklet "Product-Service-Systems in Public Procurement".

Three Austrian research institutes are involved in the project: the Inter-University Research Centre for Technology, Work and Culture (Graz), the Joanneum Research (Graz) and the Institute for Industrial Ecology (St. Pölten). The research project runs from April 2006 up to September 2007. The project is carried out in the framework of the programme "Factory of Tomorrow – a cooperation between the Austrian Federal Ministry of Trans-

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port, Innovation and Technology and the Austrian Forschungsförderungsgesellschaft.

The following chapter presents the results of the in-depth interviews. We made interviews with ten Austrian public procurers and with six Austrian companies that offer product-service-systems. We questioned only those public procurers who already implemented product-service-systems. Therefore we especially choose those public authorities that run environmental management schemes and public authorities that practise joint procurement.

2 Product-Service-Systems in Public Procurement in Austria

2.1 Definition of Product-Service-Systems

Our definition of product-service-systems follows the definition of Goedkoop et al. (1999): "A product-service-system (PSS) is a set of products and services capable of jointly fulfilling a user´s need". The suppliers of a PSS doesn´t focus on the sale of products but on the sale of the function, that lies behind the product.

We are well aware of the fact, that there is a huge transition area between PSS and services that have no direct connection with products. Therefore we distinguish between PSS that are part of the core-area and PSS that are part of the boundary. A core-PSS is a PSS where the function that lies behind the product is used and where the product belongs to the supplier. We consider a PSS, which doesn't meet this criterion, to be a boundary-PSS.

2.2 Results of the in-depth Interviews

In the following, the most important results of the in-depth interviews are presented: Indications about the current status of the implementation of PSS in public procurement, information about the requirements of users and suppliers for PSS, and indications of factors that support or hinder the implementation of PSS.

2.2.1 Which product-service-systems do Austrian public procurers currently use?

The results of the in-depth interviews with procurers and suppliers point towards two characteristics: (a) There seems to be an increasing use of PSS in some public areas of spend like office machinery and computers. In these areas there appears to be a current push towards PSS that is set out mainly by central procurement agencies resp. joint procurement groups.

(b) In some areas of spend like furniture there seems to be a difference in the establishment of PSS between the federal administration, where they are not very common, and local communities, where the PSS seems to be widely known. We have to await the results of the questionnaires to approve these characteristics. The PSS, that were stated in the mentioned interviews and the date of their implementation, are shown in the following table:

Table 1: PSS, that were reviewed in the interviews, and the date of their implementation

PSS used in public authorities	Date of the implementation
Copier: payment per copy	Ca. 1985
Cleaning Services	
Printer: payment per page	Ca. 2004
PC-Leasing	2006
Management of the transport fleet	2006
Leasing of medical textiles	Ca. 1998
Energy-Contracting	2005
Repair of washing machines	2006
Office furniture with illumination/ergonomics	
Catering	
Gardening and landscaping equipment and maintenance	
Snow ploughs and maintenance	
Hospital management	

2.2.2 Information about the requirements of users for product-service-systems

The interviewees mentioned the following requirements for PSS which are supposed to:

1. offer the user a benefit e. g. making the work for the user easier or simplifying the awarding of a contract. The PSS should be easy and run smoothly,
2. save costs,
3. contribute to the transparency of costs and improve the acquisition of data (e. g. the number of copies of a certain copier),
4. be offered by suppliers that have a considerable know-how,
5. enhance the quality.

2.2.3 Indication of factors that support or hinder the implementation of product-service-systems

The interviews referred to several factors that support or hinder the implementation of PSS. These factors, that are summarized in the following table, range from personal preferences to general conditions.

Table 2: Factors that support or hinder the implementation of PSS

Factors that support PSS	Factors that hinder PSS
Decision for green public procurement	
Creativity of public procurers	
The desire of the public authority not to burden itself with products and their maintenance	The desire of the public authority to own the products
Integration and motivation of all the affected persons	Resistance to alteration
Consideration of all the costs during the use and the disposal of the product (Life cycle costing)	Lack of transparency of costs – the procurement officer doesn´t know all the life cycle costs of the product
Legal certainty	Not enough tenderers, necessity of a procurement procedure that is time consuming and increases the danger of objections
Professional Assistance for the implementation	The Realization of PSS can be time consuming and complex
Market power of the public authority	For several PSS there is a minimum quantity. Market power of the supplier
Promotion of small and medium sized companies	Reduction of employees in the public authority. It can be difficult for small and medium sized companies to offer PSS

The in-depth interviews with public procurers showed that their creativity support the implementation of (new) PSS. Sometimes the idea for the PSS originated from a public third party (Erdmenger, Klauke 2005), sometimes from the procurer himself. The in-depth interviews with the suppliers indicated that most of the PSS suppliers offer had been established based on demand from public institutions. Apart from creative procurers the implementation of PSS needs suppliers that are able to manage risks and costs, that could be higher.

The decision for green public procurement made by the public authority is another driver for PSS – e. g. in the case of leasing medical textiles.

The resistance to alteration, missing initiatives and shortage of time for the development of ideas are factors that hinder the implementation of PSS. Therefore several public procurers recommend the motivation and the integration of all persons affected throughout the procurement process of PSS.

There are other personal aspects that affect the establishment of PSS. Some of the public procurers don't want to burden themselves with products and their maintenance whilst others want to own the products. For example local authorities, who want to hand over their old computers to schools or playschools.

It is important, that the advantages of the PSS, e. g. the cost savings, are clearly visible to the public authorities. If the public procurer doesn´t know about the life cycle costs (e. g. costs of the toner, the maintenance and the repair), the costs of a PSS may appear high. Public authorities that use life-cycle costing in their tenders, a method where all the costs mentioned above are considered, are able to identify potential cost savings offered by PSS.

The legal framework seems to support or hinder the establishment of PSS. There is at least one PSS that was implemented to gain legal certainty of tenders. The Austrian law, which puts emphasis on competition, may also hinder PSS, especially when there are only one or two potential suppliers.

Some of the suppliers mentioned that the procurement process is a barrier for PSS. Sometimes the process is very time consuming e. g. because of objections and extensive documents that are required. Usually there are additional costs for the supplier caused by complicated and long-winded tenders. A supplier mentioned that another barrier for PSS lies in tightly defined tenders, that provides no opportunity for flexibility.

Compared to the sale of products, the establishment of PSS is often more time consuming and complex, especially when the PSS is tendered for the first time. Therefore a professional assistance – e. g. offered by public authorities – supports the implementation of PSS (e. g. in the case of Energy-Contracting).

An important factor for establishing PSS is the market power of the public authority. Public authorities that purchase a great quantity can realize their ideas for PSS in a more simple way than smaller public entities. Therefore the implementation of PSS can be supported by joint procurement groups that are interested in innovation. The market power of joint procurement groups may be disadvantageous for suppliers. Some of the suppliers complained that with the cost pressure, the public institutions pass on to them, they may not be able to make a benefit from certain PSS. The market power of companies is important, too. Companies which preserve a monopoly on products can decide whether or not to offer a PSS.

Some of the public procurers mentioned that PSS may reduce the number of employees in the public authority. The implementation of PSS transforms the public authority into a manager, who has to control the award but who doesn't have to perform the service. The public procurers highlightened that the establishment of PSS supports small and medium-sized companies in the region to fulfill the service part of the PSS. However small and medium-sized companies mentioned the difficulties to offer PSS: Higher risks and costs, too much fluctuation in orders and sales if the company loose the award, the need for specialists when offering an all-in-one-solution (e. g. when offering the PSS "Office" specialists for office machinery, lightning, furniture etc. are needed). Smaller companies said that (financial) support would be needed in order to offer PSS.

3 Overall conclusion

The in-depth interviews indicate that the figure of PSS used in Austrian public authorities is currently increasing in some public sector spend areas like office machinery and computers. We have to watch the results of the questionnaires to figure out why this development is limited to certain public sector spend areas. This development seems to be supported by the following factors that currently play an important role in the public procurement in Austria:

The implementation of PSS is supported by the growing consideration of life cycle costs in tenders (that way potential cost savings offered by PSS are easier to identify) together with the necessity for public authorities to save money.

The constraint to minimize the costs supports the expansion of joint procurement, where larger quantities are purchased with lower prices. It seems that some of the Austrian joint procurement groups have several ideas

for new PSS and that they have the market power to find suppliers to realize their ideas.

At the moment it seems that financial shortage of public authorities encourages them to implement PSS. Some of those PSS lead to a win-win-situation by combining positive economical and ecological effects. For example the management of the transport fleet, that is equipped with modern vehicles using less fuel or the payment of printed pages, that may minimize the amount of printouts.

It is desirable, that the public authorities use a more systematic approach to make sure that the PSS they implement do not only have positive economical but also positive ecological and social effects. Therefore the public procurers should also consider profound ecological and social criteria in all their tenders. Joint procurement groups that foster innovation and sustainable procurement could hinder PSS that have a negative impact on the environment (e. g. because of the increased necessity of transport) or lead to poor working conditions. At the same time, these joint procurement groups could exploit the full potential of sustainable PSS.

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PSS Eco-labelling and consumers – Towards a re-focus and integrated approaches[1]

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1 Introduction

Environmental product information schemes (EPIS) have become a wide-spread market based environmental policy instrument worldwide. The most known and often discussed scheme are eco-labels of which the range reaches from mandatory to voluntary approaches. ISO distinguishes three voluntary labelling approaches, namely Type I referring to criteria-based certification programmes, Type II describing self-declared environmental claims and Type III applicable to quantified product information that is based upon independent verification using present indices. Eco-labelling provides a positive statement that identifies products and services as being less harmful to the environment than products in the same product category without a label. Eco-labelling differs fundamentally from the setting of minimum product standards or requirements that it rewards environmental leadership. Eco-labels (could) refer to several environmental issues referring to potential environmental impacts of products or services based on life-cycle considerations.

Environmental labelling, and in particular eco-labels, claim to have two general objectives (Piotrowski and Kratz, 1999: 430):

– providing consumers with the information they desire and thereby increasing market efficiency (information policy instrument),
– reducing the (negative) environmental impacts via offering environmentally less harmful products and services in the market (environmental policy instrument).

In this paper, we want to highlight three aspects:

[1] The paper is based on previous research we have been involved, see for exhaustive analysed Rubik and Frankl (2005) and IEFE et al. (2006).

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1. Which experiences exist with regard to effects of eco-labels to contribute to changing production and consumption patterns?
2. Which factors influence the success and/or failure of an eco-label?
3. Which future strategy could refocus the concept of eco-labelling and embed it into a path towards sustainable development?

2 Effects of eco-labelling: Summarising overview on direct & indirect effects

Successful eco-labelling activities rely on both *market efficiency* and *environmental effectiveness.* Eco-labelling has different meanings and implications for different stakeholders in the product life chain. For instance, companies applying an eco-label to their products intend to increase their market share and to substitute environmentally less benign "conventional" products with the eco-labelled ones. Other market competitors might be influenced by an eco-label without applying for it. Eco-labels could inform a manufacturer on environmental "hot spots" and constitute "crash barriers" – stimulating thereby environmentally more benign product innovations. Retailers might differentiate their procurement processes and range of products between eco-labelled and non eco-labelled products. Consumers could bear in mind the label and use them as an additional support while shopping. This exemplary list of examples demonstrates that eco-labelling impacts are more complex and that the paths toward environmental benefits have to take into account two different, but also complementary types of environmental benefits:

– *Direct environmental benefits* meaning environmental improvements attained through the application of eco-labelling on products/ services
– *Indirect environmental benefits* meaning environmentally positive impacts induced by eco-labelling schemes on surrounding policy, businesses and society.

2.1 Eco-labelling and changing the production and consumption patterns: direct effects

2.1.1 Changing the supply side

Eco-labelling wants to change the market and "substitute" polluting products. An important indicator of successful market penetration is the market share of eco-labelled products in relation to all other products sold belonging to the same group (Rubik and Frankl, 2005: 85). There is no statistical data in general to map the market power an eco-label may confer to a product. Data on market shares is often confidential commercial information in the hands of industry (OECD, 1997: 5). In short: research on market shifts is rare and reliable statistical data miss (Frey et al., 1998: 19).

Data on the market diffusion of eco-labelled products exist for one or the other product group and eco-labelling scheme. According to the OECD (1997: 5) some scattered anecdotal evidence shows that sales have increased when an eco-label has been obtained. But theses patchwork data do not allow drawing general conclusions. For the Scandinavian White Swan, an assessment estimated the market shares for several product groups:

– For printing paper, it was estimated that the share is about 70% in all Nordic countries (except for Iceland).

– Regarding printed matter, the shares of eco-labelled products are higher in Sweden (about 70%), being 40–70% in Denmark and 10% for Norway and Finland.

For other product groups, the estimates relating to the market shares are:

– The highest market shares of eco-labelled laundry detergents are found in Sweden (70%), followed by Norway (40–70%) and Finland (10–40%), whereas they are less than 10% in Denmark and Iceland.
– For all-purpose cleaners, the shares are up to 40% in Sweden and Norway and between 10% and 40% in the other Nordic countries.

Whereas we described above a more *static* view, we could supplement by a *dynamic* component: Eco-labels could stimulate suppliers in their product development process – i.e. their innovation processes – and influence the range of products offered on the markets. We have not (yet) found any empirical study dealing with the subject of *changing* manufacturers' strategies to adapt to newly elaborated eco-labels. An exception might be a study undertaken by Rehfeld et al. (2004). They carried out a survey among German companies' inquiring for product innovation and their environmental orientation; the authors examined also the influences of different instruments, among them eco-labels in general. It turns out that eco-labelling is only used very little both by environmental product innovators and non-environmental product innovators.

2.1.2 Changing the demand side

Looking on the demand side, a series of research has been undertaken concentrating on consumer awareness of eco-labels. In a comparative representative four-country survey Rubik and Frankl (2005: 110) report on disappointing figures: 1% of German, 1.7% of Norwegian, 0.4% of Italian and 1.2% of Spanish consumers know the EU-Flower without getting any help. Their survey showed that national eco-labels are still most well-known among consumer with 56.6% for the Blue Angel in Germany and remarkable 70% for the White Swan in Norway.

Kvistgaard Consult (2005a and b) examined the effects of the Flower week which took place in 2004 in several EU Member States. Carrying out surveys among the targeted population in these countries, recognition and knowledge of the EU eco-label was examined; the most striking results are that the EU Flower is recognised in most of the countries only by a minority, except of Denmark (see below).

A series of country-specific results could be found in IEFE et al. (2006).

However, consumers' awareness is one side of the coin, the other one is trust and confidence in labels themselves. *Knowledge, search for environmental information, and attitudes towards the reliability of this information* are crucial factors for the market performance of eco-labels and eco-labelled products. Rousseau (2004: 15) reported that only half of the Belgian consumers who know and interpret the EU eco-label have confidence in the Flower which means that finally only 2% of Belgian consumers know the EU eco-label, interpret it correctly and have confidences in it.

Obviously, a reasonable strategy might be to increase the awareness of consumers for an eco-labelling. This has been done in some countries. The most prominent examples are campaigns. Also Denmark was very active in this field: In February 2001, the Danish Environmental Protection Agency

launched a major campaign aiming at increasing the recognition and knowledge about the two official eco-labels, the Swan and the EU-Flower, and at increasing the sales of eco-labelled washing powder and textiles. An evaluation of the effects of an eco-labelling campaign was carried out via face-to-face interviews before the campaign, after it and once more half a year later after the campaign. The evaluation reports that the recognition of the Swan increased from 56% to 68% and from 16% to 36% for the EU-Flower after the campaign. The knowledge about their actual meaning also increased, from 26% to 41% for the Nordic Swan and from 4% to 16% for the EU-Flower. The trust of the labels remained high throughout the campaign. The evaluation could not directly register any increased sales of labelled products, but based on supplementary data it was concluded that the actual sales of eco-labelled washing powders increased significantly whereas the sale numbers of eco-labelled textiles remained stable (Miljøstyrelsen, 2001, quoted in Leire and Thidelln, 2004: 25f).

The impacts of different environmental product information schemes on purchase decisions have been tested in a project (Grankvist et al., 2004) under test laboratory conditions. It revealed – as predicted – that information about environmental outcomes provided by eco-labels did influence product preference.

2.1.3 Environmental performance

Several studies state a general lack of empirical data on the environmental effectiveness of eco-labelling (e.g. OECD, 1997: 8; EPA, 1994: 19). Just recently the forecasting via scenario methodologies has become an issue in the eco-label literature. Cadman and Dooley (2004) analysed the potentials of the EU-Flower with setting three different scenarios; they assume a 5%, 20% and 50% market penetration of eco-labelled-products and substitution of "average" products. Based on empirical data eco-labelled products possess a smaller environmental "footprint" than average products of the same product group. Based on this information, Cadman and Dooley (2004) develop scenarios for 21 product groups of the EU eco-label. The summarising results are the following ones:

Table 1: Direct environmental benefits of using eco-labelled products (Cadman and Dooley, 2004: iv)

	amount saved per year by scenario %		
Resource saved /avoided per year	*5% Take-up*	*20% Take-up*	*50% Take-up*
Electricity (GWh)	14,700	59,000	147,600
CO_2 produced from energy use (tonnes)	9,318,000	37,270,000	93,175,000
Water use (megalitres)	12,285,000	49,138,000	122,846,000
Reduced hazardous substance use (tonnes)	13,800	55,400	138,400
Material savings (other than hazardous substances) (tonnes)	530,700	2,122,700	5,306,700
Reduced discharges to water (tonnes COD)	30,400	121,700	304,200
Reduced air pollution (tonnes)	17,500	70,100	175,300

As to possibilities of reliable direct benefit assessment experts are sceptical. Dosi and Moretto (2001: 113) conclude that "there is still a lack of empirical and theoretical analysis aimed at assessing or predicting its effectiveness in terms of reducing the supply of polluting products". Reinhard et al (2001: 28) states that the review of previous evaluations of eco-labelling shows that a common approach is to evaluate effects on attitudes and behaviour rather than concrete environmental effects, as the latter type of effects has been considered very difficult to measure in a relevant way. It is also clearly difficult to distinguish the effects of an eco-label from the effects of other measures, which is why studies often conclude that several instruments have jointly contributed to an observed change.

Schiesser and Shinn (2004: 26) conclude against the background of lacking data and methodologies that overall the direct environmental improvements (or reduced environmental impacts) of the European eco-labelling scheme was judged to be poor to mediocre in 77.5 % of cases[2]. This was due to a lack of data on sales volumes or market share and of information on average impact reduction/unit of product. The only option was to use the number of applicants as a proxy. Whilst in some categories (textile, tissue papers, soil improvers, paints and varnishes and growing media) there is some relative success (relative to other EU Eco-label product categories), 50% of the product categories still show low applicant levels, i.e. between zero and three applicants. It is clear that the global EU market share is still relatively small.

IEFE et al. (2006) questioned actual participants of the EU-Flower as to their opinion of the label's influence on environmental performance. Nearly 2/3 of the participants indicated that the objective to improve environmental performance was very or fairly important for their application for the Flower. About every second interviewee indicated that the Flower had some effect on the environmental performance of the product in the areas of air and water emissions, waster/recycling and water/material use; improvements with regard to accidents/spills were rare and for noise/smell observed by ¼ of interviewees.

2.2 Eco-labelling and changing the production and consumption patterns: indirect effects

The mentioning of indirect effects of eco-labelling is a relatively new area; Reinhard et al. (2001) stressed this point in an explicit manner as one of the first. A (more) systematic examination was carried out by Cadman & Dooley (2004). Indirect environmental effects mean environmentally positive impacts induced by eco-labelling schemes on its surroundings in policy, business and society outside the effects on the applicant and participant of the European eco-label.

2.2.1 Policy related effects

With the emergence of the IPP-debate since the end of the 1990s, voluntary eco-labelling schemes have come into focus. While in the past eco-labels have been considered predominantly as a 'stand-alone' tool, the IPP debate changed the 'image' of eco-labels: The potential of third-party eco-labelling schemes lies in linking them to other (product) policy instruments and making them the basis for future policy instruments.

[2] This 77.5% refer to the judgements of experts interviewed during the project.

Instruments which could be linked to eco-labelling are (see also IEFE et al., 2006):

- Standards or limit values
- fiscal incentives (e.g. rebate schemes, VAT, corporate income tax)
- the "new approach" as a basis for the establishment of criteria whether companies have complied with "essential requirements" (e.g. Energy-using-products).
- internet sites (green purchasing, sustainable development);
- public and private procurement;
- cooperation and mutual recognition with other eco-labelling schemes;
- rating companies and investment funds;
- informal eco-design benchmarking for individual companies;
- product testing;
- environmental management systems.

What is striking is the fact that the debate on eco-label integration centres on the IPP discussion. For the moment, there is a starting debate on eco-labels and other policy concepts and strategies within one working group on product information needs of the formal IPP-network. A more intense strategic discussion of the potentials and constraints of eco-labels in the context of sustainable development policies, consumer policy, and thematic environmental strategies (such as waste, recycling or hazardous substance polices) seems to be rather neglected.

2.2.2 Market related effects

Market related effects and producers

Many studies assume indirect effects on the whole product portfolio of companies through eco-labelling. However, these assumptions lack in general empirical evidence.

Landmann (1999: 47) estimates that eco-labels could indirectly force producers to produce/offer eco-labelled products. Nadai (1999) assumes that negotiation of eco-label criteria improves the environmental performance of a whole market sector. Cadman and Dooley (2004: 59ff.) suppose that eco-labels could be used by companies as benchmark for their own products or as a target to improve their environmental performance.

Schiesser and Shinn (2004: 11) give some empirical evidence based on case assessment as they state that "other mechanisms are more indirect, such as the creation of a product benchmark that puts pressure on non-licensed manufacturers to evolve (mimicking all or some of the Eco-label criteria), or simply guides them as to what is expected of them, even though they may not apply for the Flower. For example, in the case of washing machines, the Eco-label has certainly resulted in creation of standard, although it is difficult to establish how much this is due to the Eco-label and how much it is also thanks to the EU energy label".

IEFE et al. (2006) confirmed this view: Their results show that also companies not applying for the eco-label could fulfil the requirements: half of the interviewed non-participants knew about the compliance with the Flower requirements; most of them indicated that between 80 and 95% of their products would fulfil them.

Some studies emphasize the market transformation potentials for changing customer and supplier relationships. Lohse and Schnabel (2000: 43) identified that the eco-label can cause severe disturbances along the

production chain. They encountered examples where SME suppliers regarded the European eco-label actually as a threat. If one of their main customers was to apply for the eco-label this would thus impose restrictions on the preliminary chain. The main fear is that a strong customer might shift the additional services and costs arising from the fulfilment of criteria and proof of compliance over to the preceding supply chain without adequate economic compensation.

Market related effects and retailers, private and public procurement

There is some evidence that eco-labelling schemes have greater impact when the eco-labels become a requirement imposed by retailers for their procurement and/or when they are used as tools to identify green products for government procurement and institutional purchasing.

The retail sector is not very much in focus of eco-labelling research. A comprehensive study carried out in Italy shows that the large majority of the interviewed companies use the eco-label as an effective and useful assessment tool for their suppliers, in order to select them for their vendor-list. Most of them consider the eco-label as an effective competitive and marketing tool (IEFE, 2003).

According to Cadman and Dooley (2004) eco-label criteria could be used in private and public procurements calls; their application support procurers and green procurement with the indirect effect of less information search; Some examples are provided by recent literature on how the EU eco-label is used in private procurement, with positive indirect effects (Toroc, 2003).

IEFE et al. (2006) looked deeper into this subject: About ¾ of the participating companies (strongly) agreed that the Flower has influenced their demands on their suppliers, whereas 43% of the non-participants indicated that. Once more nearly 74% of the participants observed an influence on the information exchange with commercial clients, 56% of the non-participants (strongly) agreed to that.

Cadman and Dooley (2004: 65f.) argue that the EU eco-label contributes to an increase of consumers' general environmental awareness.

The eco-labels' impact on awareness rising differs by country. In a country with a high level of environmental awareness like Sweden, the level of consumer awareness to eco-labels is significant and there is a demand for eco-labelled products. The market presence and therefore the visibility of eco-labelled products have contributed to the awareness of consumers.

3 Key influencing factors

What are the key influencing factors, which determine success or failure of environmental product information schemes (EPIS)? Are they dependent on product groups? Rubik and Frankl (2005: 248ff) identify a set of key influencing factors. Two of them are general, the others are dependent on the product group. Product-specific factors can be further subdivided into factors relating to the environment, market, stakeholders and specific EPIS characteristics (Figure 1). It is argued that if all factors are positive, this very likely determines the success of EPIS. However, if just one of the factors is missing or weak, this might probably lead to a failure of the scheme.

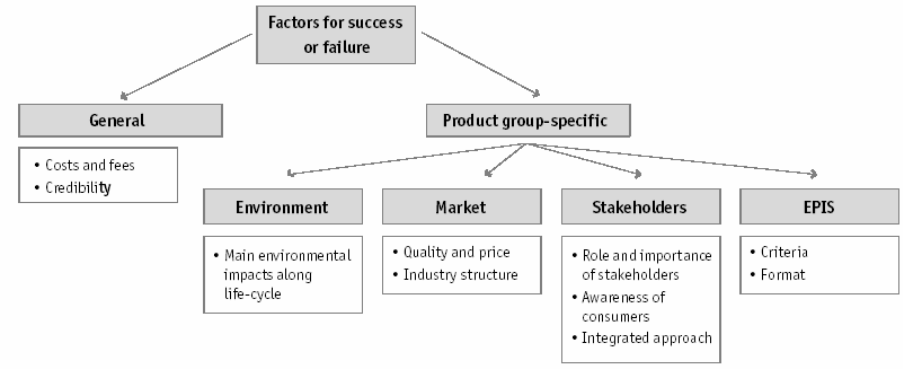

Figure 1: Factors for success or failure of environmental product information schemes (EPIS) (Source: Rubik & Frankl 2005: 264)

The two general key influencing factors are:

Costs, fees and verification: In most of the existing eco-labelling schemes, fees are based on the annual turnover of the eco-labelled product. In absolute terms, it is not a big percentage, but, in some cases, companies may prefer to invest in more profitable marketing tools rather than EPIS. Verification costs can represent another important bottleneck for SMEs. The amount of time required to obtain the EPIS, especially if proceedings are delayed by the verification process, is also cited by companies as a weak point.

Credibility: Credibility and trust in a scheme is crucial to its success and depends strongly on the guarantee of the competent body, which must be fully independent but not necessarily part of the administrative body. Consumers tend to prefer NGOs and consumer organisations as competent or guarantee bodies and generally do not trust producers and retailers as sources of environmental information. This fact could cause problems with self declarations.

Criteria elaboration is another key point relating to credibility. All the life-cycle phases of the product should be considered, this analysis should performed by an independent and competent institute.

All other key influencing factors depend on the product group. They are:

Determination of the main environmental impacts: Identification of the life cycle stage in which the main environmental impacts of a product or service occur is necessary for establishing targets, formats and criteria for EPIS.

Role of stakeholders: Identification of the key stakeholders is clearly a crucial issue – not only in terms of environmental impacts but also in terms of the economic and policy implications. In several cases, some stakeholders act as ‘champions’ or ‘first movers’. These ‘agents for change’ can break the vicious circle of lack of demand from consumers and lack of action by producers, often mentioned in discussions of EPIS. A good example for this are retailers and tour operators.

Consumer awareness: Awareness is at the basis of any behavioural change and is therefore a crucial key for success. Consumer awareness strongly differs depending on both country and product group. As would be expected, in general terms, consumer knowledge of eco-labels is high in countries where environmental awareness is high. What is a little surprising

is the significant difference in consumer awareness from one product or service group to another.

Market structure: The market structure strongly influences the motivation and strategy with respect to voluntary EPIS. Three main different scenarios can be drawn:

- Markets where production is concentrated in the hands of a few producers. In this case mandatory approaches or voluntary agreements might be effective to trigger environmental improvements more than EPIS
- Markets in which a link in the supply chain has control on the market yet is not directly responsible for the environmental impacts of the industry.
- Markets with a strong presence of SMEs in the various links of the supply chain (e.g. in the paper industry). In this case there is a need to consider more directly the complexities of adaptation as applied to SMEs.

Format: Format as another crucial factor strongly depends on (a) the product group (i.e. whether it is complex or simple), (b) the type of product (i.e. whether it is intermediate or finished), (c) the target group and (d) the impact of the life-cycle phase concerned. Above all, the format must be an appropriate compromise between conciseness and clarity. Simple products such as paper need only a very short and simple item of environmental information. On the contrary, more complex products like washing machines a logo or a phrase may result not enough. In particular, for those products which have the main impact in the use phase, additional user information is needed, as a guidance for correct use. In this case, EPIS play an important education role. This can be either provided by including information in the EPIS itself, or requiring specific information and education activities.

Criteria: Environmental criteria of EPIS are of course crucial for their success because they strongly influence the adoption by companies. The challenge is to achieve an appropriate balance between two opposite requirements. Whereas criteria that are too strict may act as a barrier to adoption, so that the scheme will lack the visibility needed for marketing, criteria that are easy to meet might create mistrust among consumers and thus discredit the scheme. Another challenge is to find a good compromise between the need to reflect local conditions and the issue of harmonization in an increasingly global market. However, the likely most important issue is related to scientific and technological change. For all the product with rapid technological development (e.g. all electronic products), classical ISO-type I timing for criteria elaboration and revision (typically three years) is by far too long. This is one of the main reasons for failure of eco-labels in this particular category of products.

Quality and price: Obviously, the quality/price ratio is the main factor consumers take into account when making a purchase. If the introduction of environmental issues represents a diminution in quality or significant increase in price, consumers will not accept it. In some cases, the perception of consumers is that protection of the environment automatically means lower quality. In order to combat this (mis)perception, it can be useful to emphasize the link between technological and environmental improvement.

The last three key influencing factors are related to the need for an integrated approach. With this concept we think not only about the link of eco-labels with other IPP tools but also about a much more complex

integration, considering how to integrate EPIS into national or international environmental policy targets as well as stakeholder involvement in the EPIS process. The related key influencing factors are:

Environmental policy targets: Until now, and in most of the schemes, product groups have been selected from among those with the most symbolic environmental meaning within the population rather than as a result of following an established plan to look for a real reduction in environmental impact. Criteria are –in general –not clearly linked to national policy.

Links with other IPP tools: According to our study, so far EPIS have been applied as a stand-alone instrument, acting like 'free runners' and not interacting with other tools or targets. This clearly reduces producers' motivation for applying them, as companies tend not to be interested in meeting voluntary and environmental targets set by public authorities not linked with legislation and/or green public procurement. Moreover they are mostly not linked also to other voluntary IPP tools, like environmental management systems.

Multi-stakeholder approach: The integration of stakeholders is another key factor for success of EPIS. Participation is more necessary when several stakeholders are responsible for environmental impacts throughout the life-cycle of the product or service concerned. This is especially clear in tourism. Tourists, hotel managers, the local community and intermediate agents are all, directly or indirectly, responsible for the environmental impacts of this sector. Co-operation of and collaboration between all stakeholders will be the key to the success or failure of EPIS that address such sectors.

Are these results totally dependent on specific product group or can they be generalized? A generalisation of results into product categories is certainly possible but needs a further level of detail. For instance, in the case of consumable products, one has to distinguish between recoverable and non-recoverable items. In the two cases, the relative importance of the end-of-life phase is very different.

Although a first-level categorisation into consumable goods, durable products and services is certainly appropriate, we propose a more detailed classification of product groups into six main product categories:

– Non-recoverable consumable goods (e.g. tissue paper, detergents)
– Recoverable consumable goods (e.g. copying paper)
– Energy-consuming durable products (e.g. cars, refrigerators)
– Energy-passive durable products (e.g. furniture, textiles and footwear)
– Simple services (e.g. car washing and laundrette services)
– Complex services (e.g. tourist accommodation).

The environmental bottlenecks for these six product categories occur at different places along the product life-cycles. This, of course, has significant implications for the selection of environmental criteria, the format of the labels, the target group for any communication and the role of stakeholders. Figure 2 shows the proposed classification of product groups into the six product categories as well as the life-cycle phase in which the main environmental impacts occur.

Non-recoverable consumable goods usually have their main environmental impacts during the production phase. More precisely, they might also have significant impacts during the end-of-life phase, but the consumer cannot influence this process to avoid impacts on the environment.

Such impacts are strictly connected with the materials, which constitute the product itself. As a consequence, criteria of EPIS on non-recoverable consumable goods should focus primarily on the production phase and on the primary resources involved.

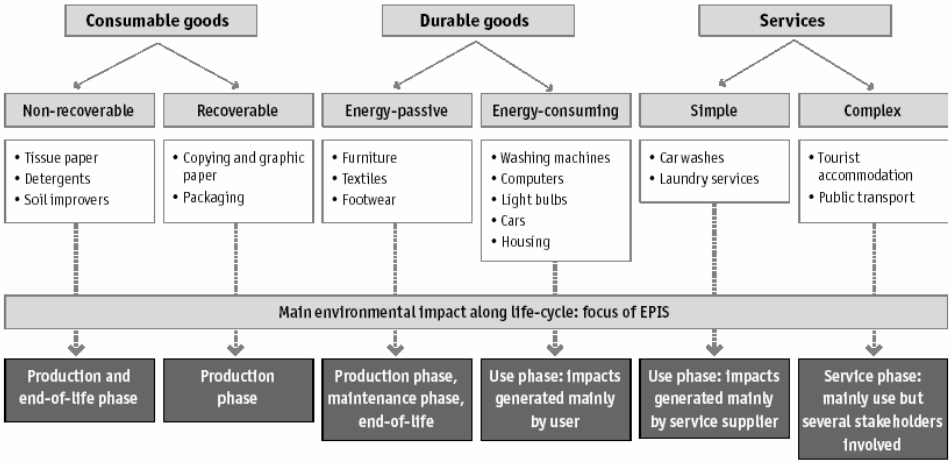

Figure 2: Classification of product groups into product categories with different focus of environmental product information schemes (EPIS) (Source: Rubik & Frankl 2005: 266)

Recoverable consumable goods can be collected and their materials recycled. Therefore, they their main environmental impacts may occur both during the production phase and at end-of-life, depending on whether the material is recycled or not. Criteria for EPIS should focus on the production and end-of-life phases.

The main impacts over the life-cycle of several durable *energy-consuming goods* are clearly related to the use phase. The same considerations developed below hold for goods that are not labelled, such as cars and housing. For this specific product group category, criteria in EPIS should therefore focus primarily on the use phase.

In contrast to the products in the previous category, the main impacts of *energy-passive products* such as furniture, building materials and so on are in the production and end-of-life phases. As a consequence, similar considerations to those for recoverable consumable goods hold both with regard to EPIS criteria and with regard to format. As far as the format is concerned, it should be simple and easily understandable, providing guidance on appropriate action at the end-of-life phase. Labels for energy-passive durable products should give guidance on best methods of maintenance and for extending the product lifetime. In addition, maintenance should be also a matter for EPIS criteria.

Simple *services* have their main impacts in the use phase. The impacts are generated mainly by the service providers. For those specific service groups in which consumer behaviour is of high importance (e.g. in the use of laundrettes), guidance for the best use of the service is needed.

The distinction between simple and complex services refers to the number and complexity of interactions between the stakeholders involved rather than to the simplicity or complexity of the technologies involved. The main environmental impacts of complex services such as tourist accommodation, airports, public transport, car-sharing, ship operation and so on derive from all three phases of the life-cycle: the purchasing phase, the provision of the service and the waste management stage. This is the most complex case, with a large variety of service types and geographical conditions, which must be taken into account in EPIS criteria. This is reflected in the fact that criteria for 'successful' ISO Type I-like labels as well as of the EU Flower have a mixture of hurdle and scoring criteria and a mixture of mandatory and voluntary requirements, as a response to the need for flexibility.

4 Strategy for the future: an integrated approach

As explained, the ultimate overall goal of EPIS – that is, to obtain net environmental benefits from the development, production and use of products with a lower environmental impact over the whole life-cycle – depends on several direct and indirect factors. Among the most important factors, effective EPIS must be able to induce changes both manufacturer and consumer behaviour. In order to reach this overall objective, we emphasise the need for an integrated approach that will leverage direct and indirect factors to maximise net environmental benefits. More specifically, we argue that it is necessary for all stakeholders involved in the various phases of the product life-cycle to do their best within the scope of their abilities.

An integrated strategy is needed to develop effective EPIS that can:

- Inform and empower stakeholders to act (all stakeholders, not just consumers), pushing them to change their behaviour and to act positively with regard to the environment
- Increase shared responsibility
- Respond to common environmental priorities agreed at the national and/or the international level

An integrated approach will also increase the efficiency of EPIS. For instance, there have been clear disadvantages to failing to co-ordinate the various EPIS in the past. The most striking example is the overlapping of the energy label and the ISO Type I label in the case of white goods, which was certainly a factor in the failure of the ISO Type I label in the case of this specific product group.

We propose a new integrated approach for the development of efficient and effective EPIS in which a wider set of EPIS and IPP tools are considered. We propose an integrated screening approach, which we call the 'path-dependent model', which should be taken into account a priori, before any new EPIS are developed for a product group. This process includes different levels of integration in a multi-stakeholder approach; that is, it features the integration of IPP tools and of different EPIS.

The proposed 'path-dependent model' approach is summarised in Figure 3 and includes seven main steps. The main message is that EPIS are a fundamental pillar of IPP but that their effectiveness might be radically reduced or increased depending on the lack or presence of a clear, integrated strategy. 'Stand-alone' EPIS may be unsuccessful. However, links between

different types of EPIS, between EPIS and other IPP instruments as well as the relationship between different stakeholders, have to be studied in advance in order to implement effective eco-labelling strategies for products and services.

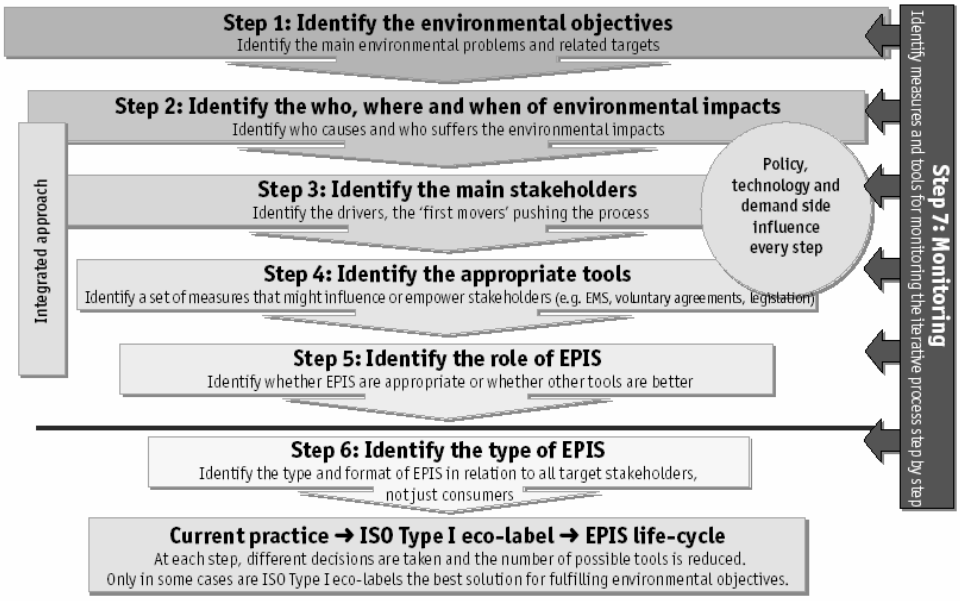

Figure 3: The path-dependent model as guideline for effective strategies for environmental product information schemes (EPIS)
(Source: Rubik & Frankl 2005: 278)

In order to be effective, EPIS must be linked to high-priority environmental objectives. The selection of product groups and adequate measures must follow accordingly. The *first* proposed screening step is therefore the identification of the main environmental issues of the product group and to check whether these coincide with environmental policy priorities. This step also serves to check whether or not the chosen product group has a large potential for improvement.

The *second* step is to identify who causes and suffers from the environmental impacts, and where and when in the product life-cycle those impacts arise. This step further helps to identify areas for improvement and intervention and the stakeholders that need to be involved. As already stated, in order to be effective, EPIS should change the behaviour of all stakeholders, according to their potential ability to act. In fact, to obtain net environmental gains, it is not sufficient to identify the life-cycle phase where impacts occur; one must also identify who is able to take action. Of course, this implies the identification of the stakeholder that causes the environmental impact(s). A little less obvious, but also very important, is the need to identify who suffers from the environmental impacts, because these stakeholders might be able to play a major role in the development of IPP tools and the promotion of EPIS.

The *third* step identifying the main stakeholders - is the crucial step in identifying who can or must act first and/or who might induce the greatest changes in behaviour. In particular, the goal is to identify the drivers who have to be the 'champions' or 'first movers' to pull the whole process along. These subjects must be involved from the very beginning in a product panel approach and in the eventual establishment phase of EPIS. In this step it is of utmost importance not to restrict attention only to producers and consumers (as subjects causing or suffering from the impacts) but to widen the gaze to look at intermediate actors (e.g. retailers).

In general, there is a wide set of possible tools to decrease the environmental impact of products throughout their life-cycle. The goal of the *fourth* step is to identify the set of measures that might best influence and empower stakeholders (i.e. all stakeholders, not just consumers). We argue that the potential use of a wider set of IPP tools should be systematically explored for all product categories. The more complex the category, particularly in terms of number of stakeholders involved, the more crucial it is to follow such an approach.

The goal of the *fifth* step is to identify whether EPIS are appropriate tools or whether other tools will be better to increase the sustainable production and consumption of the selected product or service group.

The goal of the *sixth* step is to identify the type of scheme most appropriate for the selected product group (voluntary or mandatory; ISO Type I, II, or III; selective or comparative). Moreover, the goal is to identify the most appropriate criteria and format of the scheme in relation to the target stakeholders (all stakeholders, not just consumers) for the given life-cycle stage of the product or service.

Finally, one of the major problems of existing EPIS is to develop and manage accurate monitoring and assessment throughout the EPIS process: from institutionalisation, through elaboration, to the market phase.

5 Conclusions

Environmental product information schemes (EPIS) and its most prominent tool – eco-labels – have often been applied. In contrast to this, assessment of their environmental impacts are rare. If monitoring tooks place, then direct effects are dealt with whereas the improtant indirect effects have often been neglected. Both impacts are of importance and should be considered in the context of the ongoing IPP and SCP discussions.

The success – or failure – of an EPIS is according to our research dependent on a series of key influencing factors. Many of them have never been adequately taken into account. For example, the selection of product groups has often followed industrial interests rather than reflecting national or international environmental policy targets. In some cases, EPIS criteria include a very wide variety of environmental aspects without really focusing on the major environmental 'bottlenecks' in product or service life-cycle. Major stakeholders have not always been involved in the establishment phase of EPIS.

Altogether, EPIS should be embedded in a broader framework considering the decision context in a systematic way. Therefore, we propose a 'path dependent model' approach which would significantly increase the effectiveness and efficiency of EPIS. In such a model, the role of eco-labels and their relationship with consumers could become much clearer.

PSS Emotional PSS Design

Beyond the Function

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1 Introduction

Product Service Systems (PSS) are not per se more sustainable than alternative solutions. Nevertheless, research has proven that they have far bigger potential to lead consumers to more sustainable (less harmful to the environment) way of life, if designed to reduce ecological impacts and resource intensity, yet satisfying human needs and raising the quality of life. This paper will focus on this so-called sustainable PSS, and address how to design them more attractive by learning from the competing alternative, which is, a product for sale.

2 Emotional value

2.1 Background

Consumer behaviours and decisions are not always logical and rational, but often emotional. Not to mention impulse and excessive purchasers, ordinary consumers and even rational decision-makers often show emotionally driven shopping behaviour. In spite of all kinds of reasons to logically back up the decision, after all, it is about perception and how the products or services make a potential buyer 'feel'.

Symbolic values of a product can be regarded more decisive than functional properties of products. (Scholl, 2006) According to results from social psychological research (Dittmar, 2004; O'Shaughnessy, 2003) people sometimes buy in order to bolster their self-image and the mood of a consumer at the point of purchasing plays a significant role in persuasion and choice processes. Ries also sees the emotional value as one of the essential elements in modern consumption culture.

> "Rational thought leads customers to be interested but it is emotion that sells. People really aren't much interested in attributes; they want to know if they can have a product that suits their personality. It is all about *values*." (Ries. et al. 2003)

2.2 Emotional marketing and storytelling

Based on the inherent human psychology big marketing companies already knew that it is emotion that motivates consumers to make purchases, thus they started to use emotional marketing. The underlying goal in doing so was of course to sell more products.

Jay Doblin (1920-1988) denoted, "a product is frozen information" stressing the importance of the story behind the product. In product design and marketing, stimulating emotions by using product's 'frozen information' has become a major strategy that has proven to be remarkably successful on the market. Jensen added in his book *the Dream Society*, "the purely material function gradually become trivial, taken for granted, a by-product", while "…the heroes will be the storytellers - those who create the culture and image of a company." More and more products from cars to fashion items use this 'story-telling' approach instead of functional descriptions in marketing campaigns. Abstract images engaged with the product became rather a common method of branding.

Despite its crucial influences in the marketplace, yet, emotional values are not easy to be identified because they are strongly determined by subconscious and non-verbal characteristics. As O'Shaughnessy pointed out, beyond the obvious emotions evoked by an inspirational Nike advertisement or affecting Hallmark commercial, lies an emotional universe that is less conspicuous, even transparent, yet no less influential. (O'Shaughnessy, 2003) Thus companies try hard to understand the art of accessing and the true power behind human emotions with intelligence and sensitivity. (Gobe, 2001)

3 Product design and marketing methods

3.1 Product and identity

There is no product without any function. Having a function is an intrinsic common characteristic of all products. Therefore, from a rational point of view a product is nothing but a mere object with functions. A brick is just a brick to be used to build a house and a pen is just a pen which is used for writing or drawing. Certain products, however, have the potential to be more than that. They can become even an inevitable part of the user's identity and consuming or possessing these products is seen as a symbol for success and happiness. It is not difficult to see people quoting *material* products as the indicators of someone's identity or level of aesthetic sense which are *immaterial* values.

The following illustration shows us the connection between a product and the user's identity, and how the role of a product is embedded in the life style and social status. Functions remain within the product, while information and stories are attached to the product. When the stories fit their personal lifestyle or ideal self-image, consumers pay attention to the product out of many products which have almost the same functional specifications. The lifestyle and identity built upon the information and stories from products, in return, become criteria to search for other products that they believe will complete their illusory identity.

Figure 1: Connection between a product and the user's identity

Here arise questions. What actually tells the stories and delivers the information through the silent product? What is the glue that makes them stick to the product?

3.2 Emotional product design and branding

To meet the increasing psychological role in peoples' lives, consumer goods started to be designed and marketed to deliberately function as material symbols telling who the person is and who he or she would like to be. From a functional and material point of view a soft drink is nothing more than just a carbonated, sweetened beverage. Nevertheless, the transition from the function-oriented view to the symbolic image was obvious shown, especially in advertising area. In 1970s, for example, the Coca Cola Company used to claim the function of the drink - stopping thirst. Now, the company no longer boasts the function of the product. Instead it is marketed to represent an exciting lifestyle.

Throughout the history of the last half century product design has been strongly affected by the social, economic, and philosophical streams. In the times of Modernism the form of products and buildings were designed to deliberately express their function. During the Great Depression in 1930s and the Second World War the vital role of designers were to reduce manufacturing cost of products. Now designers are oriented to design products which offer a certain emotional value by adding more characteristics which are not intrinsic within the product. A product is not designed to explain its function, but created by means of imagination of the lifestyle of its target consumer group and to fit in. Designers sketch intangible images and stories in order to plead a specific consumer group, and to make them react to the values.

Apart from the external symbolic influence, emotions are also connected with practical values such as usability. Underpinned by a series of research and experiments by a number of authors, Donald Norman stated that emotions change how human mind solves problems. In other words the

emotional system changes how the cognitive sense operates, thus people think more creatively when they feel good. (Norman, 2004) This finding opens a new perspective to the traditional product usability study which believed that good usability brings good feelings, and again highlights the role of aesthetics in product design as a tool to cause the good feelings. Not only the visual form and colour, also auditory information and tactile senses have been utilised for the promotion of consumer goods. Crispy sounds of snacks or a soft and smooth hand of satin could be more powerful than mere visual information. Indeed the territory of product design has been expanded to create the positive emotions such as willingness of trying and learning, curiosity, creativity and imaginative thoughts.

4 Product Service Systems (PSS)

4.1 Function-focused PSS design and marketing

Different from the evolution in product design, PSS design and advertisement is still focusing on the functional benefit of the system. Also PSS research has concentrated in the last years on the functional value of PSS and it is quite recently when cultural and psychological aspects started to gain attention.

Through research, Business to business (B2B) PSS offers were analysed to be economically successful while business to customer offers (B2C) are far behind. The reason is that companies make a decision from a rational point of view more than private customers do. Therefore the functional and economic benefit of PSS offers is accepted more easily. PSS cases of B2B model, for example, chemical leasing, machine rental and take back systems and textile cleaning services for hotels and companies, show relatively high successful outlook by appealing their functional and economic benefits. Judging from the rare success stories, however, B2C cases seem to have not been able to convince private customers. Examples analysis shows that one of the most crucial hindering elements in PSS implementation is rather the cultural and emotional experiences than the function of the system itself. The failure of launderettes in former East Germany in spite of the same function as ones in other regions, or the emotional harassment from the absence of ownership in car sharing systems indicate the significance of emotional quality of PSS.

4.2 Emotional PSS design and marketing

Re-orienting the consumers towards more sustainable lifestyle may seem to be an overwhelming task. However, it can be easier than it seems when we recognise the change already occurred in food consumption as denoted by the authors earlier (Wimmer and Kang, 2006). The amount of food consumption does no longer mean healthy state of body, economic wealth and emotional satisfaction. It rather indicates an undesirable eating habit, and even, lack of education and self-control. This change was brought by the consumer awareness through media campaigns and marketing strategies in food industry. Yet, the strongest driver of the change lied in the experience

of consumers themselves. They feel better in a healthy and lean body figure by themselves as well as by the society. This example shows that, once the norms of society changes, the change of consumption and production patterns substantially follows.

Not differently, the current material consumption and production patterns can be transformed through the beauty of immaterialised solutions. Sustainable PSS solutions will be more proper ways to show one's lifestyle and identity than merely buying and owning material products. For example, joyful lifestyles can be better accomplished and represented by joining a car sharing system and holding a small plastic membership card than buying and showing off a car while putting up with related hassles such as maintenance, lack of parking place and so on.

To invite more consumers to sustainable PSS through which they can experience both functional and emotional values that they have had with products, we need a new insight to read the unspoken needs (needs behind the needs) and new methods to attach emotions to systems rather than material products. In PSS development, however, emotional design and marketing is more challenging because there is often a lack of the information carrier and aesthetic objects - products. The identification and development of such new carriers and aesthetic elements is seen as the key issue for success of PSS for private customers.

Offering exclusive access through membership service is one possible approach. The key to the success of membership service exists in the fact that members experience the particularities limited to the non-members. Another dimension is shown in the virtual world: for instance, online games create and sell experiences and emotions successfully and users can share them, independently from their real lives. Stories and information surrounding the online product have already turned out to be an enormous market success.

Our current PSS development project using a series of refined and tailor-made methods based on MEPSS reinforces the argument that non-functional properties have even stronger influence on the success of B2C offer. Regarding the PSS offer from Japanese pre-fabrication housing company *Sekisui*, for example, a large number of potential clients showed their suspicion on the quality of the reused house although it was practically approved to have equivalent functional qualities with new house. Through a consumer investigation, the company figured out that it was because of the title of the offer 'URU', which stands for Unit Re-Use. People have such a stereotypical perception on old or second-hand products and this image was clung to the title. As a solution, a new brand name which can represent the positive concept - rebirth of old units into new ones – has been suggested. Also a test-living service before decision will be provided for the customers to be able to experience the high product quality which is often accessed to exceed their expectation. The service will take place at popular resort areas similarly to hotel services where people would like to have positive emotions. Likely the aesthetic beauty in product design, these detailed design methods will implicitly attract consumers to the PSS.

5 Overall conclusion

In the era of material scarcity, owning more material goods was a symbol of wealth. However, this obese consumption habit has been ended up with threatening our economic, environmental and social stability. In our matured economy in which we can get those artefacts without much effort, the paradigm of consumer culture also should be shifted to more immaterialized value.

PSS offers stand in direct competition with a huge variety of products for sale and their respective stories behind. Providing the same function of the product would not bring a large difference. In other words, PSS have to be better or, at least, as good as the corresponding products in terms of functional requirement. Yet this is not enough. They also have to be entertaining, fashionable and sexy to successfully compete with product sales. We will be able to transfer the obvious success of the product marketplace with less error by learning from the methods employed in the product design and branding.

For the market success of PSS, designers should take more sophisticated approaches overarching not only functional qualities but also non-functional values such as interactions with service staff, aesthetic joy from the product used in the system and experiences to proudly share with others.

Following the promising results of the PSS development examples, more successful models will be designed and marketed. The consideration of emotional qualities here will be the major success factor to make PSS offers, especially B2C models, more attractive.

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DEV Social Innovations in Brazil

Identifying relational qualities
as a strategy to achieve sustainable results

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1 Introduction

This paper presents the first results of an ongoing joint activity of the Politecnico di Milano, INDACO, Design and Innovation for Sustainability research unit and the Federal University of Rio de Janeiro, COPPE, Laboratory of Technology and Social Development targeted to investigate "creative communities" in the Brazilian context. The concept "creative community" was extensively developed by EMUDE (Emerging Users Demands for Sustainable Solutions), a European Commission FP6 funded programme, the aim of which was to explore the potential of social innovation as a driver for technological and production innovation, in view of sustainability

EMUDE identified cases of innovation in Europe which have been called "creative communities": situations where people organize themselves to obtain the results they are interested in, creating answers to demands for food, housing and education etc. In doing so they regenerate the social fabric and, more or less deliberately, improve environmental quality. The solutions detected are rooted in the requirements of everyday life combining, in an innovative way, several actors and their specific motivations (Manzini, 2005)

The EMUDE working paper called *Environmental and Techno-Economic Evaluation of the Most Promising Cases; Applicability to Eastern European and Developing Countries* and the EMUDE-Final Results Document started to apply EMUDE concepts and proposals to "developing countries" in the so-called "Global South". To do so these documents centred their analysis on a group of selected European cases, identifying which ones could be successfully reproduced in "developing" contexts.

Here we are proposing another approach, focusing directly on Brazilian cases, which have been collected following the same EMUDE criteria used to identify "creative communities" in Europe.

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It's important to stress that the analyses proposed here are predominantly based on the human interactions embedded in the cases. More precisely, we are considering their "relational qualities". As we will see in the following lines, the clear individuation and description of these qualities is the first criterion to be considered when dealing with creative communities - in the "Global South" as in every part of the world-, the criterion which encompasses and forms the basis for all other evaluation criteria, including environmental ones.

This is the particular contribution of this paper to a kind of "methodology" by which to identify, support and reproduce social innovation qualities.

2 Relational services

When reading the expression "relational quality" everyone has a vague idea that it is related in some way to human interactions. However, as we are using it here, the term "relational qualities" refers to a specific concept and approach. In a previous paper we defined the ***relational*** dimension as a quality criterion by which to evaluate and design services using the anthropological philosophy of Martin Buber (Cipolla, 2004). According to Buber (1923), the individual becomes a person when he is a being who establishes ***"relations"*** with other human beings. In Martin Buber's description of the two *principle-words* "I-Thou" and "I-It" he makes clear that "I-Thou" and "I-It" cover every possible kind of encounter. When "I" interact with "It", I always confront something I know, that I knew was an "It", and about which I might wish to know more through my actions of knowledge. When I relate to a "Thou", I always have before me a person whom I do not know entirely, and whom I will never know unless I listen to what his presence tells me and lets me know of himself. The "I-Thou" encounter configures a ***relation*** and this is the most unique feature of being human. It is the ability to have a face-to-face relation with the other, a direct relation harboring both dialogue and encounter. The dialogical principle of Martin Buber was used to define a distinction between two kinds of services: tourism and hospitality. Tourism is defined as an "experience" and hospitality as a "relation". ***Relational services*** are not based on an agent "serving" a client, but they are based on inter-human face-to-face and collaborative encounters, i.e., they are community-based services (Cipolla, 2006).

3 Relational qualities: well-being, citizenship and development

Placing "relational qualities" at the center of our analysis means that the main assessment of creative communities and promising cases concerns how these cases favour conviviality on a "situated basis" (Zaoual, 1998, 2006). This is not an obvious question, because there is a diffused and rather romantic idea that in the "Global South" communities are based on strong "relational qualities" that are always intrinsically positive in the sense of unconditionally promoting peace and goodwill, in contrast to the cold

instrumental rationality of the social relations dominant in the so called more "developed" parts of the world.

So it is necessary to specify what kind of "relational qualities" we are talking about here when associated with social innovations. Social innovations can be based on spontaneous mutual aid, enlarged families and many forms of solidarity that, survive in the less favored social groups, but which are often interpreted in a naïve way. However here, more precisely, we are talking about "relational qualities" as a powerful resource to change conditions of life not only in Brazil, but also in many other countries, including Europe. This means considering "relational qualities" not only in spontaneous or survival initiatives, but in a framework of strategic activity.

This occurs when the relational qualities are associated with people's "capacity to organise themselves to obtain results, and in doing so generate new common goods and new forms of active citizenship." Creative communities are "concrete opportunities for the promotion of new ideas of well-being, citizenship and development". (Manzini, Cipolla 2006)

Working on "relational qualities" means identifying promising cases and creative solutions where the achievement of well-being is based on interpersonal relations: an approach that focuses more on "actions" or "relations" than on "things" (Leonardis, 1998) and which obviously also leads to environmental benefits.

If the ultimate goal of sustainable consumption is to improve quality of life for all consumers, then achieving a state of well-being lies at the centre of our efforts. Cases and solutions where the well-being achieved is not individualistic, but produced and consumed in a shared way, generate benefits that lie beyond the single cases and situations and create, a very powerful regenerative effect in fundamental issues such as citizenship building and sustainable development. In the following paragraphs we present concrete cases, in a Brazilian context, that help us to illustrate these considerations. We cannot elaborate an estensive and in-depth case analysis here, but we have tried to select cases where it is possible to introduce the quality criterion we are developing.

4 Relational strategies

The solutions identified in EMUDE, characterised by the involvement of individuals and the generation of interpersonal relationships, concentrate on "actions" (verbs such as: move, educate, work, eat). Several types of action may be combined in a single solution that may be carried out by several social categories, who find mutually beneficial returns and personal satisfaction in providing the service.

Let's take an example from the EMUDE case collection to clarify the relational concept, the case called "Walking Bus". In this case, schoolchildren and elderly people meet and the latter guide the children to school. This is a "transport" service that puts two social categories together: schoolchildren who must go to school – in a less polluting and self-orientated way than being taken in their parents' cars – and elderly people who find a moment of social integration in everyday life. Here, we can see a mobility service that also generates "overall well-being for those involved". "Moving" as an action, free of a thing-orientated systemic approach,

obviously revives the network of neighbourhood interpersonal relations. "Moving" is "crossing" a space, but it is also "seeing", looking about oneself, knowing. Children and "grandparents" walk the roads on foot, interacting with the neighbourhood. Here, "moving" is also "educating" and, we must not forget, "sustaining": walking reduces the number of cars on the road and the pressure on air quality and traffic.

The description of this case shows how its "relational qualities" have a regenerative social effect on the surroundings. There are other examples from the EMUDE case collection that could be included here, as for example, the "Living Room Restaurant" where the service lies in the possibility of booking a table for dinner in a family house rather than in a restaurant. The "client" even helps lay the table. This "home-based service" is very usual in many parts of the world while virtually unknown in others. The same is valid for another EMUDE example called "Lodge a student at home", in which older people offer accommodation to university students, using the rooms previously occupied by their children. All these examples have a high regenerative effect in their respective contexts, effects that are desirable in any part of the world, though in some places probably more than other. Places dominated by high individualistic values and diffused unsustainable consumption patterns certainly could benefit more from these solutions.

Therefore taking these examples into consideration, we can see that the "relational qualities" are embedded in such social innovations and that the evaluation and development of these qualities are relative and depend on a situated context.

5 Brazilian cases: the "cross-hierarchichal" relational strategy

As indicated before we consider the "relational qualities" in a framework of an strategic activity directed to "concrete opportunities for the promotion of new ideas of well-being, citizenship and development". Therefore we need to identify in the solutions the core elements able to promote this impact. These "core elements" have been called here "relational strategies".

We cannot make an extensive analysis here of all the "relational strategies" identified in the solutions collected in Brazil. We are focusing our attention on one strategy, that we have called "cross-hierarchical". Since "relational strategies" occur in a specific situation, we need a better understanding of the historical background and current situation in the country in order to describe them correctly

First of all, the "cross-hierarchical" relational strategy come into being in the strong hierarchichal social structure that has historically characterised the formation of Brazilian society. In this context we should not forget that slavery only legally ended in 1888, in the independent Brazilian empire. Slavery and a strongly partriarchal family structure determines the roots of the Brazilian cultural identity. (Freyre, 1933). The urbanization process has brought the rise of a middle-class but this fact could not undermine the dominance of hierachichal elements. (Freyre, 1936). An awareness of this historical background is necessary to understand the social dynamics of Brazilian cities, such as Rio de Janeiro, deeply signed by a huge social

contrast between "favelas" and medium class areas: cities where social exclusion is widespread (Bartholo, 2006)

In such conditions, affirmative action by citizens in the social innovations identified in Brazil must be seen as a cross-hierarchical relational strategy. Using this term "cross-hierarchical" we indicate that the innovations do not aim to abolish the hierarchies but create "convivial" (Illich, 1973) situations to favour interpersonal encounters between two poles of the hierarchy, namely, the favelas and the middle-class integrants. In terms of Buberian philosophical anthropology, this means they do not hinder the capacity to develop an I-THOU relationship: direct and immediate face-to-face interpersonal relations between the two poles. To say that in positive terms, it means they promote a positive "vulnerability" to encounters between them (Cipolla, 2006). This also implies that the innovations do not try to transform the hierarchical relation into something like a purely technical functional differentiation of roles.

Let's consider a mobility case in Brazil, specifically in Rio de Janeiro, called "Mototaxi", developed in a district called Grajau. Like many other districts in Rio de Janeiro, Grajau is marked by two delimited areas: an upper and middle-class area and two favelas.

As indicated by the name itself, this is a fusion between a motorcycle and a taxi. The original purpose of the service was to transport inhabitants inside the "favelas". Motorcycles are particularly requested because "favelas" consist of very narrow "streets" that otherwise would be inaccessible to motor driven transport. Consequently, the best way to organize a taxi service there was to use motorcycles. It is important to note that "favelas" are – in general - buildt over the hills, as for example in Rio de Janeiro. The main function of the service is to save inhabitants the effort of climbing the hill to arrive home. So the "Moto taxi" center is placed at the bottom of the "favela" and the service operates covering small distances. A relevant – and probably unexpected – development of this service is that other social groups began to use it, not only the favela's inhabitants. This happens specifically when the "Mototaxi center" is placed at the bottom of the "favela" but with access to middle class areas. Another reason for middle class use is that this service is cheaper than the usual taxi, so it is more affordable for them. Particularly, middle-class students started to use the service integrating with the motocycle drivers who are young people from the favela. This integration of young people from the two areas probably requires support to ensure the affirmation of positive values. In Rio de Janeiro, middle-class parents are in general worried about this integration, protecting and isolating their kids in "protected condominiums". Today, "Mototaxi" is a solution that was created spontaneously, with no intervention (from NGOs or the municipality) so there is no assistance. Although this cross-class use of the service is not so diffused this characteristic is very important , for social cohesion and the relief of the tension and violence, considering the Brazilian context. It's a solution that solves mobility problems but also creates interaction between social groups, a strategy certainly to be repeated.

The cross-hierarchical relational strategy is also illustrated in a solution called "Jardineiros do Bairro". Everything began at the end of the 90´s in a Rio de Janeiro district called Botafogo. Botafogo public gardens were transformed into a big garbage can. A local NGO found a good opportunity to solve two local problems in one solution. The initiative Jardineiros do

Bairro: "District Gardeners- Cultivating the City Integration" intends to solve the problems of violence and lack of skills by teaching the young people from favela Santa Marta in Botafogo gardening skills. At the same time, it promotes the integration of people who live in the area: middle-class and favela inhabitants, local traders and students. The more kids from favelas learn different skills, the less they have time to play with drugs. Although they started by finding out about the necessities, fragilities and sensitivities of plants, the young people soon began to care about their personal necessities, increasing their self-esteem. The project also stimulated all the agents involved to feel co-responsible for the conservation and development of the district.

The gardeners act in three areas: public gardens, private gardens and schools. In Botafogo people used to say: "nothing works here, but the District Gardeners". Elderly people come up and give opinions about the gardens, and when they have a plant that is dying in the house; they bring it to plant at the public gardens. The traders are also motivated. Before, when the young gardeners started to work in the street, the traders were afraid of them. This no longer happens and last summer it was only possible to water the plants with the traders' contribution to the water supply. The idea is that the district now takes care of itself, raising environmental awareness, in gardeners, condominiums, traders and people who pass by or work there. The District Gardeners' program has already worked in other districts of the city and also created some projects to promote environmental awareness in state schools. The aim is to sensibilise students towards the maintenance and preservation of the gardens; to understand the importance of green areas to the environment; and the importance of urban conservation for the common good, as a primary factor in the improvement of quality of life in the district.

In a context like Rio de Janeiro, marked by deep social contrasts and violence, the "cross-hierarchical relational strategy" embedded in these solution ideas, increases conviviality, reduces the mutual lack of confidence and, we hypothesise, creates the possibility of cooperation beyond the differences. Participation and the sense of a common citizenship can be increased, and, in parallell, the definition of new common goods shared by classes usually in conflict and confined in separate, delimited areas of the city. This strategy can have a huge regenerative effect in this social framework.

6 Conclusions

6.1 Relational strategies to achieve sustainable results

The examples presented below, developed in a local context, would represent very weak and isolated cases if no effort is put into an accurate planning process. In fact, it was stated in the EMUDE Executive Summary (2006) that a strategic design approach is needed to reinforce these weak signals and to reproduce them in other contexts:

"*Obviously, adopting a strategic design approach when we deal with cases of social innovation does not mean that social phenomena in themselves can be designed. It simply means a particular way of looking: to look at cases of social innovation to identify what could be done to improve*

their potential, to maintain and/or re-new their qualities and to reduce their limits. That is, in our specific case: to look at creative communities and to imagine a strategy to reinforce them and to support their evolution towards a mature diffused social enterprise. And to do that maintaining the (most of the) qualities and values that triggered the original creative communities' ideas."

What we are arguing here is that if we want to maintain *"(most of) the qualities and values that triggered the original creative communities' ideas* . the "relational strategies" embedded in each case need to be identified, and these strategies must guide the design of solutions targeted to reinforce and reproduce the successful cases.

The relational qualities of the solutions are able to drive all the other qualities and benefits, including the environmental ones. Such an affirmation can be explained with reference to Manzini (2006b) who summarised the way we must see the transition towards a sustainable society in 3 points:

1. "The transition towards sustainability is a process in which human beings have to learn to consume (far) fewer environmental resources".
2. "The transition towards sustainability is a process in which human beings have to learn to live better improving (or, in many cases, regenerating) their physical and social contexts of life".
3. The transition towards sustainability is a social learning process.

The 3 points above can be promoted though solutions based on the "relational" dimension. Firstly, because a specific solution can enable people to share, in order to "consume fewer environmental resources". Sharing is an intensive interpersonal and relational activity. Secondly, because "improving or regenerating contexts of life" means to living better, in collaboration with others: reduced consumption of material products can be achieved by promoting community-based alternatives. Thirdly, because, the "learning process" towards sustainability is embedded in the two previous points: for example, if I have a solution that helps me to share and to collaborate with others in my neighbourhood, I'm learning how to live differently, reinforcing the transition towards sustainability and, at the same time, promoting citizenship and the creation of new common goods.

6.2 *Homo situs* and connected

We started our paper by presenting the "relational" quality in social innovations as a principle based on a philosophical approach. We have arrived at the end of this paper, indicating and recommending a strategic design activity to develop solutions oriented to reinforce and reproduce these qualities, i.e., a "strategic design towards a synthesis between quality and access" (Jegou, 2006)

Relations cannot be designed. What we are talking about is how designers can learn from them and how to foster them. The philosophical approach here- based on Martin Buber's anthropological philosophy - is a guide to designers, in giving them a filter by which to identify the relational qualities embedded in social innovations. By identifying relational qualities, designers are able also to developed a new solution inspired by these qualities, to reinforce or promote a better performance of the original solution or to reproduce the original one in other contexts. The latter possibility, i.e., to reproduce the original relational strategy in other contexts,

is a complex issue to deal with. Relational strategies are highly "situated" (Zaoual, 1998, 2006) and, to really be able to extract these strategies from social innovation cases, designers need to immerse themselves in localities to fully understand the relational values they are dealing with and the importance they have in improving or regenerating the local social fabric. As we have shown in our brief analysis, a better comprehension of Brazilian history enable us to identify the value of the "cross-hierarchical" strategy in Brazil. This means also that designers are touching localities directly (precisely "service designers"), and no longer indirectly as when they designed mainly products, produced far away from their costumers' localities. As it is said: "What the eyes can't see the heart can't feel". Designers are now seeing more.

Locally based communities and local designers are fully able to know their local contexts and identify their relational strategies, but at the same time they are able to understand if an external "relational strategy" could be useful for them or not. This highly situated dimension of "relational qualities and strategies" indicates, perhaps obviously, that actions on this issue could be based on a "collaborative network" (Manzini, 2006c) capable to catalyze local communities and to promote exchanges between them in a peer-to-peer modality.

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DEV

Consumption in a globalizing world – Assessing sustainability through the lens of 'interregional ecology'

Consuming Costa Rica

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1 Introduction

In a globalizing world we are all depend on natural resources from all over the planet. In such a world the sustainability of any given region directly and indirectly depends on the sustainability of supporting regions around the world.

Most environmental reports and sustainable development studies apply to a single spatial scale; local, national or global. These reports analyze diverse pressures on human well-being and ecosystems integrity and suggest policies needed to achieve local or global sustainability (e.g., UNEP, 2006; MEA, 2005). The main emphasis is on the impacts of production, the negative effects of economic activity on the producing region and sometimes the global commons. However, there is much to be gained by reconsidering productive processes more holistically by tracing material flows from source to final demand (i.e., consumption).

Environmental change and ecosystems degradation are complex problems with many causes or drivers (MEA, 2005:114). While local change may be a consequence of local activity, some changes result from activities in or by other regions (e.g., MacNeill et al., 1991; Dauvergne, 1997; French, 2000; Mason, 2005). By following resources used for production across spatial scales one can highlight increasing consumer dependence on distant ecosystems and trace the loss of ecosystems integrity in particular places to both local and international consumer demand. In certain cases ecosystem degradation is significantly due to non-local demand. Such reality underscore the facts that while virtually everyone in this globalizing world depends on life support processes and natural resources from all over the planet, globalization itself blinds us to the impacts of that dependence on critical ecosystems that may be half a world away (Rees, 2002). For sustainability in such a world we might need to add another perspective: an interregional human ecology. In summary, a*n interregional approach to ecological sustainability recognizes that the consumption of imported materials in one part of the world imposes burdens on productive ecosystems*

in distant locales. That is, consumers in one region depend on, and potentially negatively affect, more distant regions. This perspective emphasizes that: 1) the sustainability of any given locale/region is dependent on the productivity and sustainability of supporting regions, wherever on earth they may be located, through the medium of transboundary resource flows and 2) that unsustainable consumption habits in any region jeopardize the sustainability of both distant supporting regions and ultimately the consuming region as well.

The purpose of this paper is to explore the interregional ecology approach to sustainable consumption and production, by looking at Costa Rica as a case study for a region that increasingly being devoted to supporting other regions of the world with tremendous costs to its fragile ecosystems.

2 Background

2.1 Quantifying the flow of resources

In the past few decades numerous methods have been developed to enhance our understanding of human dependence on the natural world. Two such tools are Material Flows Analysis (MFA), and Ecological Footprint Analysis (EFA). MFA accounts for the movement and stocks of resources within a system defined in space and time. It strives to deliver a complete and consistent set of information about all material flows through a defined system (Brunner and Rechberger, 2004:4; National Research Council, 2004: 17). EFA is a quantitative tool that converts population's annualized energy and material consumption to a corresponding ecosystem area, EFA estimates the area of the earth's productive surface required to support that population on a continuous basis (Rees and Wackernagel, 1994; Wackernagel and Rees, 1996). It also enables the analyst to compare a nation's available biocapacity (its total domestic productive ecosystems area) to the actual ecosystem area required to support its population at prevailing material standards. Both MFA and EFA emphasize the relationship between the economy and the environment; materials are extracted from natural systems as inputs to the economy, transformed into products, and re-injected into the environment as waste. While these tools move us a step forward in our quest for ecological sustainability, they generally fail to identify either the origins of critical resource flows or the ecological changes resource exploitation impose on exporting regions.

2.2 The complexity of sustainability in a globalizing world

In today's world the physical impacts associated with the material flows required to support any specified regional population or economy are not solely local; only some impacts of product use occur at the point of consumption, while other impacts associated with both earlier and later stages of the product's life cycle occur at great distance.—In short, contemporary ecological footprints are increasingly scattered all over the world. This raises questions regarding interest and responsibility: Whose interests are affected by negative ecological changes in the exporting country? Is it only the producer's problem or are the consumer's (i.e., the

importers) interests affected as well? If the latter, should not both producers and consumers be held responsible for the deleterious impacts of the production-consumption process? And how should this compound responsibility should be recognized? As shown in figure 1, country 'A' imports different products (material flows) from country 'B', country 'A' **depends** on country 'B' for these products. On the other hand, to produce these export products, country 'B' dedicates a certain area of its terrestrial ecosystems (and several other inputs) to country 'A'. While production does not necessarily mean serious ecosystems loss, it generally does generate some direct and indirect **ecological impacts**. The deterioration of country 'B''s ecosystems can reduce its ability to support 'A' (and also to support its own population and other importing countries). Therefore, the citizens of both country 'A' and country 'B' have an **interest** in sustaining country 'B''s ecosystems.

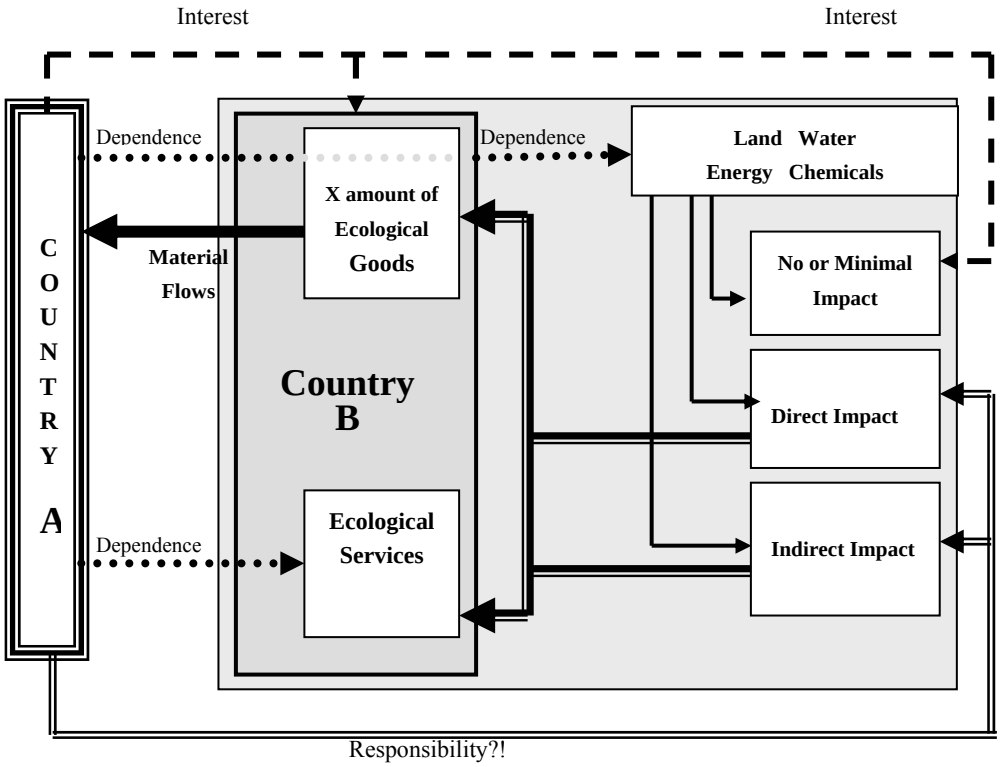

Figure 1: The Interregional Ecology model

Legend:

➡	Flow of materials	➡	Potential results
⋯➡	Dependence	⟹	Deterioration of supporting ecosystem
- - ➡	Interests	⟹	Responsibility?!

3. The case of Costa Rica

3.1 Introduction

Costa Rica, a relatively small Central American country, both in terms of population (4,326,000) and territory (51,000 Km2), is often presented as a tropical paradise. Indeed, its unique location between two oceans - a bridge between two sub-continents - and its dramatic topographic composition, including a volcanic mountainous region, tropical lowlands and coastlines, and the climatic variation between regions have made Costa Rica ecologically unique. Diversity is a key word when looking at any aspect of the Costa Rican's natural environment. Although entirely within the tropical latitudinal region, Costa Rica possesses great climatic diversity (Hartshorn et al., 1983). Twelve different types of natural zones has been identified in Costa Rica, ranging from tropical dry and wet forests, to mountain cloud forest and sub-alpine regions (Holdridge et al., 1971). Although Costa Rica covers only 0.04% of the earth's terrestrial area, its biological diversity is one of the highest in the world. It is estimated that between 4% to 6% of the world's species can be found in Costa Rica making it the nation with the highest biodiversity per unit area in the world (Vaughan et al., 1998).

Costa Rica has been facing human-induced ecological change since the colonial period; the increase of population and the introduction of new and different activities (e.g., Cocoa, bananas, livestock) contributed to that process. However, it is mostly the 20th century, and more precisely, the second half of that century when a significant change occurred (Hall et al., 2000). One of the most significant factors directly and indirectly contributing to ecological change in Costa Rica is land use and land cover (LULC) changes (Sanchez-Azofeifa 1996; Kleinn et al. 2002). As from the beginning of the 1990s, Costa Rica is widely being considered as a success story in terms of conservation and high awareness of sustainability issues. Indeed, currently about 25% of the country territories are under some kind of protection (Evans, 1999). Also, large areas are being reforested. The total area of secondary forests and forest plantation increased by 10% during the 1990s (WRI, 2006), between 2000 – 2005 the total forest area increased by 0.5% (FAO, 2006). In spite of what seems as an important change, still a deeper examination of LULC processes reveals a continuation of natural forest decline. According to WRI (2006) between 1990 and 2000, a decrease of 10% in natural forests was recorded. The FAO (2006) show continues deforestation rates of 0.9 % a year or a total decline of 16,000 Ha of forest during that period.

3.2 Agriculture production

In Costa Rica agriculture activities has been playing a central role in ecological change. Traditionally Costa Rica had an agriculture-based economy. Despite some changes within recent years, agriculture is still the base of a significant part of the economy, and it is also a major source of foreign exchange (Hall et al., 2000:124). Above all, it is a way of living and a main source of employment to both large portions of the Costa Rican society and many foreign workers from neighbouring countries. Within the study period an increase of 79% of the total agriculture production has been

identified (from 5,443,740 tons in 1989 to 9,738,710 tons in 2005). That increase in production involved an increase of 16% in the size of the harvested area (from 414,690 Ha on 1989 to 485,900 Ha on 2005). That relatively moderate increase of land use, although significant on its own, might be a result of more efficient use of land and an increase of inputs (i.e., fertilizers).

3.3 Costa Rica's interregional ecology:

3.3.1 *The trade flows*

While there are probably several reasons for increasing production levels (e.g., population growth, per capita consumption growth), it seems that within the study period the major reason is connected to trade; whether taking a producer perspective – i.e., Costa Rica's keenness to extend its trade relations (as a source of foreign currency), or consumers perspective – i.e., the increasing overseas demand for Costa Rica's products. While agriculture export of such products as bananas, coffee, sugar, beef and other products has been always major part of Costa Rica's economy, two processes can be identified within the period discussed here: one is an increase of the total export and therefore the amount of lands devoted to produce these export products (figure 2). The other is change in the proportion between production for local consumption and that for export products (figure 3). In 1989 about 44% of the production was devoted to export (36% of the lands), in 1999 about 58% (48% of the lands) and in 2004 about 74% (62% of the lands). An increasing portion of the Costa Rican production has become devoted to consumers in other regions of the world, thus increasing foreign consumers' footprint on Costa Rica (figure 4).

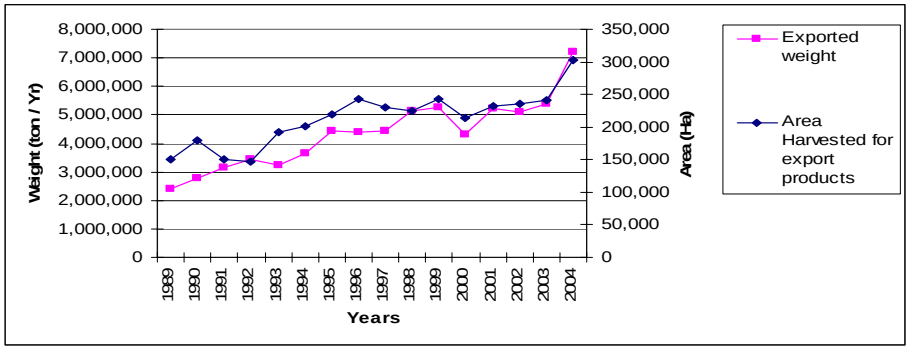

Figure 2: Agricultural export – products' weight and harvested land 1989 -2004

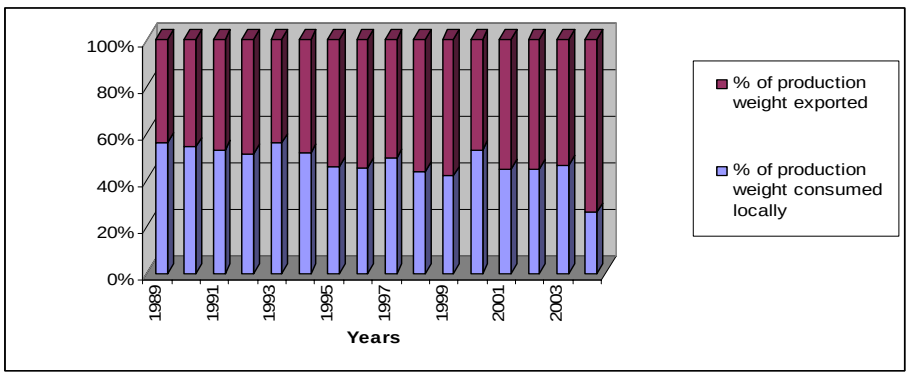

Figure 3: Proportion between production for local consumption and export; 1989 - 2004

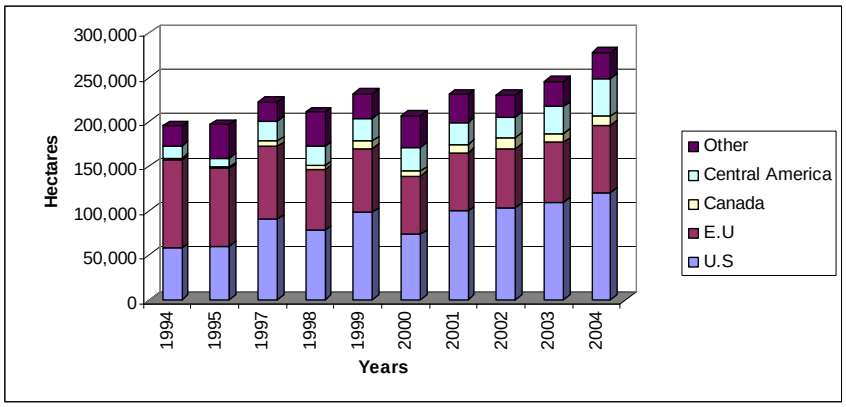

Figure 4: Land devoted for growing export products by specific destination; 1994 - 2004

While Costa Rica agriculture sector is growing and exporting diverse products, it is only 6 major products that capture most of the export (in terms of both weight and land). Figure 5 presents both the percentage of each product out of total export, and the land devoted for that production. For example while on average, sugar part is 27% of the export weight, it requires less than 8% of the land. While on the other hand coffee requires almost 40% of the land to produce less than 3% of the exporting weight.

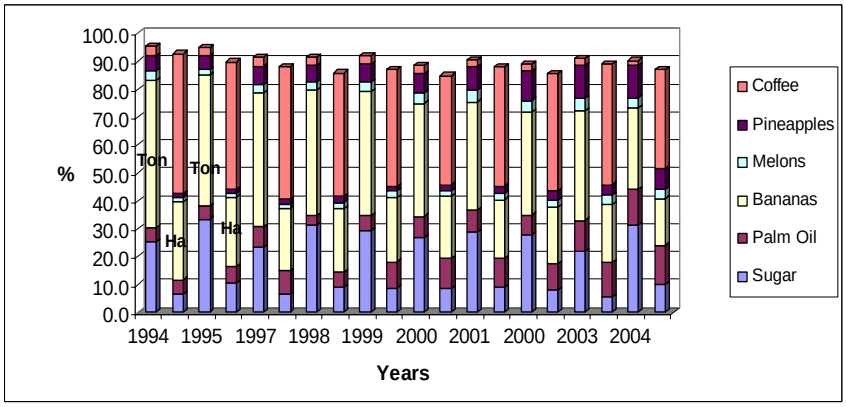

Figure 5: % of production and land devoted to export of major products; 1994-2004

3.3.2 *Ecological change*

Following the interregional ecology model presented here, producing the resources exported (i.e., agriculture products in this case) from Costa Rica to the rest of the world involved the use of several inputs such as land, chemicals, and water (see table 1). As growing these export products requires such a large portion of the country agriculture lands, it is a major reason and a significant driver to ecological change wherever these products are being grown, both prior to the production, in the form of habitat change - e.g. deforestation to make room for agriculture land, and as a consequence of the production process itself - e.g., soil erosion or water contamination.

Table 1: Inputs and potential ecological consequences of growing major export products

Product	Land Use (Ha) 2005	Change in land use (%) 1989 - 2005	Average Fertilizers / pesticide use (kg / ha)		Potential ecological impacts
Sugar	49,000	+22%	200	3.5	e.g., Habitat change (e.g., deforestation); soil erosion; water contamination; Biodiversity loss
Banana	54,600	+90%	500	45	
Coffee	113,100	+8%	350	6.5	
Palm oil fruit	61,000	+205%	200	n/a	
Melon	10,000	+335%	n/a	20	
Pineapple	17,400	+167%	650	20	

All studies emphasize the fact that Costa Rica's agriculture sector has been playing a major role in land cover change ever since the colonial period (e.g. Sanchez-Azofeifa, 1996; Evans, 1999; Hall et al., 2000). As an example between 1979 and 1992 more than 56,000 Ha of forest became crop lands (Camino et al., 2000). That process continued during the 1990s, though in lesser scope, including more than 4,700 ha to make room for new banana plantations (Clay, 2004:247). Agriculture activities are also a major contributors to soil degradation in Costa Rica (Rubin and Hyman, 2000; Bertsch et al., 2000). For example Rubin and Hyman (2000:460) estimated that while on average in Costa Rica, soil loss in forest areas is 2.6 ton/ha/yr, in agriculture permanent crops it is 10.8 ton/ha/yr and gets up to 20.7 ton/ha/yr in annual crops lands. All together, the Costa Rica Ministry of Agriculture estimated that in 2001 about 45% of the country soils suffered from soil erosion, the FAO (2005) presented even higher figures for 2004 estimating that about 57% of the soils are under severe conditions of erosion. While not all of these land are for agriculture, large part are; a fact that has significant implications for future agriculture production (and perhaps consumers' interests). Another major connection between agriculture activities and ecological change is the use of chemicals -- fertilizers to compensate the soil for nutrient loss and the demand for yield increase, and Pesticides to protect the crops. Increasing monoculture-type agriculture within the last few decades has been a major reason for the intense and predominant use of pesticides in that country (De la Cruz and Castillo, 2003:369). Several studies followed the direct and indirect connections between different agriculture activities (of major export products such as bananas, coffee and palm fruit) to ecological deterioration such as: soil contamination, aquatic ecosystem degradation, biodiversity loss (e.g., Castillo et al. 1997; Henriques et al. 1997; De la Cruz and Castillo 2003). A closer examination of the ecological results of growing specific products emphasizes and can teach us the role each product has in the bigger picture of ecological change in Costa Rica.

A conventional, widely use approach to sustainability would focus on the producer (i.e., Costa Rica in that case) and will mostly ignore the fact that one of the reasons for that production (and the increase of production) in the first place is to support the demand by consumers in other regions of the world. These consumers and their governments have an interest to: (a) Continue receiving the products they demand from Costa Rica and from

many other supporting regions around the world (i.e., to continue the flow of materials). (b) Maintain the ecological services they directly and indirectly depend upon in Costa Rica.

4. The current place of an interregional ecology approach to sustainability

There are several reasons why such interregional ecology approach to sustainability though directly and indirectly referred to in the literature (e.g., Borgstrom, 1972; Cronon, 1991; Hall and Hanson, 1992; Wackernagel and Rees, 1996; Daly, 1997; Rees, 2000) is still little appreciated:

(a) No alarm or action without negative feedback: Modern societies obtain their biophysical needs from both local and distant ecosystems. If ecological conditions deteriorate, buyers simply shift to other suppliers who still have healthy ecosystems to supply society's demands. Consumers are generally not even aware of the change. Indeed, the depletion of particular ecosystems predominantly affects the local communities that make their living from damaged ecosystems and leaves the distant consumers largely untouched. **(b) Mainstream economics is blind to the problem**: Neoliberal environmental economics is concerned almost exclusively with waste management, particularly pollution control costs and the damage costs of pollution (negative externalities). Thus, the focus of the discipline is primarily on the design of regulatory instruments—e.g., pollution charges, tradable emissions permits—to assist in efficiently internalizing these externalities. The depletion of natural capital as a result of careless consumption is almost never questioned. (c) **Popular attitudes and international law have not caught up to global reality:** In general, the international community still sees most 'environmental' problems as relatively small-scale (pollution) problems that are mainly of concern to local or, at best, national governments (MacNiell et al., 1991; Speth, 2004). Traditionally, governments have responsibility for only those environmental and sustainability issues that unfold within their own boundaries. Thus, even as global change accelerates, the sustainability policy focus of most countries and international organizations is at the local/national level (UN, 1992; Vitalis, 2003). (d) **Ignoring the role of (over)consumption:** In ecological terms, human beings are classified as consumer organisms. Understanding the role of consumption is therefore a starting point for understanding human impacts on the ecosphere (Wackernagel and Rees, 1996; Princen, 1999). Part of the burden of consumption is waste and pollution, but over-consumption leads also to the depletion of even self-producing (renewable) resources. Much environmental degradation can be traced directly to the behaviour of consumers, or indirectly to consumers through the production activities undertaken to satisfy their demands (Rees, 1995; Daly, 1996).

5. Conclusions

In a globalizing world Costa Rica is obviously just one example among many others. While, as presented here, many countries have interregional connections with Costa Rica, consumers in Costa Rica have such connections with many other supporting regions. In such a world consumers everywhere are becoming increasingly dependent on resources from all over. Single-scale approaches to sustainability are inadequate. The interconnected world we are living in forces us to embrace a different, much broader approach for understanding both ecological degradation and sustainability. For sustainability we ought to add another approach one that will provide us with negative feedback about our action and that emphasizes our dependence on others. An interregional approach which takes a consumption perspective can reveal to us the sources we depend upon and some of the hidden consequences of that dependence. Ecological change in Costa is certainly not only the responsibility of consumers in other regions but these consumers have an interest to prevent and minimize these changes. Interregional ecological analyses of energy and material flows can help to overcome barriers to effective collective action. They must be acknowledged and documented so they can be explicitly accounted for and taken under consideration whatever our path to ecological sustainability.

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The Challenge of introducing cleaner production in small-scale enterprises:

the case of Van Chang Craft Village Vietnam

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1 Introduction

Small-scale enterprises (SSEs) provide much of the employment in developing countries. Because they typically employ unskilled labour they are widely seen as providing employment opportunities for the poor (IFC and the World Bank 2002).

There is no similar consensus in terms of SSE contribution to pollution. Some argue that they are more environmentally friendly because of informal community pressure while others argue the contrary. Branden (1993, p.4, cited in Jarayanan and Lanjouw 2004) asserts that small industries "often pollute more per unit of output than large firms operating in the same sector". His argument: these enterprises use old and inefficient technologies, are not monitored for environmental regulatory compliance, and are unable to dispose their wastes safely because of lack of knowledge or resources or both. Tipple (2005) argues that pollution impacts of SSEs are small because of their scale. Young (2004) on the other hand, cites evidence from the UK to suggest that small enterprises have a strong albeit silent sense of corporate social responsibility.

Cleaner production offer real opportunities for addressing the tension between employment and environmental protection in SSEs but introduction of CP changes to SSEs have not been particularly successful.

It is estimated that in Asia alone more than 50 international public and private organisations are promoting cleaner production among enterprises. There is consensus that the adoption of CP has been very slow in spite of the millions of dollars spent in its promotion (Stevenson 2001; Zatz 2001).

Dasgupta (1999) commented on the failure of initiatives in energy efficiency and environmental improvements targeted at SSEs in India and

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traced it to the failure to link these initiatives to waste management, poor work and housekeeping practices. Bartone and Benavides (1997), Frijns and Van Vliet (1999) called for donor assistance and argued for coordinated actions in centres for training and transfer of technology among different levels of governments, industry associations, and NGOs. Fresner and Engelhardt (2004), working on two small companies in Austria, posit that desired cleaner production changes must be translated into small steps relevant to the actual conditions of the companies. Immediate and visible improvement in occupational health, product quality and environmental performance are critical to success, they argue. These CP measures can then be followed by an integrated management system and optimising the supply chain relations.

The literature on CP and small and medium enterprises (SMEs) appears relevant. The World Business Council for Sustainable Development estimates that only 5-10% of SMEs are reached by environmental outreach programs; the programs are "too general and supply-driven, poor quality" (Young 2004). The lack of qualified and competent technical assistance providers is cited as a barrier (BCPPDP 1999; GBN 2000; Hillary 1999; Huppé 2005; Johannson 2005; Lebourveau 2004). Bierma and Waterstraat (1995) stress the lack of trust among entrepreneurs in governments and consultants. The importance of involving industry associations or sector networks in outreach programs has been argued (Ecotec 2000; Kürzinger 2004). Marketing environmental improvements as productivity improvements or "lean manufacturing" is also important (Ecotec 2000; Hillary 1999; Johannson 2005; Kennedy 2005; Kürzinger 2002). The role of science and engineering institutions in providing affordable and competent technical assistance providers is increasingly recognised (Ecotec 2000; Lebourveau 2004), their value having been demonstrated in the 70s with PRISMA in the Netherlands, LANDSKRONA in Sweden in the 80s (Baas et al 1993; Backman *et al* 1989; de Hoo and Dieleman 1992). In Vietnam, a report on the *Worker Manager Factory Improvement Programme* (WMFIP) implemented by the International Labour Organization in collaboration with the Vietnam Chamber of Commerce and Industry, concluded that an important contributing factor to the successful adoption by the 12 participating SMEs, of productivity, product quality and workplace improvement measures was the introduction of in-house training and social dialogue among workers, managers and consultants. Since the training was based on the needs of each participating factory it was unavoidably integrated (ILO and VCCI 2005).

This paper examines the dilemma posed by a category of craft villages in Vietnam increasingly called "industrialising" or "waste" villages (UNIDO 2004). Made up of small-scale and home-based industries these enterprises make significant contribution to local economic development and to energy and material conservation. But their outmoded technologies and lack of knowledge also create significant risks to the health of their families and the environment. The paper focuses on one such village, Van Chang in the province of Nam Dinh, and asks: Are there sustainable solutions? What initiatives are being taken to address the health and environment problems? How effective and sustainable are they? What are the constraints? The paper concludes with discussion of short-term, transition approaches that could facilitate the long-term viability and environmental sustainability of these

industries. It is argued that lessons from Van Chang – viewed as a hotspot - has tremendous potential for application to other waste villages in Vietnam.

The case study analysis is based on information gathered through a review of project and government documents, two rounds of interviews of 40 key informants, and several site visits and observations. This was done during two field visits undertaken for the Swiss Agency for Development Cooperation in relation to the Nam Dinh Hazardous Waste Management Project in the summer of 2006.[1]

2 Vietnam: some economic fundamentals

Vietnam is a vibrant $45B economy, second only to China in Asia in terms of economic growth rates. Since the launch of *doi moi* (economic liberalisation reforms) in 1986 Vietnam has seen impressive growth rates. From 1991 to 2003 GDP rose by an average of 7.6% per annum. Real GDP per capita over the same period grew by 5.6% to reach the equivalent of US$540 per year by 2004, on par with India. (UNIDO and GoVN 2006)

While the contribution of the agricultural sector to GDP has declined from 27% to 21% that of industry has increased from 29% to 38% in the same period. Industrial exports made up 13% of GDP in 1991 but now contribute one-third, mostly from light manufacturing. The government has introduced administrative and legal reforms in order to join the World Trade Organisation.

In spite of the potential destabilizing effects of these three simultaneous 'shocks" to the country in the last 20 years, namely, the transition from a centrally-planned to a market economy, the structural shift from agriculture to manufacturing, and the increased exposure to external flows of trade and investment, Vietnam has remained remarkably stable and is predicted to achieve the Millennium Development Goals by 2015. (UNIDO and GoVN 2006)

3 Craft industries in Vietnam

3.1 Overview

Craft industries in Vietnam are in majority of cases, micro- and home-based enterprises, organized at the village level. Many were established several hundred years ago (Di Gregorio et al 1998).

A craft village is defined as " a rural village that has between 35 to 40% of households specialising in a certain occupation and … can live on the income from that occupation" (Nguyen 2005, p. 19). Six categories of craft villages are identified in Vietnam. *Handicraft* villages produce goods for daily use such as scissors, knives, baskets and mats. *Art* craft villages produce goods of cultural and decorative value such as inlaid wooden furniture, lacquered bowls. S*ervices* and *trading* villages consist solely of traders and retailers. *Food processing* villages process agricultural products, raise and slaughter livestock, produce beer and distilled liquor. *Material supply* and *processing* villages of which industrialising villages are a subset,

[1] The views expressed here are those of the authors, not of SDC nor of COLENCO.

produce goods that are used by other producers or in some cases sold to distributors (Nguyen 2005).

The basic production unit consists of a family business with between 5 to 10 employees. The employees are engaged either on a fixed or "as needed" basis. When demand is high workers may be paid by the piece; when demand is low, they receive a flat wage. This allows for the cost of production to be very low and flexible in response to market conditions.

The businesses are organized in clusters but in slightly different manner in every village. Some sell directly to consumers; others sell wholesale to distributors. In some villages there is a certain level of vertical integration with some workshops producing items for other workshops in the village. Observers have commented on the great solidarity among enterprises in a village. It is not uncommon to have enterprises in a village run by different members of a limited number of families (UNIDO 2004).

The withdrawal of the state from the economy led to the collapse of agricultural cooperatives, which had supported both production and social welfare costs. Craft villages offer an important alternative for economic development and poverty reduction in rural areas. They involve 30% of all households and contribute at least 50% of the village's total income (Korea-World Bank n.d.). Nguyen et al (2003) estimates that an average of 815 people are employed full time in each craft village. Including the seasonally hired labour, the nearly 2000 craft villages across the country employ an estimated 10 million people (UNIDO 2004).

They are a major source of additional income to farmers. The double source of income - in kind from farming and cash from craft industry employment - allows farmers to accept low wages in the home-based enterprises since they are still above the minimum levels provided by agriculture (UNIDO 2004). The incomes of craft village workers and families are reported to be 1.5 to 2 times higher than purely farming families (Nguyen 2006).

In principle craft village entrepreneurs are eligible to apply for credit from provincial development banks. In reality they exist outside the materials circuit of the formal economy and do not have access to credit and import quotas for equipment, materials and expert advice. They make up for this disadvantage by reliance on secondary materials, flexible wage and market sensitive pricing. Under these conditions their network of personal family and community relations that serve as sources of information, materials, labour and capital is critically important (Di Gregorio et al 1998). The association of particular trades with communities of craft people also provides a form of publicity based on identification with a product, akin to *branding* , and appears to create customer loyalty.

3.2 The 'waste' villages

Currently about 90 industrialising craft villages work with waste materials (paper, plastic, glass, aluminum and steel) transforming them into parts for bicycles, motorcycles, furniture or into final products, such as wash basins, ropes, decorative vases. What makes these villages unique is that, with the exception of process chemicals and fuel, the products are entirely made out of waste.

As in many other countries the expansion of Vietnam's economy has led to changes in both the types and quantities of goods consumed. This has provided a wider range of materials available for recycling but has also created a demand for recycled materials. Since the small scale private sector continues to be excluded from the state managed materials market, secondary materials provide a major source of 'inputs' for these firms.

Recyclers, from itinerant collectors and buyers, to traders and processors, operate within an open and competitive market. The report by Di Gregorio and his colleagues (1998) on their study of the recycling sector in Hanoi suggests a gender- and age-based differentiation of labour in the chain and in the mode of working. This is not different from other countries in the region.

The 'waste' villages, a subset of the *materials supply* and *processing* villages, are located mainly in the countryside around Hanoi and other cities along the Red River Delta. The city is the source of abundant supply of recyclable materials and is therefore the material base for 'waste' villages. Recycled products are mostly returned to the city to meet direct and indirect demands. The remainder is sold to wholesalers in other provinces or abroad.

Many evolved from traditional village trades such as papermaking, steel making and rope making. Residents of Dong Cao village for example produced high quality paper for 500 years primarily for religious and artistic use. They are now recycling waste paper and cartons into toilet and kraft paper. Da Hoi villagers used to make agricultural tools from scrap iron. Now they are producing steel re-inforcing bars from construction waste and scrap steel. Trung Van used to make rope from bamboo; now they make rope from recycled plastic. (Di Gregorio et al 1998)

3.2.1 Economic and environmental benefits of 'waste' villages

Research done in the late 90s showed that, excluding direct transfers of secondary materials between producers, recycling in Hanoi, diverted a third of the waste generated from the landfill. This reduces the use of energy, process chemicals and virgin materials in the economy. The wastes arriving at the landfill have very high levels of organic materials, making composting feasible and generating soil amendments for farms and gardens. (Di Gregorio *et al*, 1998).

There is also a high level of '*economising*' within the industry. In some, the wastes from processing are collected and recycled. In the village of Man Xa, furnace waste is sold to construction companies and aluminium refining waste is ground and sold to chemical companies. In Van Chang, scraps from the reprocessing of scrap metal are further transformed to make smaller items such as bolts for bicycles.

3.2.2 Human and environmental health costs of 'waste' villages

Most of the processing equipment used in 'waste' villages are old and inefficient, their layout dictated by space rather than process efficiency concerns, and the housekeeping practices are extremely poor.

Various kinds of toxic gases and dust are emitted to the work *and* home environment. The type of contaminants depends on the production activities and can include carbon monoxide, sulphur dioxide, nitrogen dioxide, hydrogen sulphide, chlorine, hydrogen chloride, lead, zinc, cyanide and vinyl chloride. No analysis for dioxins and furans has been reported (UNIDO 2004). Process wastes and waste water along with storm water, domestic and rubbish are dumped in ponds and water bodies. These ponds

are used to irrigate rice paddies. In some cases these wastes are dumped directly into the drains which frequently clog up during rains and cause flooding. Surface waters and groundwater are thus contaminated and the contamination works its way up in the food chain.

Not surprisingly there are more diseases reported in craft villages than in purely farming villages – learning disabilities among children, skin, nose, throat, respiratory and gynaecological problems, congenital deformations, and nervous disorders (Korea-World Bank, n.d.; UNIDO 2004).

4 Van Chang Craft Village

Van Chang, located 12 km southeast of Nam Dinh city, is one of 73 craft villages in Nam Dinh. One of the oldest mechanical production villages in the province, it covers an area of 37 hectares with 3885 residents in 685 households.

The *home-based* enterprises in Van Chang specialize in reprocessing, forging, polishing and plating scrap steel and aluminum,. A 1995 survey indicated 29.5% of households are engaged in forging, 8.3% in making laminated steel, 12.2% in laminated steel and aluminium, 1.2% in plating steel, 4.1% in mechanical assembly and repairs. The rest, 39.1%, of the households provide different types of service. The village reportedly produces 14,500 tons of steel products and 1,900 tons of aluminum products annually. (NDHWMP 2005)

The typical household has different production processes interspersed with living quarters. There may be a coal-fired mini-smelter for scrap aluminium or steel, plus plating line for chromium, zinc and/or nickel, a forming/cutting/forging line, and wash/polishing line. Plating wastewaters are spilled or discharged at various points and various areas in the premises, either on the floor or into a drain. Many workers do not wear any safety equipment in the workplace. Indeed some workers can be seen wearing beach sandals while working near the furnace.

The enterprises in Van Chang are reported to generate daily, 5 tons of solid waste and 1100m^3 of wastewater contaminated with heavy metals, particulates and toxic gases from the coal used and the paints, oils, and varnishes on the scrap metal (NDHWMP 2005). The plating plants alone release 4- to 50m^3 of wastewater. Untreated wastewater containing acids, cyanide, heavy metals, aluminium, and zinc, are dumped down the drains and flow to the ponds. Heavy metals have reportedly accumulated as sludge in the bottom of the ponds (Nguyen 2003). There is a solid waste collection team but there is no landfill so until recently, all solid wastes were strewn along the surrounding ponds and lakes. Few stacks are installed with some made of matted bamboo slats. The poor ventilation results in direct exposure of workers and residents to gaseous and particulate emissions. Many of the facilities are noisy, the air smells of coal dust and tastes metallic. Particulate emissions reportedly exceed the national allowable limits by 5 to 10 times (Nguyen 2003).

A recent study by the National Centre for Sciences and Technology has confirmed elevated levels of pneumonia, asthma, acute bronchitis, gastritis, miscarriages and cancer. Life expectancy in Van Chang is 6 to 10 years lower than the national average (NDHWMP 2005).

5 Are there sustainable solutions?

Most policy analysts – international and national – argue that the only long-term sustainable solution to address the environmental impacts of craft villages is the separation of production from the residential units (Korea-World Bank, n.d.; NDHWMP 2005).

Centralising pollution control systems would allow for sharing the cost of equipment, its installation, operation, maintenance and use. For instance, centralized aluminum smelting would not only allow cost effective waste treatment, it would reduce overall unit production costs through savings in energy and improved process efficiency. Introduction to individual facility of spill prevention and containment, rearrangement of equipment layout to be consistent with the work flow, good housekeeping practices and better process control would go a long way in *visibly* reducing the health and environmental impacts and arguably, product quality. In electroplating facilities, the reduction of *drag out* would certainly reduce the volume of process chemicals used per unit of output. Industrial wastewater would have to be separated on site from domestic sewage and storm water, collected and stored centrally for recovery of valued components where feasible, or treatment if not.

Where relocation of small scale village enterprises has been successful, as in South Korea, the relocation was done with various government subsidies, loans and administrative support. The program was part of what was called the New Community Movement (*Saemaul Undong*), a national program established in 1971 to reduce rural-urban socio-economic gap. The program was made a top priority for allocating government resources. The resources were provided in form of grants, cost-sharing schemes, training and development of business management skills. In addition to the economic incentives the government also constructed common pollution abatement facilities in the industrial parks. Cooperation with SMEs allowed for overcoming the structural weakness, limited financial capability and low-level technology among the SSEs. Studies have shown that *Saemaul Undong* has contributed to capital formation in the rural areas in terms of infrastructure, the improvement in rural economy and environment, changes in values and attitudes of rural communities and the promotion of participatory community economic development. (Korea-World Bank, n.d.)

5.1 The Vietnamese policy context

The Vietnamese government has introduced several pieces of legislation and decrees that are relevant to the development of 'waste villages' such as Van Chang.

On hazardous wastes, the Law on Environmental Protection (LEP - Law no 52/2005/QH11) describes what needs to be done, by whom and how. Environmental protection in craft villages is discussed in Art 38. The amended LEP, Order 29/2005, that took effect in July 2006, devotes an entire section to hazardous waste management. The Ministry of Natural Resources and Environment (MONRE) Five-Year Plan targets 80% of hazardous wastes for treatment by 2010. In December 2003 the government approved the *National Strategy for Environmental Protection until 2010 and Orientation till 2020*. Addressing the environmental and human health threats of hazardous wastes is one of the 36 national priority programs listed

in the NSEP (GoVn 2003b). The adoption of cleaner production is another. Decree 64/2003 and Decree 67/2003 prescribe measures for dealing with industrial waste generators (GoVN 2003 and 2003a). Decision 155/1999 (*Promulgating the Regulation of Management of Hazardous Wastes*) sets the standards, classification, procedures, institutional roles and responsibilities for the collection, transfer, collection and disposal of hazardous wastes (GoVn n.d.). Public participation in environmental decision making is advocated in at least two recent government pronouncements. Sec 3d of Decision 328/2005/QD-TTG instructs ministries, agencies, provincial/municipal Peoples' Committee and management boards of state agencies "to promulgate... mechanisms to encourage and boost the active participation of mass organisations... in environmental pollution control" (GOVN 2005). MONRE's Five Year Plan indicates enhancing "the participation of the community in making management decisions" as one of its 6 major implementation measures.

At the provincial level a number of decisions have been taken by the Nam Dinh Provincial Peoples' Committee (PPC) and the Department of Industry and Trade (DOI) to promote better management and the establishment of Industrial Parks at craft villages. Decision 2041/2001/QD-UB established a process for promoting and establishing new industrial parks near craft villages in the province (ND 2001). Decision 01/2003/QD-UB provides additional incentives for industrial parks at the District and City levels as well as criteria for investment. Part II, Article 6, paragraph 6.4 of this Decision bans investors from using the industrial park for living quarters (ND 2003).

5.2 Systemic constraints

There are several constraints.

5.2.1 Policy

In spite of the benefits of recycling public policy towards recycling suffers from several contradictions. Public policy support for environmental industry is interpreted in the context of modernisation. Small scale recycling is seen mainly as a problem of poverty and technological backwardness.

5.2.2 Economic

The reliance of the recycling industry on the household economy is both a strength and a constraint. It does not follow standard business practices. Much of the profits generated can be considered as a result of avoided costs – rent, wages, and taxes. It is difficult for household enterprises to transform themselves to private firms.

Processing of waste materials has been achieved in an environment of low opportunity cost for labour, high opportunity cost for capital, and limited alternative source of raw materials. As the Vietnamese economy modernises and expands there will likely be a decrease in demand for the low-priced low quality goods from the waste industries. With WTO membership could come increasing competition from imported raw materials or cheaper imported products. The price differential of recycled materials could also decline. The efficiency of the chain from collection to remanufacturing and product quality needs to be improved. This requires new technology and improved processes.

5.2.3 Political

Without some form of collaboration more efficient processing technologies will not be affordable. In Vietnam there appears to be a continuing negative image of cooperatives or associative structures (expressed by one informant as "individualism").

The association of regulatory enforcement with rent-seeking activities of state agencies may impact the credibility of government participation in CP outreach programs to SSEs.

There is a political impediment at another level. The Hanoi Core Statement, Vietnam's adaptation of the Paris Declaration on Aid Effectiveness, demands, *inter alia*, alignment of Overseas Development Assistance initiatives with Government of Vietnam priorities as well as project delivery mechanisms that allow greater local ownership of the programs (GoVN 2005a). Donors who wish to harmonise their programs with the Hanoi Core Statement are understandably hesitant to design development assistance programs that require radical changes in values and practices of government partners. Such programs could encounter resistance or implementation delays. Donor agencies are under pressure from taxpayers to show development 'results'.

5.2.4 Technical

In Vietnam as in most industrialisng countries, there is no systematic enforcement nor compliance monitoring of the environmental laws and regulations that already exist. The most commonly made observation is that there are too few qualified personnel in both MONRE and many of the DONREs, including that of Nam Dinh.

This puts a greater burden on demonstrating the financial benefits of CP changes to Van Chang producers. Unfortunately the process of introducing and implementing CP changes in these facilities will be very protracted. The production characteristics in craft villages like Van Chang are so individualised, the products are individual and frequently spontaneous, that standard and conventional CP approaches will be expensive and ineffective.

The current level of CP expertise appears to be too sophisticated (and expensive) to deal with SSE processes. The system offers little if any incentives to encourage interest in introducing CP changes in "technologically simple" industrial sector.

5.2.5 Cultural

There is very little, if any, appreciation of the benefits provided to society by 'waste' villages'. Recycling is seen as a problem by many; their products, viewed with some disdain, as being "of low quality and good only for the poor". That recycling provides an immediate source of materials and employment and *without the aid of state budgets*, is not recognised. The lack of public support may partially explain the lack of government incentives and genuine support for the development of 'waste' villages.

There is also a lack of appreciation of the need for detailed baseline information as the necessary starting point in the search for sustainable options for Van Chang. Research is seen as an "academic" exercise, meaning of little practical value, unnecessary, and wasteful use of resources.

5.3 Interventions in Van Chang

In 2001, the Nam Dinh PPC decided to build an industrial park near Van Chang craft village. The local authority encouraged the entrepreneurs to move their production lines to the park. The Provincial Peoples' Committee provided funding for the construction of sewage and drainage collection for the park but required that individual households pay for the new land and buildings themselves.

Few households could afford the move. Most stayed in the old village and continued industrial operations. The fifty nine or so facilities that did move also moved their beds and kitchens. So the new industrial park village has the same mixed land use – industrial and residential patterns. This reduces the floor space that can be devoted to production and the human health risks persist. When asked why they refuse to separate their production lines, a community leader and entrepreneur who was among those who purchased land in the industrial park, responded, "because we are afraid that our equipment might be stolen".

There was no clustering of households with similar production processes. Eventually separate pollution control systems will be needed and the cost will be high as there will be no economies of scale.

Some policy advisors call for cutting off power and water to force the relocation. Others wait for Vietnam's integration into the WTO – "these villages will disappear; they are inefficient". There seems to be no thought given to the economic and political repercussions if the waste village enterprises were to collapse *en masse*.

An initiative targeted at Van Chang was developed by COLENCO Power Consulting Ltd, a Swiss consulting company that is providing technical assistance to the Nam Dinh Hazardous Waste Management Project. The Project is funded by the Swiss Agency for Development and Cooperation (SDC) and managed by the Nam Dinh Department of Natural Resources and the Environment.

The objectives were "to develop and design practical, small scale and low cost engineering interventions at the industrial processes…" (NDHWMP 2005). This subproject consisted of CP education and outreach, construction of a hazardous waste collection shed, and construction of sewer and wastewater drainage canals. A rotating fund for the installation of septic tanks in households and workshops on occupational health and safety were also established.

Towards the end of Phase 1, the hazardous waste collection shed for Van Chang was designed and wastewater drainage canals (a covered one running along the houses and a second, wider one running along the irrigation channel) were constructed with 80% of the costs of the former covered by the households. The septic tank rotating fund managed by the Women's Union concluded loans with 50 households and received initial repayments in three months. The membership of the Women's Union has reportedly tripled.

The installation of the new structures led to a rather palpable sense of pride in the community. More roads in the village were paved, paid for by the residents.

Consistent with SDC approach, "to demonstrate experiences and encourage replication" (http://www.sdc.org.vn), CP assessments were completed in 3 households. Initially none implemented any change. This

was in contrast to the Project's work with SMEs in Nam Dinh city. Several SMEs had reportedly invested nearly VND 11.8B in CP changes and enjoyed annual cost savings of VND 10.8B (COLENCO 2006). Some Van Chang community leaders commented that the CP training was "too theoretical and not providing enough sector- and facility-specific details, nor follow-up guidance after the training courses". These echo the responses to a survey of 33 CP consultants and educators conducted by Mitchell (2003) with regards to CP training in Vietnam.

Patient follow up for several months from the Project Management Unit and COLENCO paid off. The three households implemented simple but effective measures. These include a well ventilated chamber for spray painting, a chamber for the NAOH dipping in aluminum reprocessing and building of small sumps to separate pollutants before they enter the wastewater drainage system. All the changes were done by the household enterprises using their own ideas and craftsmanship. The householders were very much part of the process, contributing money as well as their time and ideas.

5.4 How can interventions be made more effective?

Inducing change is never easy. In the particular case of SSEs such as in Van Chang, the difficulties are greater. Overcoming the financial limitations of the micro entrepreneurs with regards to relocation to the industrial park will require major infusion of funds. Addressing their security concerns over the separation of their production lines and living quarters will require time. However the health and environmental impacts of their operations need urgent attention.

What is needed is a transition strategy, one that would create the conditions favourable to the relocation of production lines away from household to industrial parks. Critical to an effective strategy is establishing trust with the micro-entrepreneurs.

5.4.1 Establish trust

Those who seek to introduce change must earn the trust of the entrepreneurs. These businesses have very small margins of profit and are therefore highly risk averse. They have too much at stake. They will not change their practices unless they trust those who advocate the changes. Trust is earned. Government officials particularly have to work to earn the trust of the craft village entrepreneurs partly because of their role as regulators and because of the association of regulatory enforcement with corruption. But enforcement has a role to play. There is abundant evidence that regulatory enforcment is a major driver in improving corporate environmental performance. Enforcement has be done and be seen to be done judiciously, consistently and fairly.

Efforts to gain local entrepreneurs' trust must start with a genuine respect for what they represent and what they know. These are people who are working hard to earn a decent and honest livelihood. Their technologies may be backward but they know the underlying principles.

5.4.2 Understand the microentrepreneurs and their needs better

Those who seek to introduce change need to understand the decision logic of those whose behaviour they are seeking to change. Why are these

entrepreneurs doing what they are doing? Why are they not doing what they ought to be doing?

Many development interventions assume that the answers are obvious. It is argued here that some of the right questions still need to be defined. The presumption that the poor are simple to understand is not only arrogant but it can also lead to failed development programs no matter how well-intentioned they are.

Without knowing the conditions *before* and *after* the benefits of the changes cannot be demonstrated with sufficient credibility. Lack of detailed background data on individual households makes feasible and realistic solutions difficult to design. It also precludes defining the correct conditions for the transfer of lessons from Van Chang to similar waste villages in Vietnam.

5.4.3 Educate and mobilise the right stakeholders

A radical shift in environmental governance is very necessary. Donors should collectively and systematically seek to motivate their Vietnamese development partners to 'share' power with civil society groups, and convince them that such sharing will reduce their administrative burden and enhance their effectiveness in governing. Different stakeholder institutions – governments at the central, provincial and municipal levels, business associations, teachers' union, and scientists with R&D institutions – need to cooperate with each other and set up the necessary "carrots and sticks". Central and provincial ministries have to give up control over funds and work in an advisory capacity in collaboration with civil society groups. But the government should not abandon its enforcement role. Experience in other countries demonstrates the importance of regulatory enforcement in driving improvements in corporate environmental performance (Yap 2000). The provincial government could use its enforcement mandate to counter the reported resistance of Van Chang producers to having their air quality and wastewater contamination level monitored.

The change program must be led and managed by the community. But community residents should be shown the link between their production and their health. Mothers and informal authority figures such as the Fatherland Front (veterans league), the teachers' union and the Youth League, need to be involved.

Role models from within the business community are needed. The 3 households that have adopted the improvements will need to be monitored and the benefits to them, carefully documented. They should be mobilised to become CP champions in the village. Community leaders should be encouraged to help bring about changes in industrial process, work flow, and equipment layout.

Van Chang SSEs should be linked with SMEs in Nam Dinh City through the Nam Dinh industry association. Such a network could be a source of market information and technology transfer for SSEs and SMEs, as was demonstrated in the South Korean experience described earlier.

5.4.4 Design the change programme to fit the local context

The change programme needs to be framed in terms of the interest and needs of the Van Chang households – sustainable incomes, improved living conditions for their families, perhaps better relations with workers and neighbours.

The small scale producers will need to be prodded and mentored to introduce cleaner production changes. Successful and widespread adoption of Cleaner Production will require technical experts who respect and are interested in learning from the small producers, and in finding ways for improving process efficiencies. The production characteristics of the 'waste' villages make a 'bluepirnt' approach to cleaner production largely ineffective. Establishment of locally-based CP circles should be explored. The Vietnam National Cleaner Production Centre (VNCPC) could be engaged to train local under- or unemployed engineers and chemists who then would work as CP extension workers but have access to VNCPC senior experts should the need arise.

6 Conclusions

The solutions to the human and environmental health problems posed by small-scale enterprises such as in Van Chang cannot be divorced from sustainable livelihood objectives. As described earlier these 'waste' villages are only one link in a chain of relationships. Because of the multiplicity of interactions and linkages, interventions have greater repercussions throughout the system.

There are grounds for optimism. The Government of Vietnam is officially committed to CP as one of its key strategies for sustainable development, having signed the International Declaration on Cleaner Production in 1999. The Ministry of Environment and Natural Resources announced in October that the Vietnam Environment Fund plans to invest VND 100B in environment projects, including those dealing with the pollution in craft villages (VEN 2006).

There is local CP expertise and it is growing. The National Cleaner Production Centre is very active in providing CP consultancy and support to industries and service providers. Five universities are reported to be offering CP courses at undergraduate and graduate levels in environmental engineering and environmental management programs (Ngo et al 2001).

Several research institutions are involved in environmental research and technology development. The Centre for Environmental Technology and Sustainable Development at the Vietnam National University, conducts research on the fate of toxic compounds in dumpsites in the country. The Institute of State and Law at the Hanoi Technology University has addressed several technical challenges in craft villages. They include machinery to collect wood dust in wood processing villages, and techniques for collecting solvents in lacquer-making processes or to separate heavy metals from sewage in villages producing zinc-coated iron sheets (Pham 2004). The Centre for Environmental Engineering of Town and Industrial Areas (CEETIA), housed at the Hanoi University of Civil Engineering is embracing and implementing participatory research approaches in its work with craft villages on municipal waste management. As does the Vietnam Agricultural Science Institute (See for example Nguyen et al 2003).

Experience in craft villages in the central province of Ha Tay and in Khoai Chau District in the northern province of Hung Yen demonstrate that with proper training and technical assistance, community-managed programme of change can resolve the tension between environmental protection and livelihoods of the poor (VNS 2006).

Equally important, there are donors in Vietnam such as the Swiss Agency for Development Cooperation that actively support research, and willing to fund small scale initiatives targeted at the real poor that integrate poverty reduction with environmental protection objectives, and therefore necessarily designed "outside the box".

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DEV Sustainable Business in Kenya

Resources Efficiency Assessment in Kenya

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1 Introduction

Developing, low-income countries like Kenya are facing environmental problems caused by past environmental negligence and outdated technologies. Therefore, the benefits of application of preventive, proactive instruments and tools bringing economical, environmental and social benefits simultaneously are especially pronounced there. Such effective instruments are e.g. cleaner production and energy efficiency assessments.

These tools we applied and implemented in project named REAK (Resources Efficiency Assessment in Kenya), project of joint activity between UNDP, Slovak CPC and Kenya NCPC.

REAK project, with the start in December 2005 and the end in March 2007, is oriented on national capacity building in the area of practical application of preventive environmental approaches in Kenya.

Focus area is efficient resources usage (energy and material) in Kenyan SME's with emphasis on potential of renewable resources, environment and cost benefit. By the end of project a group of trained local consultants and trainers will be able to provide resources efficiency assessment. National case studies in 4 participating SME's will be developed also with the aim to enhance their viability and competitiveness on the market. Reduction of pollution into air, water, soil and energy and material savings is important part of project that leads to the protection of environment and sustainability. Set of theoretical trainings and hand-on experiences in pilot companies are tools how to achieve project results.

Based on experiences within this project, we would like to share our gathered knowledge in this paper.

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2 Sustainable Business

2.1 Towards environmental performance and efficiency

In Kenya, the implementation of demand-side energy efficiency improvements is among the strategic development objectives in the industrial sector. In order to achieve this energy efficiency, the government is promoting energy audits of commercial and industrial enterprises, developing demand-side energy efficiency management programs, making information available regarding the efficient use of energy and cost-effective technologies, and encouraging private sector participation in the delivery of energy efficiency improvement measures. In the past, investments in energy efficiency were being impeded by the historically low power tariffs and price controls on petroleum products. This situation has since been ameliorated through the Government's new tariff policy, power sub-sector reorganization and the newly liberalized petroleum market. With the liberalization of Kenya's economy Kenyan goods now face very stiff competition as a result of being expensive and not meeting the ISO 14000 series of standards requirements.

From the perspective of efficient energy usage, REAK project should help to remove barriers to energy efficiency and renewable resources assessment while increasing the institutional capability to implement resources efficiency projects. In particular, REAK project facilitates the learning process required for the wide spread application of energy efficiency and energy conservation activities in Kenya.
There have been certain barriers that have prevented Kenyan SME's from adopting the relatively new concept of cleaner technologies of industrial production in existing or new production lines.

Identified barriers, which thanks to the project implementation can be replaced or limited, are:

- Lack of information on latest environmentally-friendly technological achievements as well as inability to locate sources of such information,
- Lack of information exchange between various interested groups on opportunities for pollution prevention and energy conservation,
- Lack of confidence that techniques for reducing waste and enhancing energy efficiency and potential of renewable resources will be economically and technically feasible in practice,
- Cleaner technologies of industrial production are country specific based on socio-economic conditions. They cannot be directly imported from successes abroad as it is with add-on-units for end-of-pipe treatment,
- Lack of adequate financial support,
- Lack of institutional support facilities – inadequate institutional network and limited and non-availability of sufficient trained manpower,
- Lack of proper record keeping and continuous improvement target setting,
- Lack of a culture of input and out put measurements,
- Lack of Management and Environmental Performance indicators for purposes of facilitating benchmarking activities,

- Week linkages between Energy Efficiency and Renewable Resources.

2.1.1 Asset of Resources Efficiency Assessment

Resources efficiency **A**ssessment is term for sustainable business. In detail, it presents reducing environmental impacts from processes, products and services by using better management strategies, methods and tolls.

Its methodology is based on carried energy audits and cleaner production assessment, and on integration process of cleaner production (CP), energy efficiency (EE) and potential usage of renewable resources.

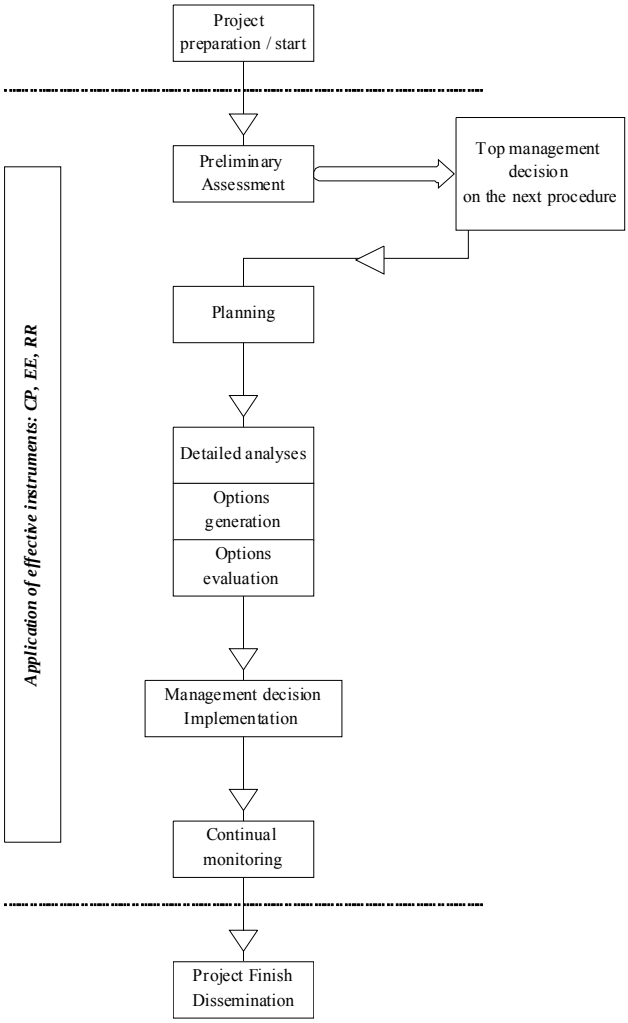

Figure 1: Typical course of the REAK project in companies

To add, resources efficiency assessment tends on prevention, which reduces or eliminates wastes or pollutants at the source during production process. It generates financial as well as environmental benefits by encouraging companies to use inputs from raw materials to energy more

productive way. Moreover, it supports the application of renewable technologies, practices, and promotes process that prevents emissions of greenhouses gases and reduces local and regional air pollutants.

Expected benefits from project implementation are:

- Increased awareness of preventive environmental approaches,
- Better competitiveness of involved companies on national and international market,
- Reduction of unemployment,
- Abatement of environmental impacts caused by industrial activities within the country,
- Possibility to implement the pilot project in other localities

2.1.2 First Findings

The table below shows the first findings within the project realization. These findings are results from carried energy audits and cleaner production assessment in project participating companies. Next step is to estimate the potential of renewable resources within companies.

Table 1: List of chosen finding and recommendations for material and energy savings

Company its part	Finding	Recommendation
HACO Ind. Ltd. - cosmetics sector		
WAREHOUSE - pic	The goods are warehousing manually by the help of ladder	Company can increase work efficiency and safety by the use of high-lift truck
HALL for PENS COMPLETING	12 fans are used for good environment – it means consumption of energy and air-flow does not decrease the air temperature	For air condition they can use potential of renewable energy following natural exchange of the air, etc
DIESEL GENERATOR STATION	Load of blackouts cases a big loss in the productivity. After 15 seconds of blackout the generator starts up automatically. Each short interruption means a sequential start of technology with consecutive losses	For continuous operation can be install UPS system which will cover short blackouts and guarantee elimination of the losses in period of blackouts. Especially is suitable the rotation UPS system
PRODUCTION HALL	During the pressing phase some moulds are producing a lot of waste, which have to recycling	Recycling costs money! They should reduce waste material in the way of new design of better mould, focus mainly on maximal utilization of the material for the final product
KIRU Tea Factory Co. Ltd. - tea production sector		
BOILER HOUSE	Due to bad insulation are cases losses into boiler house	Repair insulation
MAIN HALL	Heat losses on pipes near to	Repair insulation on the

Company its part	Finding	Recommendation
	fluid dryer.	pipes. Rebuilt the installation of the steam traps for better access to maintenance of the steam traps
OUTSIDE of the HALL	Big losses of steam – through non-functional steam traps the steam leaks into condensate pipes and into collectors. Steam is taken away through pipes to the environment without its utilization	Temporary option: Utilization of the steam into boiler house for pre-heating of the fed water and insulation of the steam pipes Permanent option: Invest to the new functional steam straps
SARA Lea Household & Body Care (K) Ltd.- - shoes and cosmetics sector		
BOILER HOUSE	Non-effective steam production	Install solar panels for water pre-heating or use waste heat from the nearest compressors
SHOEs POLISH PRODUCTION HALL	Cooling boxes have its condensers on the ceiling - these condensers radiate the heat into the hall	More efficient will be to install condensers outside the hall /or in the area where higher temperature is required/ or utilize heat from compressor for pre-heating of washing water
WAREHOUSE	Illumination is going all day (54 lamps = 58,3 kWh/day)	Use day light by installation of the skylights for energy saving
KITABU Ind. Ltd. - paper sector		
FINISH PRODUCTS STORE	Final products are storage in the boxes too high one by one. The lowest ones are damaged by mass of uppers ones.	Better management by installation at least one rack for better product quality
PRODUCTION HALL	Illumination is going all day (35 lamps= 13 kWh/day)	Installation of transparent roof, bigger windows for better daylight exploitation

3 Overall conclusion

The high cost of petroleum products coupled with inefficient energy technologies result in high manufacturing costs making Kenya's products less competitive internationally. In addition, Kenyan manufacturers are facing increased competition from low priced imports as a result of globalisation. Electricity is the second most important source of commercial energy, with installed capacity of 1100 MW. Development plans for the next 15 years indicate that additional capacity of 1300 MW will be required. By enhancing the combined resources efficiency awareness, training, setting up of demonstrations, information dissemination, and policy dialogue, this project will enable Kenyan SMEs to increase their productivity by ensuring a more efficient use of raw materials, energy and water and promote better environmental performance through reduction of waste and emissions. Clean and secure energy future is also about renewable resources. Particularly in the country residential land where old unreliable diesel generators are only

source of electricity supporting the local electric grid system is need for cost effective installation of photovoltaic, wind and small hydro systems. Besides that, the large expansion is coming from usage of biomass.

DEV Promoting eco-efficiency in small and medium sized companies in Africa

Public-Private-Partnership between UNIDO/UNEP and BASF

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1 Introduction

UNIDO (United Nations Industrial Development Organization), UNEP (United Nations Environmental Programme) and BASF, the chemical company, are bringing together their expertise and know-how in a partnership. The goal of this partnership is the dissemination of a management tool, namely BASF´s eco-efficiency analysis, to smaller and medium sized enterprises (SMEs) in developing countries. The partnership facilitates the transfer of know-how contributing to sustainable industrial development.

2 The Global Compact

For BASF, the project is part of its active involvement in the Global Compact initiative under the leadership of United Nations Secretary General Kofi Annan. The initiative is addressed to business worldwide, to help build the social and environmental framework for open and free markets while ensuring that people everywhere have a chance to share the benefits of globalization. In a globalized world, which is characterized not only by economic growth and welfare but also economic and social imbalances, business must be an active part of the solution in order to maintain its license to-operate. The Global Compact provides a basis for a dialogue between the UN, business community, labour and civil society.

2000 in New York, BASF became one of the 44 Global Compact founding members and is willing to contribute to the implementation of the Global Compact Initiative and to embrace the Compact's ten principles (Fig. 1). One focus of the Global Compact lies on the individual strength that each member can contribute to the progress of the initiative as a whole. The concept of best practices is a cornerstone of the Global Compact, since it

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enables the partners to detect potential synergies and win-win situations which best help to put the ten principles into practice.

The Global Compact‘s Ten Principles

HUMAN RIGHTS

- Support and respect the protection of international human rights within their sphere of influence; and
- Make sure their own corporations are not complicit in human rights abuses.

LABOUR STANDARDS

- Freedom of association and the effective recognition of the right to collective bargaining;
- The elimination of all forms of forced and compulsory labour;
- The effective abolition of child labour
- The elimination of discrimination in respect to employment and occupation.

ENVIRONMENT

- Support a precautionary approach to environmental challenges;
- Undertake initiatives to promote greater environmental responsibility;
- Encourage the development and diffusion of environmentally friendly technologies.

ANTI-CORRUPTION

- Work against corruption in all its forms, including extortion and bribery

Figure 1: The Ten Principles of the Global Compact

Every participant must set in motion changes to business operations so that the Global Compact and its principles become part of the strategy, culture and day-to-day operations. The members are expected to publicly advocate the principles. Furthermore, business companies are asked to post an example of concrete steps taken to act on the ten principles. For BASF the motivation for the realization of the eco-efficiency partnership project was providing the expertise on eco-efficiency to contribute to achieving the goals of the Global Compact.

3 Public-Private-Partnership

UNIDO and BASF met during UNIDO’s expert group meeting on business partnerships in October 2001. At this meeting the idea to jointly develop a project supporting small firms in the developing countries was conceived. In February 2002 at a workshop with UNIDO / UNEP / BASF at BASF´s headquarter in Ludwigshafen all participants agreed to accomplish a partnership project to carry forward eco-efficiency know-how of SMEs in developing countries (Fig. 2). For the pilot phase of the partnership the Moroccan dyeing industry was selected. The textiles industry plays an important role in Morocco’s economy. A large number of people find occupation in many small and medium sized enterprises. These companies are confronted with the permanent challenge to remain competitive by working more efficiently and at the same time in a more environmentally

friendly manner. The goal pursued by UNEP, UNIDO and BASF is to support these companies in their operations. The implementation in Morocco is accompanied by the UNEP / UNIDO National Cleaner Production Centre (NCPC) in Casablanca.

Chronology

- Feb 2002: Kick-off workshop with UNIDO/UNEP and BASF in Ludwigshafen
- Mar 2002: Pilot implementation started in Morocco (dyeing industry)
  → Direct work at companies in Morocco by BASF and UNIDO/UNEP NCPC
- Apr – Aug 2002: Company assessments in Morocco for data collection and application of the eco-efficiency manager at company level
- Aug/Sep 2002: Training of NCPC staff by BASF
- Sep 2002: Results presented jointly in Johannesburg (WSSD)
- 2003: Training of UNIDO staff by BASF experts in Ludwigshafen
- 2004: Workshop in Morocco for participants out of five different African National Cleaner Production Centres
- 2006: Workshop in Cairo – Training for participants from textile companies and members of the NCPCs
- 2006: Nominated for the "European Business Award for the Environment"

Figure 2: Eco-efficiency Partnership Project - Chronology

The best results in Public-Private-Partnerships can be achieved, if every partner brings in its knowledge in the best possible way. For the eco-efficiency project in Morocco, BASF brought in its scientific and methodical eco-efficiency knowledge and its experiences of many years with products in the textile range; the UN-organizations contributed with their knowledge about technical cooperation projects, the country and its culture, and also with the provision of contacts. The NCPC brought in its contacts to several textile companies on site and its knowledge in their production processes. It is only due to this pooling of competences and knowledge that the project can be implemented. Furthermore, learning processes are initiated and the dialogue with partners and different stakeholders is intensified.

4 The Eco-Efficiency Analysis

Regarding sustainable development tools, one of BASF's core competencies lies in the field of eco-efficiency analysis. In simple terms, eco-efficiency describes, how environmental friendly and economical a product or process is. The eco-efficiency analysis investigates the entire life cycle including its applications. Through determination of the total impact on the environment and all costs from manufacture to disposal the complete value-added chain is covered. The eco-efficiency aims to achieve a balance between environmental and economic factors: this means to manufacture cost-effective products with the smallest possible amount of raw materials and energy, and to minimize emissions. The BASF eco-efficiency analysis is a tool for quantifying sustainability of products and processes. It provides an assessment of the total costs and of the environmental impact that a product or process creates over its complete life cycle, starting with raw material extraction and continuing on to post-use disposal or recycling. The analysis includes an in-depth comparison of the pros and cons of various product alternatives, all of which fulfil the same customer need. It is a strategic instrument, which assists companies in their selection of the most cost-effective and environmentally sound product or production process.

The eco-efficiency analysis is an important tool for putting the principles of sustainable development in practice. BASF began to develop the instrument, which is based on an idea of Schaltegger and Sturm (1992), in 1996. In the meantime, the method has matured and more than 250 products and production processes were analyzed to date. The eco-efficiency analysis makes it possible to consider economy and ecology side by side in the development and optimizations of products and processes and to select the most eco-efficient alternative. The objective is to identify products combining optimum application properties and good environmental performance at lowest possible cost. The analysis yields clear indications of possible improvements in the products and processes employed. Scenarios and variants enable us to show the distance between potential new products and existing solutions. The eco-efficiency analysis is a strategic instrument for BASF. Strategies are developed for sustainable analyses of our product lines and support is provided for decisions on capital expenditures.

Half of the eco-efficiency analyses conducted to date have been used for internal strategy and research decisions. The other half of the analyses has been carried out in cooperation with external partners such as customers, NGOs, and governmental institutions.

Right from the beginning the eco-efficiency analysis was discussed in public. This has led to many valuable contributions from external parties and has put the method on a high level of acceptance throughout various industries and stakeholders.

4.1 The methodology

The eco-efficiency analysis starts with the definition of a specific customer benefit. The analysis then compares economic and ecological advantages and disadvantages across several product or process solutions,

which can fulfil the same function for customers (Saling et al., 2002). This means that products are not compared with one another in over-all terms but rather their application performance such as “painting a square meter of furniture front”. In the case of the Morocco pilot study the customer benefit was defined as “pre-treatment, dyeing and post-treatment of a specific amount of yarn or fabric”. The eco-efficiency analysis focuses on each phase of a product's life cycle “from cradle to grave”, beginning with the extraction of raw materials from the earth and ending with recycling or waste treatment after use. The basis is a life cycle analysis according to standard ISO 14040 and the following.

In this way, the environmental impact of the products used by BASF as well as of the starting materials produced by others is measured. The usage behaviour of the final consumers together with the various possibilities for reuse and disposal are also analyzed. In addition, a comprehensive economic assessment if performed including all costs incurred in manufacturing or use of a product. The economic analysis and the overall environmental impact are then combined to evaluate the eco-efficiency. Thus, all relevant decision factors are analyzed with specific customer benefits always being the focus of attention.

Eco-efficient solutions to the problems are those, which provide a better customer benefit from a cost and environmental point of view.

4.2 The indicators

The representation of a multiplicity of individual results from the actual life cycle assessment is frequently opaque and difficult to interpret. To improve the interpretation of results, BASF has developed a method, which combines the ecological and economic parameters plotting them as a single point in a coordinate system.

The environmental impact is described with reference to six categories resulting in what is called the “ecological fingerprint”:

- Consumption of raw materials,
- Consumption of energy,
- Area requirement,
- Emissions into air, water and soil (wastes),
- Toxic potential of the substances employed and released, and
- Potential for misuse and hazard potential.

Each of these categories covers a large number of detailed individual criteria.

The results of all environmental impact categories are combined by weighting. This weighting scheme is made up of societal weighting factors and so-called relevance factors. Societal weighting factors account for the importance society attaches to the different forms of ecological impact (Fig 3). The relevance factors are based on actual data and indicate the relative importance of the environmental impacts to the overall impact.

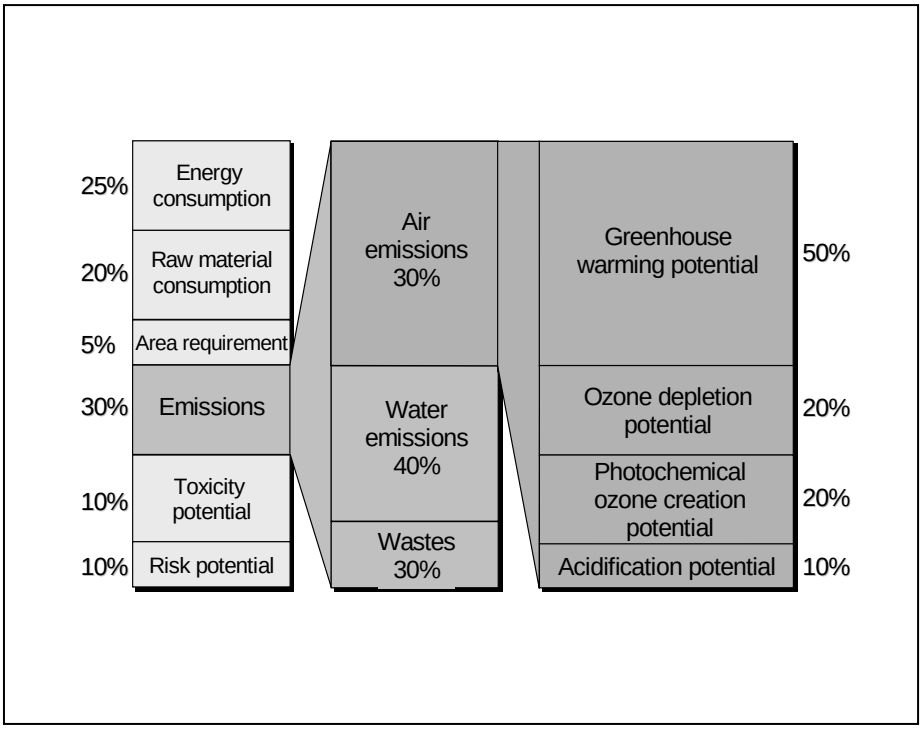

Figure 3: Societal weighting factors in eco-efficiency analysis for Morocco

Also the economic data is compiled over the entire life cycle. For this purpose the material and energy flows, including all relevant incidental flows, are taken into consideration. The total costs are normalized with respect to the average of all alternatives. This helps identifying cost drivers and areas offering potential for cost reductions.

The data on relative costs and environmental impacts are used to construct a graph, the so-called eco-efficiency portfolio, which clearly shows the strengths and weaknesses of each product or process. The relative costs are plotted on the x-axis of the portfolio, and the relative environmental impacts on the y-axis (Fig 4). The closer a product or process is to the upper right hand corner, the more eco-efficient it is.

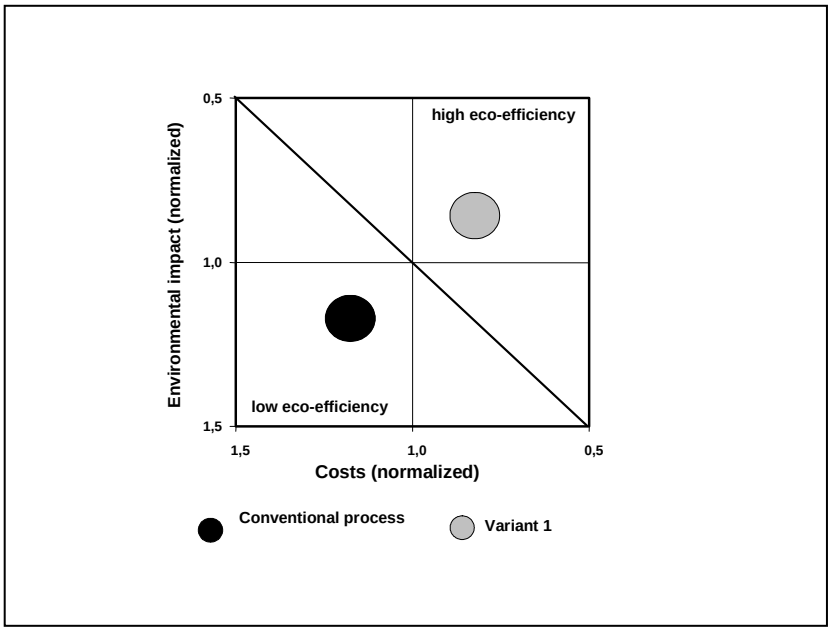

Figure 4: The eco-efficiency portfolio

4.3 Decision-making aid for complex issues

The value of the eco-efficiency analysis tool, apart from its description of the current state, results from the recognition of dominant influences and the illustration of "what if...?" scenarios. The stability of the results is verified by means of sensitivity analyses in every project. Underlying assumptions as well as system boundaries and societal weighting factors are varied and checked within realistic ranges. The results of an eco-efficiency analysis make it possible to identify weaknesses in products and processes over the entire life cycle. This allows us to identify factors with significant optimization potentials.

Eco-efficiency analysis permits a condensed representation of complex interrelationships, which then are easier to grasp and to understand. Often, the facts and implications of a case are only vaguely understood. The results of an eco-efficiency analysis allow the visual presentation of these facts and provide a sound basis for discussion. Moreover, the detailed information gained from the investigations enable a more targeted technical, ecological and economic development of the products and processes. From a user's perspective, the understanding of costs and various environmental aspects of a product is often of a relatively subjective nature. The eco-efficiency analysis illustrates these aspects and makes them more readily accessible for discussion.

5 Pilot project in Morocco

The textile industry in particular is experiencing an increase in the demand for environmental compatibility coupled with intensive worldwide competition. This affects mechanical engineering industry, manufactures of processing chemicals and textile finishers alike. For manufactures and processors of textiles to maintain long-term competitiveness, they must satisfy both environmental and economic requirements. For the pilot-phase of the partnership Morocco was selected. The textiles industry plays an important role in Morocco's economy.

For BASF, the eco-efficiency partnership project led to an advancement of its eco-efficiency analysis. As yet, the method was not so easy to operate. An expert needs 4 – 10 weeks to calculate an analysis. Because of the concrete example of the dyeing-factories in Morocco, BASF-researchers had to think about a new variant of the method, because the conventional procedure was not applicable in Morocco: The dyeing factories should not have to ask BASF to calculate an eco-efficiency analyses, they should be able to do it on site for their required products and processes with consulting service of the National Cleaner Production Centre. The solution was a software tool, called "eco-efficiency manager". The software tool simplifies the compilation of an eco-efficiency analysis in the textile dyeing sector substantially. Competent dyeing factory staffs can carry out this program together with members of the Cleaner Production Centre. The factories in Morocco can now repeat these analyses as often as they need to.

Based on the eco-efficiency analysis a software package was developed and provided to Moroccan companies. This package covers the process steps of the production of these dyeing factories.

In the textile dye works industry, three important production steps take place:

- Pre-treatment of the yarn or fabric,
- Dyeing, and
- Post-treatment

For each step, chemicals, energy and water are needed, while emissions and solid wastes possibly occur.

The basis of the program is a life cycle analysis, so the steps before the dyeing process like raw material extraction from earth are also considered as well as the production of the chemicals, the required energy and the amount of emissions.

The program uses key technical data to calculate how the manufacturing process can be improved (Fig. 5). Required data are for example the amount of used water, electricity, steam, duration of the process, the used chemicals, the quantity of chemicals and their hazard classification. To calculate the economical part of the analysis information about e.g. the costs of labour, machines, chemicals, the charge of water, electricity, waste or waste water

disposal is needed (Fig. 6). These data are commonly available at the companies on site.

Eco-efficiency manager

Prétraitement														
Données à entrer													**Processus conventionnel**	
Matière (poids) = unité d'utilisation (un.ut.)														**kg**
Rapport de bain														**/1**
Rincage														**Nbre**
Durée du processus														**min**
Eau													**0,000**	**m3**
Électricité														**kWh**
Vapeur (mazout)														**kg**
Vapeur (gaz)														**kg**
Calcul de la consommation de vapeur			**Quantité d'eau**									**m3**		
			Augmentation de la température									**°C**		
			consommation de vapeur calculée								**0**	**kg**		
Produits chimiques			**Teneur subst**		**Prix**		**Marquage phrases R**						**Quantité**	
			100%		**MAD/kg**									**kg/un.ut.**
			100%		**MAD/kg**									**kg/un.ut.**
			100%		**MAD/kg**									**kg/un.ut.**
			100%		**MAD/kg**									**kg/un.ut.**
			100%		**MAD/kg**									**kg/un.ut.**

Figure 5: Part of the form of the eco-efficiency manager

Eco-efficiency manager – the costs

Coûts

Frais généraux			
Électricité		0,72	Dirham/kWh
Vapeur		0,03	Dirham/kg
Coûts pour l'eau		0,50	Dirham/m³
Coûts pour eaux résiduaires		0,50	Dirham/m³
Déchets	Ordures ménagères	1,00	Dirham/kg
	Déchets spéciaux	2,00	Dirham/kg
Personnel		30,00	Dirham/h

Prétraitement	Processus conventionnel		Alternative 1		Alternative 2	
Coûts pour machines	100,00	Dirham/h	100,00	Dirham/h	60,00	Dirham/h
Électricité	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Vapeur	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Eau	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Produits chimiques	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Eaux résiduaires	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Ordures ménagères	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Déchets spéciaux	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Coûts pour machines	3,33	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Personnel	1,00	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.
Total	4,33	Dirham/un.ut.	0,00	Dirham/un.ut.	0,00	Dirham/un.ut.

Figure 6: Part of the cost form of the eco-efficiency manager

The result of an eco-efficiency analysis makes it possible to identify weaknesses in the aforementioned production processes. It allows the

identification of factors within those processes whose optimization would result in distinct improvements, thus creating an alternative production.

The eco-efficiency analysis permits a condensed presentation of the economic and environmental impacts of a given production process. The impact of a current process, of which companies are often only vaguely aware, can now be presented in visual terms. Moreover, detailed information gained from the analysis permits simulation exercises as a basis for the selection of alternative production processes. Background information on costs and environmental aspects of a production process from the company's perspective are represented as clear images, and therefore can be used easily for the actual decision making process.

The software tool simplifies the compilation of an eco-efficiency analysis substantially. With consulting services of the National Cleaner Production Centres also SMEs in developing countries are now able to create an eco-efficiency analysis on the basis of the eco-efficiency manager.

The implementation in Morocco is accompanied by UNEP/UNIDO National Cleaner Production Centre (NCPC) in Casablanca. Members of the Cleaner Production Centres Morocco, trained by BASF, visit the dyeing factories in Morocco. The relevant process data are arranged and registered into the eco-efficiency manager. Process alternatives with possible improvements are prepared.

The environmental soundness of products and production processes is becoming more and more important. Yet, SMEs often lack the know-how or financial resources to keep abreast with cutting edge technologies. While many factors that have an impact on sustainable development are beyond the direct control of the individual SME, broader business partnerships can be an important factor in inducing change.

Using eco-efficiency analysis SMEs are able to: capture, calculate, evaluate and then transparently depict even complex matters within the production process; improve their decision-making relating to alternative production processes; communicate with customers and consumers; increase acceptance of defined solutions to problems; promote understanding for thinking in overall contexts; and prove and illustrate acceptance of corporate responsibility principles.

It is sometimes claimed that eco-efficiency will not work in poor economies because prevention pollution is too costly and requires legal enforcement and substantial financial help. But, given that the concept is about producing more with less (as well as decreasing pollution), then poor countries need eco-efficiency more than wealthy countries do, especially poor countries where feedstock such as oil are expensive and some natural resources, such as water or wood, are already in short supply (Holliday et. al, 2002).

Improving eco-efficiency is one way in which developing-world companies can compete in global markets. The chance, that the results of an

eco-efficiency analysis are implemented into the practice of SMEs is very high, because the evaluation of the cost situation is one part of the analysis.

6 Examples

In pilot companies eco-efficiency improvements are achieved. A two-tier process for the dyeing of a mixed fabric was changed to a unitary process through the use of a new chemical. That only one process step is necessary leads to saving of rinsing water, saving of energy for the heating of the water and saving of time (much shorter process time). A positive environmental impact was measured in almost all environmental categories. The new chemical was more expensive than the traditional one but through more efficient use of energy, water and personnel, the overall costs remained unchanged. Using the new chemical an improvement in environmental impact is achieved with the same costs. So the new process is more eco-efficient than the conventional one.

In a second case a hazardous acid was substituted by another, less harmful acid. The newly used acid had a different hazardous classification. The substitution had a positive impact on the environmental category „toxicity potential“. Small cost savings were associated with less environmental impact. So the assessment shows an improvement in eco-efficiency.

7 The way continues

The next step of the partnership started in 2003 with the training UNIDO staff members at the BASF headquarters in Ludwigshafen. The main focus of the several weeks training, subdivided into different parts lied on the expansion of the eco-efficiency manager to other industrial sectors and other countries.

At a workshop in Casablanca (Morocco) in December 2004 participants out of five different African National Cleaner Production Centres learned how to apply eco-efficiency analysis with the aim of making their know-how widely available in the future and provide expert advice to textile companies in their home countries. Together the participants discussed the potential of the decision-making tool using specific examples from plant practice. Therefore also an English version of the eco-efficiency manager was built.

Another workshop was held in Cairo in February 2006. About 40 participants from textile companies were trained on the application of eco-efficiency manager. The workshop offered the participants also the opportunity to establish contact with European brand manufactures and dealers. This helps Egyptian textile manufacturers to meet the demands of the global market, while at the same time keeping the environmental impact to a minimum.

In April 2006 the partnership project was nominated for the EU Commission's Award for the Environment. The award is the most prestigious environmental award that a European company can receive – out of 139 projects submitted from 23 counties, 12 were selected for the final round - with BASF amongst them. In June 2006 BASF received the "Federation of German Industry (BDI) Award for the Environment" in the category "Technology transfer to Developing Countries" for the partnership project.

8 Benefits for the partners

In the partnership project, the partners act exemplary together. BASF was open to share its eco-efficiency analysis method and makes it possible for UNIDO and UNEP to use the know how out of this method. BASF developed user-friendly software for SMEs in Africa and also provided training to the members of the National Cleaner Production Centres in Casablanca and staff of interested dyeing companies. The National Cleaner Production Centres enables access to the target companies and ensures wider dissemination of the methodology and training of a large number of companies. The network of the National Cleaner Production Centres functions as the base for further outreach of the program and as the institutional anchor of the related training services on eco-efficient production systems and processes.

For BASF, this partnership project with UN organizations is a successful experience. Beside the achievements of the pilot project itself the outcome in the perspective of BASF can be summed up as follows:

- Experience on cooperation with UN agencies and access to some of UNIDO's networks
- Acceptance of the eco-efficiency analysis by important UN organizations (UNEP and UNIDO)
- Further development of the eco-efficiency methodology and dissemination of the eco-efficiency methodology
- Creation of the eco-efficiency manager software, which was a new product
- New contacts with potential customers

Benefits to UNIDO / UNEP (Bethke 2003)

- Integration of cutting-edge know-how in technical cooperation projects
- Creation of a replicable service model ("eco-efficiency analysis manager")
- Applicable in a number of countries and industries in a cost-efficient way
- Practical UNIDO contribution to support SMEs within the framework of the GC and its business partnership program

This joint work will not only build up a new sustainable service for the NCPCs but will eventually support the build-up of cutting-edge know-how and capacity at the NCPCs, which will further foster the outreach and sustainability of this unique service.

Business partnerships provide access to specialized expertise and encourage changes among all partners - greater openness and efficiency, new ideas - which can lead to a sustainable impact on economic development.

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DEV Sustainable Consumption at University of Maribor

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1 Introduction

In recent years, unsustainable consumption patterns world-wide have received a great attention, introduced in the Agenda 21 and its chapter 4, "Marrakech-Process" as well as Oslo Declaration. According to these documents, unsustainable consumption is key driver, leading to the overall environmental degradation, having societal consequences such as global poverty, illness, inequality, inequity, etc. On the other hand, sustainable consumption focuses on formulating equitable strategies, fostering the highest quality of life, efficient use of natural resources, and effective satisfaction of human needs while simultaneously promoting equitable social development, economic competitiveness, and technological innovation (Oslo Declaration, 2005). In order to achieve sustainability of our economy and lifestyles, we need to revise our consumption patterns (Myers, 2000).

While sustainable consumption often refers to individual and household consumption, a summary by Co-Chairs of the Second International Expert Meeting on the 10-Year Framework of Programmes on Sustainable Consumption and Production, held in Costa Rica 2005 has identified "institutional consumers". These are consumers within all public and business institutions, to which also universities belong. Universities, with the mission of making worthwhile and significant contribution to sustainable development should not only promote the sustainable consumption and production, but also put this concept into practice. Institutional consumption is substantial, and efforts to promote sustainable institutional consumption may be different from the efforts to promote sustainable consumption by individual consumers (UNEP, 2005).

To our knowledge, not much attention has been paid to the institutional consumption, especially to the universities as the institutions with the mission of making a worthwhile and significant contribution to sustainable development through research and education. In the European Union almost 17 million students are studying at more than 2500 higher education

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institutions (Andren 2005, Webometrics, 2005), presenting an enormous body of consumption as well as great potential for implementing the sustainable development practices. Therefore, universities face a new challenge – to create our future sustainable, while we cannot have a sustainable world where universities promote unsustainability (M'Gonigle and Starke, 2006). In order to transform universities into sustainable institutions, attention to the following documents should be paid:

- Delivering on the modernization Agenda for Universities: education, research and innovation (European Commission, 2006)
- Graz Declaration on Committing Universities to Sustainable Development (Graz Declaration, 2005)
- Oslo Declaration (Oslo Declaration, 2005)
- Mobilizing the brainpower of Europe: enabling universities to make their full contribution to the Lisbon strategy (European Commission, 2005)
- The role of universities in the Europe of knowledge (European Commission, 2003)
- A Sustainable Europe for a Better World (European Commission, 2001)

The objective of this paper is to introduce the state-of-the-art of sustainable consumption and production practices at the University of Maribor, entailing university's water and energy consumption, difficulties of data acquisition, a review of efforts made the approach to sustainable consumption, and to develop the concept of a Sustainable University, enabling the integration of sustainable consumption and production principles into its various activities. The bases of such concept are: the statement, including university mission and vision, and appropriate and efficient organizational structure. Therefore, establishment of a sustainability committee or office is essential for support, coordination and communication between academic departments, university, government and local community. On the other hand careful consideration should be given to the integration of sustainability into current research and teaching. The concept of sustainable consumption and production shall be integrated into curriculum courses, directing and supporting the consumption and production practices. That way, university can become a learning laboratory for students and staff.

2 Methods

The study is based on the following activities:

- establishment of an organizational framework
- case study concerning water consumption practices
- project: second hand textbook market
- integration of sustainable development into curriculum

2.1 Case Study

The case study is based on the inclusion of sustainable development principles into University of Maribor activities. University of Maribor presents one of four Slovenian Universities, where more than 25,000 students, staff, administrators, and others study and work. Therefore, this University presents a substantial body of water, energy, resources, material, and products consumption.

2.2 Council for Sustainable Development

The organizational framework is essential to manage the consumption and production activities at the university and it manly refers to sustainable management.

The establishment of a Council for Sustainable Development (CSD) began in 2005, when authors proposed a project "A Sustainable University". A top-down approach by the university management has been taken to foster this idea. The initiation phase of establishing a CSD demands co-operation of all departments. After the beginning enthusiasm, the university management (Rector, Deans) did not show willingness and the project was thus shoved aside. In another attempt a bottom-up approach has been used, appealing to the students and professors, whose main occupation is sustainable development. The project has been introduced to the Student Council as well as being published in the Slovenian academic and student newspaper *Katedra*, in order to introduce the project the whole body of students and professors. The project was well received by the Student Council, and the students confirmed their support.

2.3 Water Consumption at Engineering Departments

A quantitative measurement of water consumption at the Engineering Departments has been carried out. First, volume flow-rate of water on a monthly basis between 2000 and 2005 was investigated in order to get the information about annual water consumption. Observations between 1st of October to 30th September have been taken as a academia year. The annual water consumption, its costs and water consumption per person were calculated. It is important to notice that only Engineering departments (Civil Engineering, Chemistry and Chemical Engineering, Mechanical Engineering, and Electrical Engineering and Computer Science Department) have been taken into consideration, because the data at other departments were not available.

2.4 Curriculum support

An inclusion of sustainability into research and teaching indirectly influences the consumption patterns, because the educational process has impact on student's habits and attitudes. Therefore, the integration of sustainable consumption and production into educational process is inevitable.

The curriculum support and development of new modules at bachelor and master degrees are fostered within project "Environmental Engineering and Sustainable Development Study Programme" at Chemistry and Chemical

Engineering department, funded by Slovenian Ministry of Higher Education, Science and Technology, and European Social Fund. The development of new, sustainability oriented modules is based on the following activities:

- review of bachelor and master courses in Europe. As a basis, programmes in the studying year 2005/6 have been taken into consideration. At each university three chemical or environmental engineering and technology programs at the most, have been investigated in detail. The universities were selected from *Top 500 Universities 2005* and *Webometrics*,
- distribution of a questionnaire to the professors, students, and potential employers about importance of this study programme and labour possibilities for graduates,
- design of a new curriculum and
- accreditation of new modules.

3 Results

3.1 Organizational framework and projects proposal

In May 2006, the CSD was established, including representatives from nine of thirteen departments. Its main task is to support, stimulate and coordinate sustainable development projects, and to link dissipative activities of departments. The representatives within the CSD are those professors, who are actually engaged in sustainable development, from the research or pedagogical point of view. The professor, teaching sustainable development is the chairperson of the council. The representatives serve as a communication link between department and the council. Other stakeholders (students, community members) will join the CSD in November 2006. A review of the existing, sustainability oriented project at the University of Maribor was carried out (Table 1). At a meeting of the CSD it was agreed that in the beginning a small, profitable project should be carried out (Table 2). This project was proposed as a team work between different departments and stakeholders.

Table 1: Present sustainability oriented projects proposed at University of Maribor

Department	Projects
Department of Criminal Justice and Security	Environmental criminality
Chemistry and Chemical Engineering	Postgraduate School of Industrial Ecology (6^{th} Framework Programme)
	Environmental Engineering and Sustainable Development Education Programme
Economics	Social Responsibility at University
Pedagogical	Sustainable University
	Ecoremediation as standard

Table 2: Future sustainability oriented projects proposed at University of Maribor

Department	Projects
Civil Engineering	Improvement of university building isolation, based on principles of passive buildings
Logistics	Sustainable transportation
	Commuting of students and staff
Mechanical Engineering	Heat pumps and cooling towers
	Economical ventilation
Chemistry and Chemical Engineering	Minimization of water consumption
	Wastewater treatment
	Technological Platform SusChem
Economics	Environmental Accounting
	Corporate Social Responsibility
Pedagogical	Education for Sustainable Development
Law	Slovenian legislation on environmental protection
Organizational	Environmental management
Geographical	Local Agenda 21
Social	Principles on sustainable consumption

3.2 Water consumption

The water consumption has been carried out only for engineering departments. Fig. 2 shows that water consumption has decreased, although number of students increased. An enormous increase of water consumption has been perceived in the academic year 2004/05. The consumption is more than double than one of the previous year, although the number of students decreased in the same academic year (Fig. 2). The reason for such an increase was new laboratory equipment at Department of Mechanical Engineering, where they were using water for cooling. White part of the graph column for 2004/05 (Fig. 1) represents water consumed by the new laboratory equipment when the consumption of the remaining users was assumed equal (or 20 % lower, following the trendline). The identification of the greatest "water spender" fostered other cooling options. Thus, Mechanical Engineering Department has designed cooling towers. In the year 2006 lower water consumption is expected.

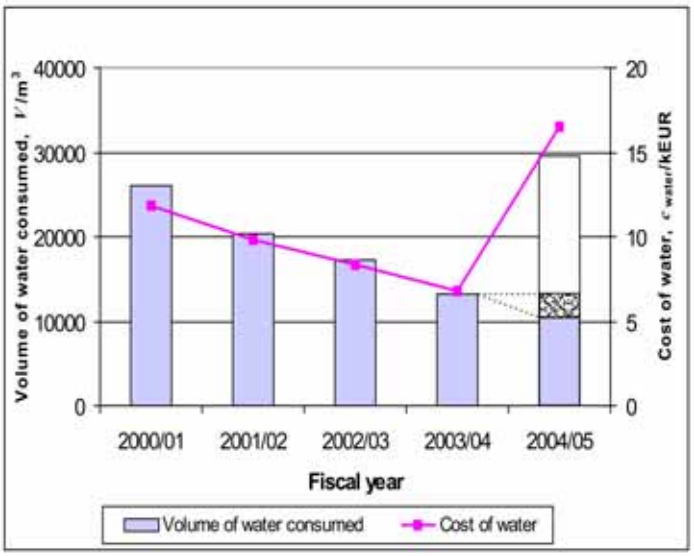

Figure 1: Water consumption at School of Engineering

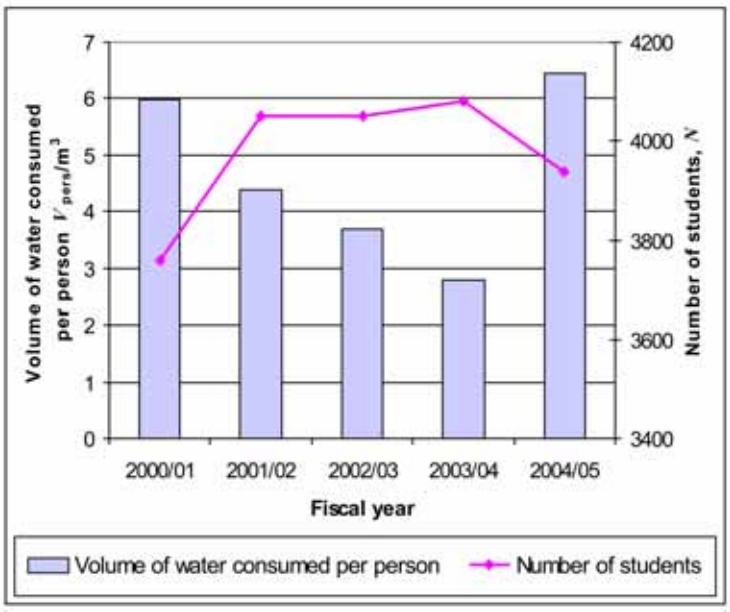

Figure 1: Annual water consumption per person

A research has been expanded to the energy consumption (electricity, heating). It was found out that the cost of electricity at the engineering departments was 137 500 EUR in last year and average costs in last five years were 135 000 EUR. Costs for heating were almost the same. School of engineering has paid for heating 136 000 EUR last year, and annual average for the last five years was 120 000 EUR. It has been also found out that most expenses are dedicated to the commuting of the employees, telecommunications, and cleaning and other services. Unfortunately, we could not manage to get data for energy consumption, and other services. The great barriers was the hesitating behaviour of top university leaders

(rector, deans) and university management, keeping these data as a top secret.Reuse of textbooks

Reuse of textbooks presents waste reduction, environmental preservation opportunities as well as decrease of financial burden for students. A project "Second hand market of textbooks" has been carried out in October 2006 under supervision of CSD. In June 2006 the preparation for market begun. The coordination was left to the students. Students form eight out of thirteen departments were included. The students decided that the market will take place at each department separately, which was not the best decision. The market was advertised by local radio and by posting flyers. The market was successful only at the engineering departments. The reasons for that could be not enough motivated coordinators at other departments, as well as crumbled market place.

3.4 Curriculum support

This paper summarizes the state-of-the-art of education for sustainable development in Europe, considering countries, following the Bologna Process. Several chemical engineering/technology and environmental engineering/technology programmes have been reviewed in order to find common characteristics in European Higher Education Area. The programmes indicate that European universities are in the progress of implementing the sustainable development and simultaneously following the Bologna Process. The scope of the courses offered is usually environmentally oriented. Therefore, a larger inclusion of sustainable development oriented courses into programmes is desirable. Sustainable development issues, including sustainable consumption and production, are still missing in most courses offered. Only few countries in Europe like Czech Republic, Estonia, Lithuania, Netherlands and Poland are offering Sustainable development courses in the first cycle, while Belgium, Czech Republic, France, Greece, Ireland, Italy, Netherlands, Slovakia, Sweden, and United Kingdom are offering sustainability oriented courses in the second cycle.

4 Discussion and Conclusions

For the successful integration of sustainable consumption and production principles at the university level, an appropriate management is needed. Therefore, the establishment of the council for sustainable development or sustainability coordinator should be a reasonable first step. In our case, the bottom-up approach showed as more appropriate to establish a CSD. Furthermore, a sustainability oriented university's vision, mission and goals should be proposed. It might happen that some individuals (professors) or departments are carrying out sustainability oriented projects independently. Therefore, a CSD should overview these projects and could propose collaboration between departments.

A data acquisition to detect water, energy, and other materials consumption has shown to be main problem, because it has just been followed to the cost and not to the consumption patterns. Furthermore, accounts of the university are not available for stakeholders. Exposing a department, that consumes the most (in our case water), showed as a positive

action, because at this department, technology changes were made to reduce the water consumption.

Major changes are needed to revise the consumption and production patterns at the university. The most important is the educational process, comprising sustainability issues. It is a long-term process, demanding all university stakeholders to take action.

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HOU The Importance of Placing Equal Stress on Technology and Education in Housing

Lessons from Kobunaki Eco-Village, Japan

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1 Abstract

The importance of reducing Carbon Dioxide Emissions is well known. As housing accounts for around 1/3 of these emissions in many industrialized countries, it is imperative that housing is a key focus in environmental policy. Improvements in technology have brought increased levels of comfort at home, but improper use of the technology and low design quality leads to ever increasing energy use. Recent work at *Bedzed*, Kronsberg and across the globe by the Usable Buildings Trust has shown that sustainable technology only fulfils its potential when used by educated and motivated users. Although much has been done to promote understanding of technology amongst architects, current work doesn't focus on empowering home buyers to understand the importance of their own actions when buying a new home.

The Kobunaki Project, places equal stress on providing sound technological solutions and education. Approximately 400 new homes provided will be tailored to the central Japanese (hot humid) climate. In 2006, studies of the Kobunaki Project's prototype building will yield data and experience of summer cooling strategies, condensation problems and user behaviour - the key issues in hot, humid Asian climates. Throughout the design process, workshops and other disseminations techniques have been used to make the process educational. This foundation will be extended by experimental work to create opportunities for education within the construction, handover and occupancy periods; most crucially this work will focus on educating home-buyers.

A significant proportion of the world population resides in hot, humid climates. Thus, a solid understanding of the culture, climate and behaviour in buildings, coupled with sound methods to educate and inform homeowners is essential when producing sustainable policy for the 21st

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century. This paper presents the preliminary findings of the work at the Kobunaki project in terms of these factors and offers comment on where lessons for European policy can be taken from the work.

2 The Project

2.1 Introduction

This is a field report of work in progress at the *Kobunaki Eco-Village* in Shiga, central Japan. G-project, the company charged with realising the *Eco-Village*, have worked throughout 2006 with the Global Environmental Architecture department at Kyoto University. This collaboration has resulted in two projects; the *Out of the Box* project (OutBox) and the Eco-housing system. The Eco-Housing system is currently in the early design stages so this paper focuses largely on the OutBox project for which construction will begin in December. Our roles in this work were as research students from Kyoto and Hanover University working within the Out Box team.[i]

2.2 Technology and Education – natural partners, often estranged.

Western cultures spend an average of 90% of their time in buildings (Taylor, 2006) and Carbon dioxide emissions relating to buildings are estimated to be 1/3 of global emissions which are known to be exasperating Climate Change. In turn, the affects of Climate change will affect how we design and use our buildings. Therefore there has been an increased focus on improving building technologies to reduce environmental impact in the West in recent times.

The OutBox project is an interesting case study because the work aims to create a building on sustainable lines using both technological and educational approaches. These are the two key approaches for reducing the environmental, social and economic impacts of a building project. The term technology here is used to describe both 'hi-tech' or 'modern' solutions such as photovoltaic cells or super insulation as well as 'low tech', 'traditional' solutions such as passive solar design. Since the end of the 20th century, a strong focus of policy in the US and Europe has been on educating architects and planners to understand and incorporate technology to reduce environmental impact. Examples of this are the production of building assessment tools such as *LEED* (in the US) CASPEE (*in Japan*) or *Eco-Homes* (in the U.K.) all of which work to encourage the use of more appropriate building technologies.

These assessment methods and the processes and education work they result in have been successful to in terms of raising awareness of sustainability issues through the design and use of flagship 'Green' buildings. However, it should be noted that studies have found that a considerable proportion of these `green buildings` upon inspection often use a lot more energy than expected at the design stags. This 'gap' between expectations of technology and its performance when the building is in use is identified by the Usable Buildings Trust (2005) as being related to a lack of understanding of how the building system works and what the users

expected role in this is. In short, education regarding the use of technology is an essential aspect of success.

As we spend more time in buildings and have increased access to building technology, our demand for comfort rises. This has been increased phenomenally by our access to cheap energy. The ease of flicking a switch has meant that simple adaptive behaviour such as adding or removing clothing or opening and closing windows is often forgotten. Therefore, what is needed is education to make users aware of their own role in the climate of the building, and building technology and technology which allows for a high standard of comfort with a low energy input level. BedZed in the U.K. and Kronsberg in Germany are seminal examples of what can be achieved when technological approaches meet educational ones. *Kobunaki Eco-Village* in Japan is also working in the same way.

2.3 The Japanese Climate and its effect on construction and lifestyle

A factor which heavily affects design and construction of buildings in Japan is the need to produce structures which are resistant to the loads placed on them in earthquakes. As Europeans, this is not a subject on which we have experience or expertise. Therefore we have relied heavily on the Japanese team members, particularly at Kyoto University for input on this theme. In the work of the OutBox team, issues regarding earthquake safety have been resolved by using the j.Pod as a structural unit. Details of the j.Pod system and its ability to withstand earthquakes are given in section 4.

In terms of design for thermal comfort, while Northern European strategies focus predominately on providing warmth in winter, we find that the opposite is true in Japan. In order to cope with the long, hot humid summer, craftsmen in Japan long ago developed very energy efficient construction methods which enabled humidity to be stored in the building materials. Materials used include rammed earth and bamboo mats. In addition to this, natural draft was encouraged in summer by channelling prevailing wind directions through a house air flow through the house by the by shading one side of the building or the use of an inner garden. These two methods work by creating a temperature difference which results in the desired movement of air.

However, as in many industrialised nations, although the traditional technology used little energy, modern buildings depend on a very high energy use. Two problems present themselves in combination when considering this modern situation in Japan: First there is a considerable reliance on electricity for heating, cooling and ventilation which results in very high consumption peaks especially during summer**.** Second, this high energy consumption cannot simply be dealt with by improving insulation as per the European model, as the climate, in particularly the humidity make the design and construction of a working super-insulated wall tricky. With regard to the high levels of humidity, the combination of humidity with the extremely hot summer conditions in Japan calls for one of two things: 1) a very strict regime of user behaviour or 2) a flexible construction which adapts to the climate producing a higher level of comfort.

2.4 Kobunaki Eco-Village and the OutBox project

One focus of the Eco-Village is the development and use of future technologies for housing. For this reason, the developers supported a year long exchange with Hanover University. During this time German best practice for glazing, insulation and air-tightness was introduced to the group. Details of modern and traditional housing design and construction in Japan and the local climate were made available in return. Following this, it was possible to use this new understanding to make suggestions of how benefit may be gained from the modern European energy efficiency techniques listed above in the Japanese context.

A second focus of the Eco-Village is the promotion of links to the local community through the use of local materials. For this reason, G-project has formed a strong link with j.Pod project at Kyoto University. The j.Pod originates from John Barr, a British architect. The structural system has been developed in association with Torisumi Manufacturing, Katagihara Structural Engineers and Kyoto University. It is a new type of timber framed - unit architecture which is resistant to earthquakes and is specifically designed to maximise use of local forest thinning (Kobayashi & Kobayashi, 2006). As roughly 70% of Japan is covered in forest, which is in dire need of thinning, use of the wood in this way, not only supports the local economy but increases bio-diversity and reduces the carbon dioxide emissions associated with transport (*ibid*).

The Eco-village will be situated on a green field site just outside the town of Omihachiman. The OutBox project aims to provide an office space and meeting room on the edge of the site for the G-project team. The space will serve as a place to entertain and serve potential customers (members of the new community) and so a key design specification was that the building should embody and showcase the atmosphere and ideals of the Eco-Village. Therefore, G-Project and the j.Pod project team, including the authors were very keen to see the j.Pod adapted to become an energy efficient construction. This will then serve as a prototype for future work by members of the team.

The building will have two wings: which will have the same structure and size however they will be finished with differing materials. The West wing's theme is local wood and community. The east wing's theme is energy efficiency and 21st century technology. The east wing will feature soil panels, a humidity layer and high quality glazing, which is rare in Japan. The West wing will be constructed using 100% local forest thinnings. The two wings will be joined by a covered deckoffering views of the eco-village site and a restroom.The construction will aim to maximise the use of local workers and local materials. Therefore it represents a 'sustainable solution', although the flavour of the sustainability will be different for both wings.

The juxtaposition of these two types of finish and material choices is hoped to allow visitors to interact and feel the difference of the two spaces. Post occupancy evaluation work will be done to record the energy use, temperature, and humidity and occupant reactions to both spaces. This data will inform future education, design and technological innovation at Kobunaki Eco-Village, Kyoto University and Hanover University.

Figure 1: Perspective drawing of the OutBox showing the two wings

2.5 Technology in the OutBox

The technology used in the OutBox project aims to synergise Japanese traditional solutions and German technology in order to develop methods for realising affordable, comfortable and energy efficient 21st century buildings. OutBox will stand on a temporary site for approximately 8 months and then be moved to a new site within the Eco-village. At the time of moving, some elements of the East Wing construction will be changed, in order to facilitate the testing of a greater range of materials and solutions. Two of the innovations the project will feature in the first phase are described below.

Glazing

High quality glazing in combination with insulation and air-tightness has been proven to be the key to realizing low energy consumption buildings in Europe. In Northern European climates, solar gains in winter are aimed for, while overheating in summer has to be prevented, which makes the design of a house in most locations an interchange between heat gain and loss in winter, over-gain in summer and the ability to shade or store heat.

Although the Japanese climate requires similar decisions to be made regarding solar gain and shading, glazing is only available up to a U-value of 1,3 W/m²K inside of Japan. Previous experiments with better insulation values have resulted in condensation forming on the outside of the glazing, especially in the morning. While this is the case in many European climates as well, it is of increased significance in Japan because of the higher humidity different vegetation and the abundance of rice-fields. On the contrary, glazing with a low insulation value combined with poor insulation levels result in condensation on the inside of the glazing. This can be countered by turning up the venting system, however the outside of a façade cannot be vented in the same way and therefore the usage of glazing better than 1,1 W/m²K is advised against by Japanese companies.

The outbox project will use imported glazing with an U-Value of 1,0 W/m²K and lay special attention to the space between the glazing sheets

created by the framing mechanism. This is due to the fact that previous work with other high insulation glazing systems has shown the edges to be the critical areas, affecting the transmission even approximately 50cm within the window area. The framing mechanism used in this case is made of TPS and is hoped to address these issues resulting in a much better performance of the overall window element.

Soil panels

Soil (clay to be specific) has traditionally been a building material wherever it is available. In Japan it was used in combination with timber frame mainly because of its excellent humidity storage behaviour and local availability. This traditional construction system has for the most part been discarded for two reasons: first its production is time consuming and therefore expensive, second the soil shrinks as it dries which results in rifts and therefore is not deemed suitable to use in conjunction with modern building processes. As better humidity storage would lessen the need for dehumidification performance by cutting peaks, it is considered to be wise to find ways to adapt the use of the material which allow these barriers to be overcome.

The Outbox project aims to re-establish the usage of soil in the form of soil plates that have been developed and improved over the last few years. These plates, similar in usage to plaster boards undergo no shrinking on the building site, have both good absorption and perspiration capacity and are expected to find acceptance in Japan as a synergy between a traditional aesthetic, local material use and modern technology. Field tests of the soil plates in Japan in the later stages of the OutBox project will accompany climate chamber tests currently in progress at Hanover University. Thus data regarding the composition of clay most suited to the central Japanese climate and the performance of the soil plates in a real building. The results will therefore give a working example of how to create a building with a lower energy use than average. In addition the reduction in humidity problems may increase the lifespan of the building.

2.6 Education in the OutBox

The education work in the Outbox project is threefold: 1) the education of the OutBox team through international exchange 2) the education of degree level students through involvement in the design and construction process and 3) the education of the future residents of the Eco Village through visits to OutBox and an education system at the point of sale.

The design team includes 5 key members from 3 countries and 3 different languages all with differing educational and vocational experience. The key areas of exchange have been of building technology from Germany to Japan and of Climate and behavioural studies from Japan to Germany. Some difficulties were experienced with cultural expectations, not just of communication but of differing definitions of environmental issues and expectations of buildings. The production of bilingual minutes of all meetings helped to improve the flow of information as did the variety of types of meetings i.e. brainstorming, planning and decision making and presentation. Therefore the focus throughout has been to make these cultural difficulties a chance to learn with each other.

The key example of education of students through involvement in building process is that our universities and G-project have empowered us to use the project as a field for part of our research. Parts of the design process: namely brainstorming, model-making and the creation of display materials were also opened up to other students at the Global Environmental Studies department in Kyoto University. This allowed the students not just to feed into the work but to increase their knowledge and understanding of the issues involved, particularly with regard to the use of local materials. It is hoped that this work will be concluded by allowing aspects of the construction to be self-build, allowing students to get hands on experience of eco-building which will be supported by presentations and discussions to raise understanding of relevant issues. This is a technique which has been found to be successful in the institutions at the *Centre for Alternative Technology`s* courses, in Hanover University's Architectural Undergraduate and at international workshops at the *Earth Design School* in the UK, Germany and Japan respectively. Figures 2 and 3 below show students and staff involved in practical building work on the MSc course in Environmental Architecture at CAT.

Figure 2: Students and Staff exploring the use of gabions and sandbags.
Figure 3: Students work together to create a rammed earth wall.
Source: (AEES, 2006)

A major but as yet only just evolving part of the educational work in the Out Box project is the creation of an education programme for potential residents of the Eco Housing. This will range from workshops at the OutBox to an interactive computer programme which calculates and explains the impact of your new house in terms of financial, economic and societal benefits and costs. The educational work will make use of the experience figures and data gained in the monitoring of the OutBox. Although there is a lot of education material for homeowners or home designers or builders, there is as yet no tool to help guide clients through the design process. Therefore in supporting this work, the Kobunaki Eco-Village and j.Pod project are demonstrating a commitment to novel approaches to encourage responsible lifestyle choices.

2.7 Adapting European Solutions to fit in Japan – Lessons learnt

Technology for reducing environmental impact in a building, such as PV solar system or double glazing always has an initial cost. When specifying a system, most will compare the initial cost with the payback of the system to decide whether or not to invest. A key deciding factor is often a comparison

between the amount to be gained over time through the investment (i.e. the amount of money saved on electricity because you are generating your own) versus the amount achievable by leaving the investment sum in a savings account to gain interest.

We are faced with a confusing situation in Japan: as the interest rate is extraordinarily close to zero, according to the principle above we would expect a high investment in technology with any level of payback above zero. However, we observe that there is very little excitement regarding investing in technology to reduce running costs in public or private business. Therefore, the use of energy efficiency technology is observed to not be seen as a selling point argument by building companies or a motivation to buy on the part of contractors.

It could be said that a key reason for this situation is because many Japanese people have a fairly secure life plan: life time contract at work low interest mortgage etc. This combines with strong community ties, the tendency to wish to fit in to a group is commonly held to be stronger in Japan than in other industrialised countries to create a situation where in real terms high running costs in a home are not considered an issue. Recent articles in the *Japan Housing Journal* discuss various 'Low energy' technologies such as glazing and insulation, giving reduced CO2 emissions as a motivation for incorporation. However mention of the financial savings possible is not made (JHJ, 2006a&b).

However, despite concern over the energy future, the trend in Japan, as in all other nations, is towards more: more comfort, more space. Therefore new, modern houses are increasingly relying on the use of electricity in compensation for their poor climate tailoring. This quite often results in damages to the construction as a result of condensation which in turn leads to a fast cycle of construction and deconstruction: approximately1,2 million new homes every year in Japan. It is possible that an exchange of best practices between European and Japanese companies could address these issues, but experience shows many are hesitant to take to the Asian markets.

One simple reason for this hesitation is common cultural misunderstanding associated with different styles of business and communication as we encountered to some extent in OutBox. Another, more serious issue is the issue of intellectual property rights and the need to make guarantees for the performance of their product in a climate they have no experiences with. In the case of the German companies approached in this work, the difference in conditions between the two countries is great: Japan's high humidity in summer is 4 times more than Germany. Considering that in Germany 80% of building damages are caused by humidity this shows what a commitment taking up work in such a comparatively extreme climate is.

To this end, to increase chances for cooperation building up trust and a lasting dialog and exchange is paramount. However, the issue of intellectual property rights is one which needs serious consideration if good technology is to be shared freely without ignoring the need to give credit to the originators of ideas and systems.

2.8 Expected Outcomes of OutBox

In order for European technology to be usefully adopted in Japan, it needs first to be tested for appropriateness. The OutBox project offers a unique way of doing so. As the occupants of the OutBox will be members of the team, the educational work achieved during the design process is hoped to help them understand the technology in the building and their role in its use. As the West and East wings are structured, sized and orientated in the same manner, reasonable effort has been made to achieve test conditions. Therefore, we will be able to experience and measure the difference, if any, in performance between the two systems. The results of the monitoring will feed into future work on the j.Pod system, which at present under consideration for part of the housing at the Eco-Village. The data regarding the performance of the materials and technology in the Japanese climate and the Japanese staff's reactions to the space will inform not just future work at the eco-village but within the j.Pod project at Kyoto University.

2.9 Relevance to the future of Japanese Housing

As the need for comfort continues to grow but external forces increase the importance of lower energy use, it is predicted that an increase in design and construction quality will be required in the Japanese housing-market. In Europe, when this issue was first raised, the most important moves were found to be increasing insulation whilst improving air tightness. Our simulations suggest that this is the same in Japan, but as described in detail in section 5, concerns about humidity require us to test this first before drawing conclusions or making recommendations. Therefore the results of the OutBox project, particularly related to air tightness in high humidity will be valuable.

However, a reduction in construction and running costs only makes good sense if combined with longer building life cycles or design for re-use. Recent research has shown that the average age of buildings at demolition in Japan is 26 years as the modern buildings are designed to last for only 30 years, on average (Minami, 2002). Recent statements by the Architects Institute of Japan (AIJ) acknowledge that in order to improve environmental impacts etc, this should be increased to 100 years (Ikaga *et al*, 2002). This move if accomplished would certainly help not only to reduce impacts but make life cycle costs more applicable to clients. However, architects contacted during our stay believe this is a policy that has not been backed up by definitive action.

Despite this lack of a concerted national effort, the use of the j.Pod system, which is deliberately designed for re-use (Kobayashi & Kobayashi, 2006), is an example of how the work in OutBox is working towards tackling this issue. The whole structure is designed to be moved as 8 units to a new site. In addition to this, the new foundation system is minimises the use of concrete, there will be little remnant of the building's presence after re-construction. As the j.Pod system is relatively new, the OutBox project will be the first time that the de-construction and re-construction of j.Pod units has been attempted. This of course will give important lessons for the team and for other similar work.

However, even if buildings across the country were fitted with improved technology and designed for re-use, comfort levels cannot be

maintained while reducing energy use, unless there is a change in living style. As the OutBox project will monitor the reactions of the Japanese occupants to the climate created within the building and assess how their heating and cooling behaviour changes, we will be able to gain an understanding of how users interact with the new building type. This is crucial, as although many papers exist describing the traditional behaviours of Japanese people in traditional homes, there is very little data or discussion of behaviour in modern homes in Japan. An understanding of which is crucial to any attempts to influence living style through national policy or education work.

3 Conclusion

The OutBox project has been discussed in terms of its use of technology and education to produce comfort in buildings at an affordable cost. It has been shown that in aiming to do this, the project looks set to be able to reduce its environmental impact and make a positive contribution to the local society and economy through the use of local labour and local materials. To this end it can be considered to be an example of a sustainable approach to construction. As the project has yet to be realised, there is still a great deal of work to be done in performing these tasks and monitoring and assessing their success. At the present, in consideration of the lessons learnt so far, we feel able to draw the following lessons for European Policy:

1. It is imperative that Technology and Education work are planned and executed hand in hand This is as true in Europe as it is in Asia and future policy should seek to encourage and support this.
2. The emphasis on lifecycle costs which is growing in popularity in Europe is work that could be useful in other cultures to promote a more holistic set of criteria when designing and commissioning buildings. It would be useful for ways of sharing best practice such as this to be found at the international level.

Finally, it is well known that the use of local, natural materials offers the ability to improve the local economy through the production of jobs and local interaction as well as being able to reduce the heavy environmental costs of current construction methods. The work on timber and earth at Kyoto and Hanover University as featured in the OutBox shows that these Natural products such as timber and soil can be adapted to suit modern construction demands – even to meet the strict regulations regarding earthquake structures. Therefore, European policy should aim to provide supportive frameworks which make the integration of these materials in a modern way more easily achieved.

The j.Pod system and soil plates introduced in this work are examples of sustainable products which create a demand for local materials which in turn provides jobs for local workers. The teams behind the two products are keen to see their ideas adapted and replicated using local materials in other areas. However, given recent concerns regarding abuse of intellectual property, there is a concern that the replication of good ideas such as these on a global scale may result in the originators of the idea losing their recognition. For this reason, ‘sustainable products’ with locally sourced components are often made by the originators and then transported to the customer to protect the originators suffering from a loss of intellectual property. In an ideal world,

the system would allow the initial group to achieve an income through the licensing of the right to use and adapt the good idea to a different location. Such a system would reduce the need for transportation of products, thus reducing the environmental costs whilst stimulating local economies. Therefore, we wish to conclude with one final recommendation: that policy makers can best support sustainable products such as these by developing mechanisms which protect the intellectual property of an originating group but avoid the need for the initial group to control the supply and distribution of all products.

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HOU Designing low and zero energy houses

A system approach to evaluate renewable and energy saving options on different scale levels.

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1 Introduction

A large amount of energy is used directly by households for heating the house, cooling the house and food, for heating water, for lightning, for washing and drying cloths, for many educating and entertaining activities and so on. The total direct energy use by households contributes substantially (about 20%) to the societal energy use.

The most important factors determining the direct energy use are factors related to the house itself, factors related to personal behaviour, and the appliances within the house.

From a policy perspective it is difficult to exert a direct influence on personal behaviour and on the presence of appliances in the houses. Otherwise the influence of policy on the house related factors may be considerable, because of policy involvement in general standards with regard to building quality and with specific building development projects.

The structure of the house (including insulation) and the energy infrastructure with which the house is connected to energy grids (electricity, natural gas, heat) are the important determinants of the direct energy use by households. Both features of the house are determined during the building phase of the house and will remain almost unchanged during the lifetime of the house. Therefore policy should give high emphasis to the design of new houses and to the energy infrastructure of new districts, to contribute to policy objectives to reduce the use of non renewable energy in the houses.

Presently the design of low energy houses, even zero energy houses gets high attention in the Netherlands. Zero energy should not be interpreted literally. Each household requires energy to function. It is meant with this concept that (almost) all energy used in the house is derived locally from renewable flows of energy, like sun, wind and biomass.

The design toolbox for low and zero-energy houses contains many elements: insulation measures to reduce the heat and cooling demand, passive and active solar energy measures to make direct use from sunlight or

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to produce energy from sunlight (solar collectors and photovoltaic cells), energy storage devices in the houses itself or collective storage in the underground, generation of energy with help of external renewable sources (wind, biomass), and some high-efficient energy generators like heat pumps and combined-heat and power installations using non renewable energy sources. All these elements from the design toolbox influence also the other dimensions of sustainability such as housing cost and comfort and quality of life for the household members.

System analysis, including the consideration of different scales levels, is a fruitful methodology enabling the evaluation of different measures that may contribute to the design of a more sustainable housing especially with regard to the direct energy requirements. In this paper we aim to evaluate integrally measures and combinations of measures in the context of the sustainable energy design of new housing districts in the Netherlands, using a system approach and addressing some scale levels (the house, the district and the region). So we identified interesting relationships between the level of analysis and the energy designs that appeared as optimal. These findings may steer policy approaches to install effectively low and zero-energy building practices.

2 System analysis and energy designs of houses and districts

The system analysis follows the principles of demand-side analysis. We follow the demand chain, starting with identification of the fundamental needs to be served by the system, followed by analysing how these needs may be satisfied in low resources demanding way, thirdly by increasing the share of renewable resources, and finally by aiming at maximal efficiency of the use of non renewable resources. This line of reasoning is also named in energy analysis Trias Energetica: first prevention, second renewable energy sources, and third maximal efficiency.

The most important fundamental needs related to house are shelter and protection against the sometimes low (and sometimes high) temperatures in the ambient environment. The required services to be delivered are thus heating and cooling. Additionally hot water is required for hygienic purposes (bathing, showering, cleaning cloths and dishes) and electricity for many specific services. The structure of the house and the heating and cooling habits determine mainly the amount of energy resources for heating and cooling. The supply of renewable energy to the house is influenced by the structure of the house (amount of windows) and its location (access of solar light) but also by technologies like solar collectors, PV panels and wind turbines on the house or in close by the house. Efficiency is determined by the kind of appliances present in the house.

In the energy design of new districts the following elements should be addressed according to this analysis: the structure of the houses (insulation to prevent heat losses), the energy infrastructure in the district, the application of renewable energy sources, and the kind of heating appliances. Some of these elements are mainly relevant on the level of individual houses, but also some are relevant on the level of

the district or also above the district level. Therefore we apply the Trias Energetica for energy design on these three levels successively. We refer to Leduc (2006) and Ling (2006) for detailed reporting of the analyses presented here.

3 Energy designs at the level of an individual house.

The line of reasoning according to the Trias Energetica presents at the level of an individual house the following measures:

3.1 Prevention

The most important preventive measure is the application of thermal insulation measures for the roof, de floor, the walls and the windows... Other measures are also possible to reduce the heat demand for the house, like a compact design (reducing the exterior area of the house through which the heat losses occur) and to improve the access of solar light, in the seasons that heat is demanded (the so called passive solar energy).

3.2 Renewable energy sources

Solar energy is the best applicable energy source on the level of an individual house. Solar (heat) collectors may be installed to supply a part of the hot water demand (solar boiler) and photovoltaic panels (PV) may be applied for the delivery of electricity.

Extracting heat from the ambient environment with help of a heat pump (HP) is also an example of the use of a renewable resource.

3.3 Efficiency

The High-efficient condensing boiler (HR) is very popular in the Netherlands. This boiler produces heat for the central heating system and for the hot water demand. The thermal efficiency of the HR boiler is above the 90%. A small-scale appliance generating heat and electricity at once (the so called micro-CHP) is a new and more efficient technology to heat houses. Micro CHP converts natural gas in 15% - 25% electricity and 60% - 80% heat. The use of micro CHP results in substantial savings of energy in the electricity production sector. Another important design measure increasing the efficiency is the recovery of heat out of the ventilated air.

3.4 Evaluation of the various measures on the level of an individual house

The influence of the discussed measures on the direct energy consumption by the house is very different. Also the effects of combinations of measures are interesting. These effects should quantitatively be compared.

Table 1 presents the heat demand, the use of natural gas, and the electricity demand (from the grid) of a detached house for 12 combinations of amount of insulation (very good and good), ventilation system (regular and with heat recovery) and heat appliances (HE boiler, heat pump using ground water as heat source, and micro-CHP). The use of natural gas is expressed in MJ per annum and is related to the heat delivery and the delivery of hot water by de HE boiler, respectively to the use by the micro-CHP delivering heat and hot water. The electricity demand is expressed in primary energy terms: i.e. the energy required to produce the electricity in an average electricity plant. The electricity demand includes the regular

electricity use by an average household and the specific electricity requirements for the heating and the ventilation system. The scenarios with an electric heat pump demonstrate a relatively high electricity demand. The scenarios with micro-CHP demonstrate a relatively low Electricity demand because of the electricity production by the micro-CHP.

Table 1: Energy analysis of heating equipment and insulation for some house-scenarios

House-scenarios		1	2	3	4	5	6	7	8	9	10	11	12
Heating equipment	HE central heating	■	■	■	■								
	Heat pump GW					■	■	■	■				
	CHP									■	■	■	■
Insulation	High (very good)	■		■		■		■		■		■	
	moderate (good)		■		■		■		■		■		■
	HE ventilation			■	■			■	■			■	■
Need for heat	MJ	30035	35922	13458	18590	30035	35922	13458	18590	30035	35922	13458	18590
Na. Gas Demand	MJ	59993	66516	41625	47312	0	0	0	0	59813	67967	36853	43961
Ele. Demand primary	MJ	31820	31999	39575	39731	83634	88504	78183	82428	13871	11649	28387	26450

In a comparison of the total energy requirement (the addition of the natural gas use and the primary Electricity demand) show high energy requirements for the HE scenarios, a bit lower energy requirements for the heat pump scenarios (6% tot 10% less than the corresponding HE scenario), and the lowest energy requirements for the micro-CHP scenarios (about 20% lower than the HE scenarios). The application of a very good level of thermal insulation and of heat recovery out of ventilation air contributes also substantially to energy saving: scenarios with a moderate insulation level and with heat recovery require 15% to 20% more energy than the scenarios with a high insulation level and with heat recovery.

The investment costs are the highest for the heat pump scenarios, and the investment costs for the micro-WKK scenarios are a bit higher than the investment costs for the conventional HE boiler. Also higher investment costs are needed for higher levels of thermal insulation and for the heat recovery ventilation system. An integral assessment of the user costs (investment costs and the annual energy costs) shows that the micro-WKK scenarios are the cheapest and the heat pump scenarios are the most expensive. The additional costs of heat recovery out of ventilation air are paid back after a reasonable period (within ten years). The additional costs of a very good level of insulation are not paid back within ten years but within twenty years.

For the six most attractive design scenarios the effects are determined of the integration of a solar boiler (capacity 180 l) and 4 m2 PV panels. The energy requirements diminish in all the scenarios, as demonstrated in Table 2. However in the micro-CHP scenarios the decrease is less than in the other scenarios. In the scenarios the application of a solar boiler results in a decreased use of the heating equipment. In the micro-CHP scenarios less use of the heating equipment implies also less electricity production. For all these scenarios the total costs increase with application of these locally available renewable energy sources.

Table 2: Energy analysis of the application of solar energy for some house scenarios

Scenarios		3	7	9	10	11	12
Heating equipment	HE central heating	■					
	Heat pump GW		■				
	CHP			■	■	■	■
Insulation	High (very good)	■	■	■		■	
	moderate (good)				■		■
	HE ventilation	■	■			■	■
sustainable local sources	solar PV	■	■	■	■	■	■
	solar boiler	■	■	■	■	■	■
Na. Gas Demand	MJ	33573	0	54323	62477	31363	38471
Ele. Demand	kWh	4005	7361	1340	1093	2953	2738
Ele. Demand primary	MJ	36046	66248	12060	9838	26577	24640

The direct energy use is also determined by the size and the type of the house, just as the investment costs and the energy costs. In Table 3 the total energy use, the investment costs, the annual energy costs and the total costs are presented for three design scenarios and for five different types of houses (detached house, duplex house, corner house terraced house, and gallery apartment). The micro-CHP scenario gives for each type of house the lowest energy use and the lowest total costs.

Table 3: Energy and costs analysis of different types of house in some house-scenarios

Types of houses		Detached house			Duplex house			Corner house			Terraced house			Gallery appartment		
House sceniaros		3	7	12	3	7	12	3	7	12	3	7	12	3	7	12
Heating Equipment	HE central heating	■			■			■			■			■		
	Heat pump GW		■			■			■			■			■	
	CHP			■			■			■			■			■
Insulation	High(very good)	■	■		■	■		■	■		■	■		■	■	
	moderate (good)			■			■			■			■			■
	HE ventilation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Nett fossil fuel use	MJ	77216	74281	67388	73976	70841	65552	69886	66861	62420	64656	63061	55861	48127	47072	42676
F. cost	Euro	11568	16295	10887	9634	14377	9194	9301	14012	8936	7721	12200	7739	6296	10635	6580
V. cost	Euro/year	1420	1568	1199	1361	1495	1163	1290	1411	1110	1206	1331	1020	912.4	993.4	795.4
total cost	Euro/year	2577	3198	2288	2325	2933	2083	2220	2813	2004	1978	2551	1794	1542	2057	1453

Evaluating all the designed scenarios on the level of an individual house, scenario 12 (micro-CHP, good insulated and heat recovery out of ventilation air) seems to be optimal with regard to energy use and total costs. However also this scenario is still requiring a substantial amount of fossil energy resources. The installation of al solar boiler and PV-panels reduces the use of fossil energy sources, but implies also substantial additional investments, that are not recovered by the saving of energy costs within a reasonable period.

4 Energy designs with measures on the district level.

On the district level the Trias Energetica is also useful to characterise energy measures:

4.1 Prevention

The spatial design of a district may also contribute to a diminishment of the heat demand. A compact district structure and the use of trees as wind shields are some examples. The lay-out of, the height of and the distances

between buildings determine the possibilities for the access of solar light in the buildings.

4.2 Renewable energy sources

The same renewable energy sources are applicable on the district level as on the level of an individual house. The extraction of heat from the ambient environment by a large heat pump serving a district is more energy efficient and cheaper than a heat pump used for an individual building. For a district heat may be extracted from underground aquifers in stead of from air or surface water, but also a district heat distribution system is required. A heat pump serving for one large building block or a district may also be used for cooling during summer. In case of cooling the removed heat may be stored in the underground and may be reused for heating in the autumn and in the winter. Solar boilers and PV panels may be applied on the district level, however no economy of scale will be realised by such an approach. There exists also a potential to apply small wind turbines and to produce and use biomass within a district. However the scale of a district is too small in most cases to produce a substantial amount of energy with wind and biomass within the district itself.

4.3 Efficiency

Cogeneration of heat and power (CHP) is applicable on all scale levels. The micro-CHP for an individual house is a simple appliance (Comparable with a HE boiler), but shows a relatively low electrical efficiency, and therefore also a low energy saving potential. Mini-CHP on the level of building block or a district gives a higher electrical efficiency and also lower investment costs per dwelling than the micro-CHP, but on these levels a heat distribution system is required, asking also for substantial investments.

4.4 Evaluation of the different measures possible on the district level

As already remarked, the same measures are applicable on the district level as on the level of an individual house. Collective systems on the level of a building Block and of a district have some advantages above individual systems. The total energy use per dwelling is lower for a collective heat pump system and a collective CHP system than for individual systems. Also the investment costs for a heat pump system decreases in proportion to the scale of application. However conclusions drawn for the energy design on the level of an individual house remain also valid for energy designs on the level of a district. The most optimal design from an energy and a cost perspective is the design based on CHP, and the use of heat recovery out of ventilation air and a good level of thermal insulation.

One additional remark should be made: A zero energy district may be created by installing a heat pump system that transports and stores the excess heat in the dwelling during summer to the underground and recovers this heat during the heating system. To create an energy balance on annual base it is also required to apply a high level of thermal insulation in the houses. The investment costs for such a design are very high, but the energy costs for heating as well as cooling are almost zero, for now and the farther future, independent of the energy price level.

5 Energy designs with measures on higher scale levels than the district

The Trias Energetica is of limited to identify design measures on the higher scale levels than the district. Prevention and efficiency approaches are available on higher scale levels but the do not influence the designing process of houses and districts. The application of renewable energy sources produced outside the district may be related in a spatial sense and by investments and usage to a new build or existing district. We may consider the production of biomass and wind energy elsewhere in order to acquire renewable energy supply to a district.

5.1 Renewable energy sources

To cover the total energy demand (heat and electricity) of one house the biomass yield is required from 3,000 to 5,000 m2 area. Such an area is not available within the district itself. So biomass supply from elsewhere is needed. The biomass conversion plant should also be located not in but close by the district because of environmental and transportation regulations. Two different biomass systems are applicable for a district and one wind energy system.

1. Digestion of biomass (energy crops). The produced biogas is partly distributed in the district and is partly combusted on the digestion plant in a gas engine, producing the necessary heat for the digestion and electricity. The digestate of the digester is gassified elsewhere on a large scale, also producing electricity. The biomass yield of 10,000 m2 (corn) produces after digestion enough biogas and electricity to deliver the energy to 2 to 3 houses.
2. Combustion of biomass (wood). 10.000 m2 produces enough wood to meet the heat demand of 4 to 6 houses. About the same amount of wood is required to produce the electricity demanded by average households.
3. Wind energy. 1.5 to 2.0 kW per house wind power is required to meet the electricity demand. So a district with 250 houses using HE boilers for heating needs a wind turbine with 500 kW nominal power (40 m rotor diameter, axis height 40 – 50 m). A district using a heat pump requires 4.0 – 4.5 kW wind power per house in order to meet the electricity demand. Now a district with 250 houses needs a wind turbine with 1.1 MW nominal power (60 m rotor diameter, axis height 60 – 80 m). In this case the whole energy supply system of the district is based on a renewable energy source.

5.2 Evaluation of the different renewable systems.

So three designs are identified of district energy systems fully based on renewable sources.

1. Digestion of energy crops, with delivery of biogas and electricity to the district from the digester.
2. Combustion of biomass for heat delivery to the district and production of electricity by a wind turbine.
3. The use of heat pumps for the heat delivery to the district and production of electricity by a wind turbine.

These systems are applicable in districts with at least 200 houses connected to the system. The investment costs for the first system is the highest, and is the lowest for the second system. The exploitation costs are almost zero for the third system, for the other two systems it is necessary to acquire biomass. Therefore the total costs of the second and the third system are almost equal. With the current energy prices one may expect that the higher investment costs related to biomass conversion equipment, wind turbines and heat pumps are paid back within 10 to 15 year.

Of course it is possible to combine the production of energy from wind and biomass with the application of solar boilers and PV panels. Calculations show that emphasis on solar energy causes a substantial rise in the investment costs without a significant lowering of the exploitation costs.

6 Conclusion

The evaluation of energy designs addressing different scale levels results in differing optimal approaches. The evaluation on the level of an individual house as well on the district level indicates that the application of CHP (micro and mini) produce optimal result with regard to fossil energy savings and total costs. The evaluation on a higher scale level demonstrates a high potential for the use of renewable energy sources resulting in substantial energy savings and in solutions cost effective on the long term. These conclusions seem to contradict each other. However, this apparent contradiction occurs because the most effective (economical and from an energy perspective) renewable energy sources are not available on the house and the district level. At the levels where renewable energy sources are not (enough) available, energy efficiency should get the highest attention in the design process (i.e. CHP on the house and the district level). When at a higher scale level wind and biomass energy becomes available for use in the district energy system, the energy supply system may be directed at an optimal usage of these renewable sources, resulting in the use of heat pumps driven by wind electricity and HE boilers using biogas.

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HOU Experiments for Transitions: an interactive approach to setting up breakthrough experiments

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1 Introduction

Society faces problems that are so persistent that radical change is needed to address them. Structural solutions for the problems in areas such as the transport system, the energy system and the care system, call for fundamental changes at the source. These radical societal changes are called **transitions** (Rotmans et al., 2001). As part of a transition management process, experiments can be carried out to gain an understanding of the impact of technological, ecological, economic and social innovation. These practical experiments can be used to generate and try out potential solutions in a **system**. A system is a complex of products, services, legislation, infrastructure, conventional practices, etc. which together meet particular needs.

MiXT® is a procedure developed by TNO which is designed to contribute to the creation of a sustainable society and increase the innovative capacity of the Dutch business community. MiXT® stands for "Maatschappelijke Innovatie-eXperimenten van TNO", or "Social Experiments in Innovation by TNO". It is a method for addressing deep-rooted problems involving many different actors and hedged by considerable uncertainty as to how to deal with them, but which clearly have a major impact on society. MiXT® provides a blueprint for setting up practical experiments with which we can link long-term visions and concrete innovations and test them out in practice.

This article describes this method of setting up experiments, with special attention to the aspect of process management in relation to the interaction between all the actors directly or indirectly involved in the experiment. In the course of an experiment new relationships are formed between people that normally have little or no contact with each other, between the disparate

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worlds of the researcher and the practitioner, with the aim of devising sustainable solutions that can be applied in practice. How can the process of bringing together groups of people to conceive and initiate solutions for deep-rooted problems be facilitated and stimulated?

The opening chapter briefly discusses transition management and the role of experiments in it and briefly describes the pilot projects that have been carried out using the MiXT® approach.

The second chapter describes the main features of the MiXT® approach and the knowledge creation spiral. Chapter 3 describes the knowledge creation process in each phase of the MiXT® method and illustrates it with some practical examples. Finally, chapter 4 presents some conclusions and recommendations.

1.1 Transitions and experiments

A transition is defined as a process in which societal functions change, structurally and irreversibly, over a period of at least a generation as a result of interacting economic, social and ecological processes [Geels and Kemp, 2000].

Each step in a transition to a sustainable future calls for innovations (technological, social, economic, etc.) in the system that cause a **system breakthrough**. We refer to a system breakthrough because we are searching for those system innovations that can set in motion the structural and irreversible changes needed for a sustainable future. It is impossible to say in advance what system innovations will lead to this system breakthrough or who should be involved in them. One way of finding out is to conduct practical experiments [see also Kemp and van den Bosch, 2006].

These experiments are therefore intended to achieve a breakthrough in the existing system. They are experiments with a high degree of risk which may help to resolve social problems. For the individual parties that participate in an experiment, the experiment can be defined as a goal in itself. But if it is to actually achieve a breakthrough in the existing system, the experiment must create a ripple effect. It must serve as a source of inspiration for others, perhaps encouraging them to start similar experiments or to employ the findings in other processes, in policy, etc.

1.2 MiXT® in pilot projects

Briefly, MiXT® is a method of addressing deep-rooted problems that involve many different actors and are hedged by considerable uncertainty as to how they need to be addressed.

The MiXT® approach has already proved its worth in four experiments that TNO has carried out with different partners. In these experiments, different actors have formed innovative partnerships at local level to find solutions for four major challenges facing the Netherlands.

Accommodation and care for the elderly: The ageing of the population is placing an ever greater strain on the capacity for care of the elderly. The costs are rising, but the quality of the care provided is also at risk. TNO conducted one experiment with *De Woonmensen* in Apeldoorn, an organisation that provides sheltered housing for the elderly. The aim of the experiment was to find innovative solutions which would allow older people to live independently for longer, with a better quality of life and at acceptable cost. Everyone concerned, including the future residents and the home care providers, the local authority and the church, together defined a vision of the future. Taking this future scenario as a starting point, the participants experimented with various solutions. These included *Guide Me*, an instrument that allows companions and carers to pinpoint the location of elderly people suffering from dementia, and *Personal Climate*, a concept that allows the user to tailor the climate around their favourite chair to their own wishes. So it's goodbye to cold feet without the expense of running the central heating at full blast. This pilot project showed how MiXT® can be used to transform social problems into opportunities.

***Mobility*:** One possible solution for the problem of congestion in urban areas is the concept of People Movers. These are clean, safe and fully-automated vehicles which can be used in different ways in the transport system. The aim of the mobility pilot project in Almere was to achieve a breakthrough in the use of conventional modes of transport in Almere by encouraging regular use of the People Mover for various functions. The more distant ambition of the pilot project is for the business community and authorities to grasp the opportunities that the concept offers so that the system can be scaled up.

Nutrition: The popularity of fast food seems unstoppable, particularly among young people. And this is unhealthy. The pilot project on nutrition focused mainly on the interaction between different elements of this social problem, specifically the choice of food, the ingredients and the method of preparation. Together with food companies and suppliers of equipment TNO ultimately developed a snack for schoolchildren that is easy to prepare and healthy as well as the innovative concept of 'steam baking', which produces chips that taste just like regular chips but using far less fat.

Water management: A societal problem is usually influenced by a great many factors. This means that often complex appraisals have to be made. MiXT® helps simplify the weighing up process. Take the issue of water, for example. The climate is changing and the importance of integrated and sustainable water management and cooperation between district water boards is increasingly apparent. In an experiment with a provincial authority and a water board TNO is trying to define what sustainable water management means in practice. The experiment is based on an interactive groundwater model. The effects of various measures are calculated in the groundwater model to provide insights into the social, economic, spatial and ecological consequences of water management measures in the short and the long term.

2 MiXT® and the knowledge creation spiral

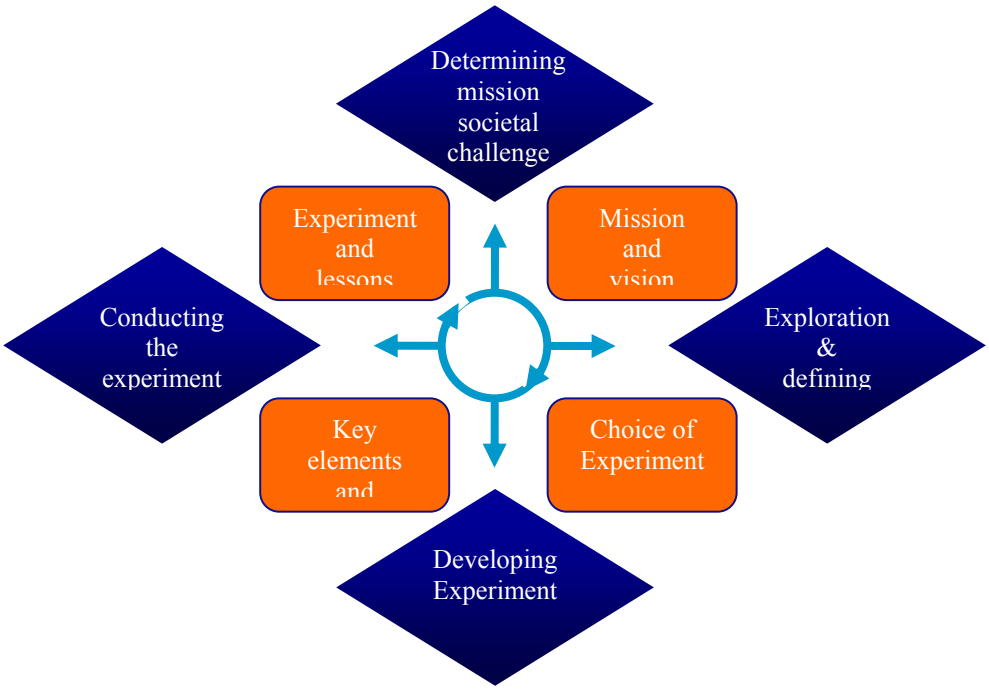
2.1 The main principles of MiXT®

What makes the approach unique is the specific attention devoted to the following aspects:

- Cooperation between parties: Collaboration between stakeholders that are involved in finding solutions for social challenges is crucial. TNO's MiXT® concept is geared heavily to promoting that collaboration by engaging the relevant parties closely in an experiment.
- Content and process are intertwined: in the MiXT® approach, the content (the mission, the long-term vision, the experiment and the solutions that are used and/or found) and the process of involving stakeholders, creating commitment, formulating a vision and jointly conducting an experiment are interlaced. Every step in the process has both a substantive and a process-driven objective. Formulating a vision of the future is not simply a goal in itself but, because it is jointly developed, also a tool for changing the perspectives of the parties.
- Linking of short term and long term. An essential feature is the linking of a long-term societal challenge and vision with short-term opportunities for companies.
- The objective is not only to set up an experiment but also explicitly to scale up and disseminate the insights and experiences to indirect stakeholders at other levels

The four steps are as follows (see the figure below):

1. In the first phase we determine our *mission and vision*. What is the social challenge that we wish to help resolve with our experiment? What are the possibilities and what is our mission?
2. In the second phase we ignore the present and look to the future: what precisely do we want to achieve and *what would we like to see in the future*? Above all, what experiment will best help to accomplish this and what interests of the individual parties are served by participating in it?
3. In the third phase we develop the *experiment itself*. We explore the possibilities and obstacles and identify the various steps to be taken in setting up the experiment. What products and services are needed to carry out the experiment? What role should the local authority play in the experiment?
4. In the fourth and final phase *we carry out the experiment*. We examine the results: what worked and what didn't, what are the possible consequences of large-scale application and will the ideas be adopted? As already mentioned, our intention is that an experiment will have a ripple effect. In other words, that opportunities and ideas will be widely adopted. For example, by companies exploiting commercial opportunities, by other local authorities starting similar experiments and translating what has



been learned into new policy. The groundwork for achieving this has already been laid in the preceding phases by ensuring that all the relevant parties are involved.

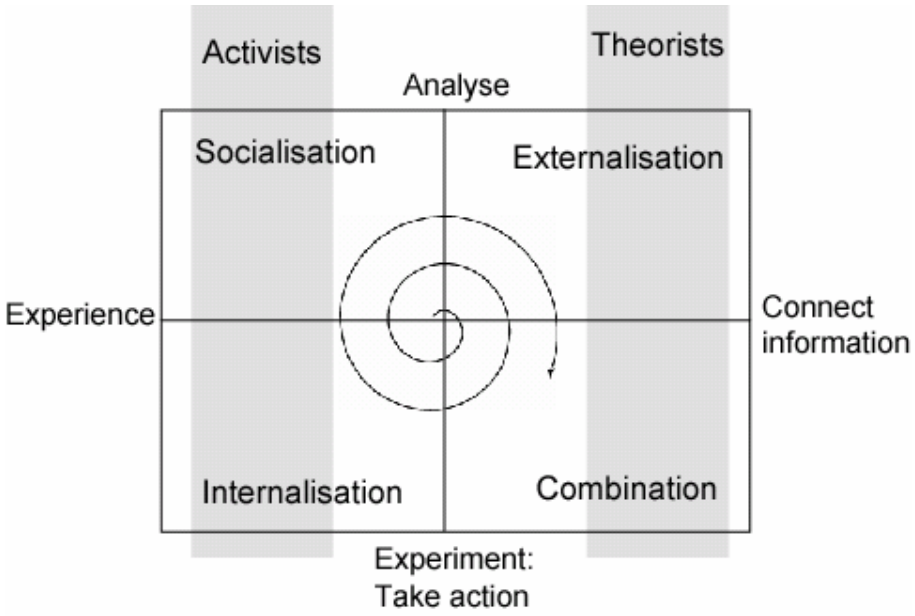
2.2 Knowledge creation aimed at conceiving and initiating sustainable solutions

During the pilot projects, the need to constantly switch between the long term and the short term perspective, between 'looking ahead' and 'what does this mean now' proved a dilemma. Not everyone finds it easy to forget about the present and reflect freely on what might be possible in the future. Others find it difficult to stop 'philosophising' and concentrate on what is actually needed in the here and now. The process manager constantly has to find the right balance between looking ahead and discovering new possibilities and defining specific actions to maintain the dynamic of the process and keep companies interested.

To understand this process, we will consider the MiXT® approach in terms of the knowledge creation spiral devised by Nonaka and Takeuchi (1995). They have developed a model to explain how knowledge is developed in organisations. Learning in organisations is a form of collective learning which is derived from the knowledge possessed by individuals but also from shared views. Nonaka and Takeuchi distinguish four typical stages of knowledge conversion that follow one another in logical succession:

- Socialisation: gaining and sharing experience

- Externalisation: observing, articulating experience, systematising, brainstorming
- Combination: thinking of new solutions, making new policy
- Internalisation: the person changes and takes action.



Stages 1 and 4 are typical mental activities that fit in with an intuitive approach based on tacit knowledge, the knowledge that is contained in people's heads and is therefore implicit. Stages 2 and 3 mainly involve logical thought and explicit knowledge.

We defined 'socialisation' and 'internalisation' (1 and 4) as the preferred styles[1] of '**activists'**. And 'externalisation' and 'combination' (2 and 3) the preferred styles of '**theorists'**. We suspect that stages 1 and 4 of knowledge creation are found mainly in companies and organisations and stages 2 and 3 in knowledge institutes and the public sector.

The knowledge to be developed in the transition experiments is the knowledge required to come up with and initiate new solutions which will bring about breakthroughs. The method is not primarily concerned with developing knowledge for new technological solutions within existing frameworks, for example, but rather the knowledge that is needed to think outside the box and to actually take action. It is a question, for example, of gaining a clear picture of the ramifications of a breakthrough and how you can contribute to it. We want to establish special new connections between the theorists and activists which can lead to new working methods, new solutions, new forms of collaboration and new ways of seeing things.

[1] Nonaka and Tackeuchi's phases correspond closely with Kolb's phases of a learning process: 1.Concrete experience ('sensing/feeling'); 2.Reflective observation ('watching'); 3.Abstract conceptualisation ('thinking'); 4.Active experimentation ('doing'). Kolb argues that people have preferred styles with which they prefer to start and devote most time. These preferred styles are the activist, the reflector, the theorist, the pragamtist [Kolb].

We believe that consciously connecting and following the four stages of knowledge creation can make a crucial contribution to this.

In chapter 3 the phases of the experimental approach are considered in more detail on the basis of the knowledge creation spiral.

2.3 Seeing is believing

Another aspect of success within starting up experiments is the extent to which participants have an entrepreneurial spirit or are able to develop that. An essential attitude for the participants in an experiment is belief in the face of uncertainty and a willingness to take action regardless to put ideas into practice and to win the commitment of others.

"First believing, then seeing" (or "blind faith"?) rather than "seeing is believing": that is the power of imagination: achieving by believing [Ode (2006)].
For many people, however, this is not the conventional approach.

If the experiments are to cause a system breakthrough the people involved must become aware of new possibilities and think in terms of those opportunities. The clearer the new possibilities and opportunities are to them, the more likely they are to be spurred into action. MiXT® contributes to the development of clear visions of the future that serve as a source of inspiration for the participants.

3 Knowledge creation in each phase of MiXT ®

3.1 Phase 1 Determining a mission for a societal challenge

3.1.1 Determining a common mission

The aim of this phase is to define, select and create empathy with the societal challenge, the mission of the process and the learning objectives. The outcome is a challenging and inspiring mission and the mobilisation of a team of potential partners and key actors in the domain ready to build a social experiment and to scale up and disseminate the lessons learned in the experiment.

The initiator of the project will begin by writing a position paper. Based on knowledge about transition paths and experience gained in previous exercises in developing visions, the author produces a broad outline of a social problem where an experiment could make a difference. A position paper outlines the problem and the mission and suggests parties that could or should be involved in the experiment.

The interaction with potential partners starts at this point. Workshops are organised where potential partners redefine the mission. These parties must at least endorse the new mission. Better yet, the potential partners should next to this also identify with the mission and recognise their own role in it. If the common vision and the company's mission correspond there is a solid basis for a sustainable partnership.

This first phase also includes a survey of the existing system. The aim of this survey is to discover why certain aspects of the current system are not working and why they will not be automatically solved in the long term. The survey highlights the opportunities and bottlenecks. In terms of knowledge creation, this activity should broaden the participants' perspective of the current situation. It should strike a spark, for example by instilling a sense of urgency in the partners.

An essential aspect of this phase, therefore, is to gain an understanding of the system, of what works and doesn't work in it in social, economic and ecological terms. The first stage of knowledge creation, socialisation and gaining experience, can be generated by involving actors, including end users, from the existing system. These actors are essential for conveying 'the sense of urgency' that something needs to change and that that change is not going to happen in current ways of innovation. One method of gaining 'genuine experience' is through role plays. In the Housing and Care project, for example, the architect drove through a nursing home in a wheelchair to experience personally what it is like to be elderly and infirm.

Observing these experiences (stage 2 in the knowledge creation spiral) and combining them with other essential information about the existing system (stage 3) should yield insights into the key problem and the opportunities that exist. The fourth stage, internalisation, becomes apparent when potential partners sign a declaration of intent expressing their enthusiasm for the project and their willingness to invest in the next phase.

In practice, this has a spiral effect and the four stages of knowledge creation are repeated again and again.

The leaders of the pilot projects in the MiXT® pilots had many discussions about precisely when potential partners should be drawn into the process. The pilot projects showed that there are advantages and disadvantages to involving parties at an early stage.

The major advantage of involving **market actors** (who play an important role in carrying out the experiment) and **policy-makers** at an early stage is that they help to formulate the vision: their knowledge is used as input and they are part of the process, which increases their commitment.

A possible disadvantage is that market actors are too focused on the short term, which means that the focus of the process can easily become too narrow causing major opportunities to be missed. A supplier of frozen meals was involved in the Customized Food Production project from an early stage. The company was interested in conducting an experiment with TNO and was consequently a major driving force behind the project. However, there was a conflict between the company's mission and the overall vision of the project. The company had a defined target group in mind for its products but once it became clear that the target group was not ready for the solution there was no added value for the company in taking further part in the

project. The company had greatly determined the direction of the project while all the time this contradiction was not discussed explicitly.

A disadvantage of involving policy-makers early on is that they can be captives of the conventional paradigm and that the project consequently will focus on short term goals of the policy-makers.

Our conclusion is that ultimately the mission must have been defined with potential partners by the end of phase 1. It may be a lengthy process before the right partners are found but we still feel that it is pointless starting with phase 2 until it is clear that the mission has been 'internalised' by the parties and that therefore their perspectives have broadened.

3.1.2 Creativity and pleasure

To get companies and local authorities interested in participating in the first phase it is important to create a sense of excitement about the project. The potential partners must feel it is an opportunity not to be missed, that it is an interesting group or an interesting subject. At that time it is not clear what focus will be chosen at the end of phase 1. Exciting activities can be attractive to people and a stimulus to take part. Team building is important too in this phase.

Following new paths that can lead to a breakthrough in current solutions and conventional ways of thinking calls for creativity. Creativity is a complex of mental attitudes, skills, techniques and processes which increases the chance of altering the way we think, our ability to make new connections in our brains [Byttebier, (2002)].

We argue that the process manager must be able to activate the intelligence and creativity of the participants in the project in such a way that they will take part wholeheartedly and with pleasure.

From our own experience we defined the following conditions to be necessary for creative thinking:

- the participants must feel safe, there must be trust, participants must feel they do not need to be afraid of making mistakes;
- the participants must have an open mind, abandon their convictions, not be judgemental about the input of others;
- the participants must abandon their own short-term interests, act unselfishly and impartially;
- participants must show engagement with the problem (it helps if they have a sense of urgency);
- the participants must look at the problem in a new wider context.

What is required is a process manager who can create a safe environment and encourage people to think for themselves about the contribution they can make. They themselves will try to deepen their understanding of what is needed to push the process forward and start making greater use of their own creative energy.

3.2 Phase 2 Exploration and definition of the experiment

3.2.1 Changing perspectives about future possibilities

The key to phase 2 is changing the perspectives of the participants as regards the ideal future situation. At the end of this phase the partners have jointly defined an experiment and given a commitment to further develop that experiment in the succeeding phases. One point that needs to be made clear though is that during this phase the partners may still change according to the needs of the team and of the participants themselves.

The main question in phase 2 therefore is: given the mission defined in phase 1, where do we want to go in the longer term and what experiment could help in the short and medium term to clarify uncertainties with regard to whether that future situation can be achieved?

A change of perspective is needed among both theorists and activists. By collaborating with theorists, the activists acquire a broader picture of future possibilities and the opportunities for their company. An activist is inclined to translate experiences directly into action. In current practice, the reflection (stage 2) and combination (stage 3) are usually implicit. Through collaboration with theorists, activists follow far precisely these two phases more explicitly. This is not to say that the activists should also do the thinking. What counts is the collaboration and the more explicit attention that the activist gives to joint knowledge creation. Clearly visualising the new connections that the theorists have made and the new ideas and the new policies that are generated then in turn helps the activists to assimilate the new insights and translate them into action. We expect this to make a major contribution to the ability of activists to think outside the box. The pilot projects in any case suggest this is true. For example, the carers in Apeldoorn became enthusiastic about new technological options and realised the added value they could have for them.

The process works in a similar way for the theorists. By matching it more closely to practical experience and the decisions taken in the real world 'the new policy' (phase 3) is based more closely on current practice. The more expressive the experience of the activists (the business community, the users, etc.), the more the theorist can empathise and the more likely it is that these experiences will be a factor in the conception of new ideas.

The success of this step in the process can then be measured by the extent to which the theorists are able to get their ideas translated into action, either by themselves or by others.

3.2.2 The organisation behind the project partners

In the MiXT® approach, the process is managed with a view to promoting knowledge development among the participants in the project and initiating the upscaling of the results. We occasionally find, however, that the new insights of the participants in the project cast them adrift from their own company or organisation. Apart from the fact that the participants in the

project must be constantly, as it were triggered to follow the knowledge creation spiral in order to come up with new ideas, initiate new actions and remain committed, it is equally important for the organisation 'behind' the participant to follow the same circle and accompany the individual on the journey. For the participants in the project, it is always a choice between either repeating the entire process within the organisation in order to convey every nuance or explaining too little and facing the risk that the people in the company do not experience the same change of perspective and therefore do not immediately accept the new ideas. We are convinced that more explicit attention must be given to knowledge creation among colleagues of the projectpartners. Coaching by the process manager can help in this.

3.3 Phase 3 Development of experiment

The aim of phase 3 is to develop the specific solutions to be assessed in an experiment. Smaller experiments are carried out to test these solutions in practice and to see what works, whether they are accepted and what more is needed.

To produce solutions that will make a difference in the domain covered by the experiment, the system is first analysed and then the path from the current system to the desired future situation is sketched in a roadmap. This system analysis is therefore more specific than the one in phase 1 since the subject of the experiment has now been defined.

The role of the user survey.

A specific feature of this phase is a user survey. The survey in phase 1 is still in broad terms, but in phase 3 it is far more detailed since the experiment has been defined and a specific group of people can be considered more closely. There are different approaches that can be taken. The HiCS project[2] [Manzini et al (2004)], for example, used a Context of Use study. In this method, a number of users were monitored for a day and kept a diary of precisely what they did (in relation to the specific subject). The designers who then had to generate new solutions were therefore able to see for themselves where the problems arose in the system. They had a clear impression of the actual situation and the actual needs.

Working back from the ideal situation, a roadmap is then drawn to the existing situation. All of the participants take part in this process. It is a crucial phase of the project. It is important that it highlights crucial elements, key elements, which need to be developed or elaborated in order to arrive at the ideal situation. But the fact that roadmap is produced jointly is just as important as the actual elements of the solution. By explicitly identifying the team's goal and what still needs to be done in a roadmap, implicit choices and assumptions become explicit. One of the results of the process of producing the roadmap is that it states an ambition that automatically spurs the participants to proceed, for example to recruit crucial partners.

[2] HiCS: Highly Customerized Solutions , EU project in the 6th Framework Programme.

Roadmapping:
During the Customized Food Production project a leading market player indicated that it no longer wished to participate. The development of a low-fat method of preparation ("steam baking") and ingredients for a healthy snack had meanwhile proceeded. But there was clearly some reluctance to involve a new company. When the ambition and the strength of the idea again became entirely clear, the passion returned. The project partner again clearly saw which partners he wanted to involve in the project. We feel the process manager has a very important role to play in this respect. With a strong process manager who is able to produce a transparent and inspiring vision of the future with the team, the project partners are inspired and see new actions, possibilities and opportunities for themselves.

3.4 Phase 4 Conducting the experiment

In phase 4 the entire experiment is tried out in practice.

In the course of the experiment new experience is acquired. By putting things into practice, the learning extends beyond the participating companies, knowledge institutions and local authorities. Practical experiments visualise ideas. Others for whom 'seeing is believing' can now see and feel for themselves what is possible (and what isn't!).

4 Overall conclusion

To refine the MiXT® approach and make the interaction between theorists and activists even better and to link the long term with the short term, we have studied the MiXT® method through the prism of the 'knowledge creation spiral'.

Conceiving and initiating sustainable solutions calls for people with an entrepreneurial attitude (action!). These are the people who dare to think ahead and to act. They are the people who can make things happen by believing in them. They are risk takers and are prepared to experiment.

For their part, the experiments demonstrate 'experiences' for others whose attitude is 'seeing is believing'.

In other words, the experiments work as a form of socialisation: acquiring experience, for a large group of people.

The MiXT® approach connects the long term and the short term by linking theorists and activists. By consciously following the four stages in the knowledge creation spiral (socialisation, externalisation (observation), combination and internalisation (action!)), there is interaction between the theorists and the activists. The long-term outlook of the theorists (observing and making connections) gives direction to the short-term outlook of the activists (gaining experience and making decisions). And the thinking of the theorists is influenced by the experiences and actions of the activists. Visualisation of the experiences of activists and visualisation of the ideas and new directions of theorists constitute an important tool for stimulating

the necessary knowledge creation between the two groups and so creating an upward spiral!

Process management is required to foster knowledge creation in a group of people aimed at creating solutions for deep-rooted problems. The process manager must be able to facilitate and stimulate the knowledge development needed to think of and initiate sustainable solutions. For example, by getting the right people around the table and kick starting the knowledge creation process. With good process management the participants in the project will be inspired and stirred into action and to new insights. The dynamism created in the team by the process manager and the structure must lead to action.

During the process as a whole, a lot of attention is given to knowledge development in the experiment by representatives of companies, government agencies and other organisations. A similar knowledge development process must take place in the companies 'behind ' these representatives since it is the company that decides whether to make any further investment. The MiXT® approach does not yet devote enough attention to this aspect. One cannot assume that the participants in the project are automatically able to persuade their colleagues and superiors of new insights, directions and opportunities. There is a risk that the project participant will become a 'loner' within the company or the organisation.

To sum up, the management of the process plays an important role in bringing about the necessary knowledge creation. The success of the process management could be measured by the level of investment made and the actions taken in the following phases of the process. A process is successful if they increase in the course of the project.

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HOU Collective housing with shared services

The Instrumental role of design of services

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1 Abstract

This paper aims to present and analyse two examples of collective housing, past and present, and, further down the line, to identify the strategic role design should play in its execution. The results presented are part of the research done in the unit of research Design and Innovation for Sustainability at the Politecnico di Milano.

Changes in society's structure stirr new lifestyles with a completely different living culture, not matched or accommodated by the existing housing and residential models. The demand for solutions and the failure to produce them solely through top-down initiatives makes people organize themselves and with themselves to find answers to their needs, with bottom-up initiatives, creating alternative ways of life, promoting the organization of strategies in line with sustainable development, as well as stronger local economies and social ties.

The instrumental role of design of services is of paramount importance, not only because it captures the strength and creativity of the civil society and its creation of bottom-up initiatives, and researches new behaviours and new ideas of well being monitoring their evolution through time; but also because it too analyzes the phenomenon, presenting it again therefore through representation instruments distinctive of this discipline.

This stage of project analysis is required in order to develop the instruments and guidelines to facilitate the implementation and replication of these same services in other scenarios. In this way, the designer of services becomes the contriver of instruments which promote the organizational dimension of services with high social and environmental content.

In order to attain the goals, it will be structured in three different parts. In the first one, the social drives behind the emerging living patterns will be illustrated; in the second, two case studies will be presented ("Citè Radieuse" and "Urban Village Bovisa 01"); finally, in the third one the role of the design of services in developing the process behind the case "Urban Village Bovisa 01".

2 Community

Throughout most of human history, community was the normal pattern, with people living in large extended families or tribal networks and small villages functioning like real communities. Until recently a true sense of neighbourhood existed in most places, as people helped each other in diverse work projects. Just as our society has become more technological, with increased wealth and urban growth and ephemeral patterns, have people lost touch with a strong community consciousness. There is greater individual freedom, but the cost has been social isolation (McLaughlin and Davidson, 1985), even if urban space has always been a place for the community rather than the individual (Jenks and Dempsey, 2005).

Perhaps because of this deep alienation in the modern industrial era, there has been a recent rebirth of the idea of alternative or intentional communities.

Since the fall of the Berlin Wall and the subsequent expansion of more democratic forms of governance around the world, civil society, NGO's and citizens groups of all kinds have emerged in great number everywhere and have shown themselves to be a vital force in tackling some of the world's most pressing problems (Hill, 2006).

Whatever are the goals of these groups of people, the fact is that civil society has emerged as a key driver of progressive social, economic and political change.

The community solution offers new options in the areas where modern society has clearly failed: national security, agriculture, energy, economics, health care, housing, etc. (Giddens, 1999; McLaughlin and Davidson, 1990).

When we talk about sustainable development we talk about radical changes in the way we produce and consume and in the way we live (Manzini, 2005). According to Manzini the link between the environmental and social dimensions shows that *radical social innovation*[1] will be needed, in order to move from current unsustainable models to new sustainable ones.

Observing contemporary society, cases of social innovation are continuously emerging in the form of new behaviours, new forms of organisation, new ways of living that indicate different and promising developments. Signals, still weak, but all the same stating clearly that another way of being and doing is possible[2] (Manzini, 2005).

[1] *Social innovations:* changes in the way individuals or communities act to get a result (i.e. to solve a problem or to generate new opportunities). These innovations are driven by behaviours changes (more than by technology or market) and they emerge from bottom-up processes (more than from top-down ones). If the way to get a result is totally new (or if it is the same result to be totally new), we may refer to it as a radical social innovation (Manzini, 2005).

[2] Manzini refers to the results of research activities and, in particular, to the results in progress of EMUDE-Emerging User Demands, an on-going Specific Support Action that focuses on promising European cases of social innovation oriented towards sustainability. More precisely: EMUDE - Emerging user demands for sustainable solutions: social innovation as a driver for technological and system innovation 2004-2006 (NMP2-CT-2004-505345) EMUDE seeks to shed more light on cases where subjects and communities use existing resources in an original way to bring about system innovation. From here, it intends to pinpoint the demand for products, services and solutions that such cases and communities express and point to research lines that could lead to improved efficiency, accessibility and diffusion. Actions: a) identify cases of social innovation geared towards sustainability; b) evaluate, select and bring the most promising cases to light; c) clarify the demand for products, services and solutions they give rise to; d) visualise, communicate and disseminate

Samuels (1997) maintains that changes in lifestyles are more important for sustainable development than ecological constructions and that some kind of self-organisation is required in order to achieve necessary changes in lifestyles. Such self-organisation exists in collective housing which makes it more compatible with the paradigm of sustainability (Vestbro, 2004).

3 New housing for new living

"If we fail to recognize the demographic facts of contemporary household diversity, we will continue to design and build housing in community patterns and densities that more or less suit the traditional, autodependent nuclear family that exists today more in myth and nostalgia than in reality"[3].

Nowadays, talking of ways of sociability adjusted to the economic, social and cultural characteristics of the various typologies of families, means talking about very different social demands from those of forced and controlled collectivism and mass housing initiatives seen in the post-war period.

For a long time, traditional family was the main reference for housing project. But, the modifications within the family require new systems and new spaces, hence the traditional family is no longer the ruling model and the social infrastructures are inadequate to the emergent typologies. Some changes in society's structure[4] (increasing number of seniors, singles, monoparental families, among others) stirrers new lifestyles with a living culture completely different from that of the traditional family (Giddens, 1999; Beck, 1986), and with aspirations, desires and needs not matched or accommodated by the existing models.

The typical single-family home is designed for a demographic profile which hardly exist any longer: a bread winning father, a stay-at-home mother, and 2 to 4 children (Toffler, 1980; Giddens, 1999; Beck, 1986). We can find these type of houses in the suburbs, single-family home clearly separated from the city by a system of transit ways. Their design stresses independence and isolation of the domestic environment (Torres, 2001).

Suburban sprawl wastes land, energy, and human resources and offers, in most cases, none of the nurturing and satisfying aspects of community. We can also see that a major segment of the urban population, not being offered an alternative, lives "boxed" in large suburban housing estates. On the other hand we witness a growing number of communities organizing themselves

these cases and their possible implications by mean of technological trends, scenarios and roadmaps. (End date: 2006-03-31 Duration: 24 months. Instrument: Specific Support Action).

[3] (Torres, 2001: 2) – Weisman quoted by Torres-Antonini, Maruja (2001) – Our Common House: Using the built environment do develop supportive communities, PhD dissertation, University of Florida, Florida

[4] http://www.iccr-international.org/impact/docs/avramov1.doc

to create more co-housing[5], and also the emergence of the gated villages phenomenon (Barajas, 2006), especially on emerging countries. For many people, the combination of factors described above has resulted in a high level of dissatisfaction in their living situation, and has motivated them to look beyond the traditional nuclear family home.

These interdependent and increasingly changing realities contribute to the emergence of new behaviour patterns, new business models and new ways of interaction with the environment, building a world with new values.

The "Halifax Happiest Home Report" prepared by the Social Issues Research Centre in Oxford[6], shows that some factors (amount of space; security/safety; garden; privacy, etc.) contribute to peoples' happiness within their homes. 58% considers that the relations with neighbourhoods makes them happier, while 28% consider the sense of community an issue for their happiness.

According to Saggio, the residential service is central to a new strategy, as it might increase the opportunity for informal meetings, for assistance to an elderly people when needed, and also for the preparation and consumption of common meals. The service becomes an essential element, be it for social reasons or for general aspirations to a more integrated lifestyle.

The demand for solutions and the failure to produce them solely through government action (welfare state, housing policies, town planning, etc.) makes people organize themselves and with themselves to reach the solutions for their problems and find answers to their needs[7]. We can observe a large number of bottom-up initiatives concerning new organisational forms outside the residential scope. The easiness present in this kind of association allows for the creation of small (but numerous) knots or hubs that are naturally reproduced in different places.

The growth of these creative communities[8] begins to create human networks, nevertheless they do not constitute a cohesive movement yet, because their actions are mostly private ones occurring in unconnected pockets in many nations. Still, the spontaneous and grassroots nature of these

[5] The co-housing phenomenon is growing in the United States and in Britain. . In Italy there is already a project under way.

[6] http://www.sirc.org/

[7] 'Communities' - means groups of people who share a common sense of belonging. They can be based around where people live - the neighbourhood, the town, or even the region. They can also be formed by people sharing a common interest - such as water conservation or the environment (or even politics), or sharing a common identity such as age, culture or lifestyle. What is important about any community is that people feel a sense of belonging and connection - and a sense of coming together to achieve common ends. - Candy Broad MLC, Minister for Local Government, 9 September 2003 in *The Victorian Government Agenda for Building Stronger Communities* (http://hnb.dhs.vic.gov.au)

[8] *Creative community*: groups of people who cooperatively invent, enhance and manage innovative solutions for new ways of living. This concept has been focalised in the framework of the EMUDE research. EMUDE was a Special Support Action promoted in the ambits of the 6th Framework Program (priority 3-NMP) of the European Commission (Manzini, 2005).

innovative solutions may well signal a deeply felt desire by many people to build neighborhoods, societies of well-being, in sum, a more satisfying life for themselves and their families. However, when we talk about the housing system, the structure is more rigid and implies a more complex organization.

We begin to see that Governments are using terminology such as strengthening communities, building community capacity, and building social capital. Community renewal or urban regeneration is seen as a way to build communities which are socially and economically sustainable. The policy debate is no longer primarily about whether community strengthening strategies are important components of good government - there is enough evidence to suggest they are – the debate is now about what are the approaches that work best (Parker and Heapy2006).

4 Citè Radieuse . Unitè d'Habitation

Local _ Marseille . France
Date _ 1946/52
Number of units _ 337 apartments
Proponent _ Le Corbusier
Facilities _ Nursery school; Shops; Hotel; Gymnasium; Offices; Cafeteria
Motivations _ New architectural response for the problem of collective housing. According to Le Corbusier, the Unitè d'Habitation creates a social space in which the individual and the collective are equally balanced.

The idea to build the "Citè Radieuse" is the result of a research program that Le Corbusier oversaw for almost 25 years. The aim was to find a new architectural response to the problem of collective housing.

Designed as a "vertical garden city", the complex accommodates 337 apartments, served by "mid-air streets" with a series of equipments or services, such as shops and a hotel, while the roof terrace accommodates a nursery school and a gymnasium.

According to Le Corbusier, the Unité d'Habitation creates a social space in which the individual and the collective are equally balanced. The central idea of the model remains simple: to build on artificial grounds individual flats that are placed within the logic of a collective structure. The way in which "The Unité" is organized and the integrated services it offers are meant to enrich social life in the building.

In 1945 the French government asked Le Corbusier to build a "vertical garden city" in Marseille, due to the housing crisis the city was facing. This project evolved between 1947 and 1952 under the supervision of 7 ministers, having the French state decided to sell the estate, but buyers nevertheless have shown no interest in such a daring building. At this time there are already many homeless people that start occupying the empty houses, and the government decides to attribute the flats to some Civil Services (Police, Education, Finances, etc) so that they could lease them to employees, and 80

apartments were leased to civil servants coming from all over France and also the French colonies.

The residents' common difficulties and needs fostered close interrelations, sharing solutions and services amongst themselves.

After they arrived, a bakery, butchery, hairdresser, greengrocer, doctor on the 3th and 4th streets, and finally, in 1962, the Hotel-Restaurant were set up. The panoramic Restaurant on the 8th Street would never be built, but the school, located on the same level, is designed and decorated by Le Corbusier and the Head Teacher. However, 10 years later the kindergarten had to be shut down due to monetary problems.

The management of the building was undertaken by High level Officials from Paris and afterwards also from Marseille. The residents, excluded from the management equation, decided to create a group that starts meeting in order to solve small problems, like heating, for instance.

Le Corbusier has motivated the residents to engage with and in the community life, so as to defend their interests and create leisure facilities. With this aim, in 1953 the Inhabitants Association of the Unitè d´Habitation of Marseille is born, and in 1955 the residents create a Union, in which some of them have seat. The Association aims to organise the cultural and sporting life along with the contacts with the outside world, whilst the Union has an organising role and is in charge of the building's financial and material management. These two organs exist for already 50 years fulfilling their respective roles and having materialised Le Corbusier's request for the creation of a leisure centre.

Within the Unitè d'Habitation all proposals for the creation of clubs are accepted, as long as the proponents are willing to assure its management. They have created since then a library that has been working in several rooms, a cinema which initially had 100 seats, but has since then been relocated to a smaller room, with capacity for 50 people. The Theatre, the Choir, and the music have since then been extinct, as the government rented the space where these activities took place to a company that opened there a Gym. The residents have moved to explore the common parts of the building in the following way: Terrace- balls, theather, paint and sculpture exhibitions; winter garden – exhibitions, parties, cinema and gatherings; 4 small rooms of clubs: cinema, ping-pong, library, entertainment, all of which are still up and running until this day.

There are some milestones in the life of the Unitè, namely the financing and planting of trees, which created in 1972 a green area hard to find in other public buildings around Marseille. In 1982 they celebrate The Unitè 30 years with a number of events, namely conferences and guided tours to the flats. In 1999, the Association's management is transferred to a younger generation, which has to live up to its predecessors level of commitment and initiative[9].

[9] http://www.marseille-citeradieuse.org

5 Cohousing - A working definition

Co-housing, a residential community with shared services and facilities, first appeared in Denmark during the sixties and is widely found today especially in Sweden, Holland, England, the United States, Canada and Japan. It is essentially a combination of private dwellings, each with its own intimacy and autonomy, with the advantage of shared facilities such as micro-nurseries, DIY workshops, laundries, guest accommodation, vegetable gardens, gardens and so on, which offer social, environmental and economic benefits to the community.

Each settlement typically consists of 25 to 40 dwellings where families and single people decide to live together, after a long process of participatory planning. In addition to being part of the building process, the shared planning stage is necessary in designing a "neighbourhood community": before individual physical space is planned, the communal space must be designed and "filled" with the shared facilities chosen by the community itself.

There are essentially two motivations that steer people towards this new form of neighbourhood: the desire to socialise in neighbourly relationships, while at the same time reducing the complexity, and consequently stress and fatigue, of managing everyday activities.

5.1. General characteristics

The architectural structure of existing residential buildings, organised into day space: kitchen-dining-living room and night space: bedrooms and bathrooms, is geared to the old family model (father and mother with two children) and is no longer able to satisfy a series of needs/requirements that have changed because families have changed. The basic structure of the nuclear family has altered over the years: the number of single people is growing, couples with children are on the decrease, children stay inside the nuclear family longer and the number of multi-nuclear families (i.e. families formed after the break-up a previous marriage) is increasing. Along with this change in family structure, there have also been changes in the activities of individuals and the way residential buildings are used and, consequently, what people require of the place where they live.

Physical space undeniably influences people's relationships, so these will differ in a tower building from those in a linear structure, in a terrace and so on. We have seen that *Co-housing* projects prefer low rise units facing onto an internal driveway, to facilitate relationships between neighbours. A typical *Co-housing* community has an external parking area, enabling inhabitants to meet their neighbours on their way home. Space is planned so as to multiply opportunities for meeting and developing neighbourly relationships.

5.2. Activities

Activities that can take place in a Co-housing community are essentially linked to the shared spaces, or are not carried out in any particular space, but always imply a more or less close relationship between people. They are therefore convivial activities (eating, having fun, opening the *Co-housing*

community to the wider neighbourhood) or organisational activities (useful or necessary activities, general management, working, transport) caring activities (looking after children, animals and other people through little everyday jobs and errands) and leisure activities (hobbies, sports, physical and mental well-being and looking after green areas).

6 Urban Village Bovisa 01

The idea of promoting Co-housing in Italy arose from the meeting of two realities: the agency for social innovation INNOSENSE PARTNERSHIP and the Dipartimento INDACO del Politecnico di Milano, in particular the Unit of Research DIS – Design and Innovation for Sustainability.

After sounding interest in shared housing among the citizens of Milan, through the survey-event "ABITOMILANO" in January 2006, three main problem areas still remain to be solved.

The first, concerning the formation of interest groups around a Co-housing project, has been solved thanks to the creation of the community cohousing.it. The idea behind the project is that the internet will be the best tool for finding the critical mass of people interested in each project.

Cohousing.it aims to be:

a centre for collecting co-housing related information and experience through its website, newsletter and study journeys throughout the world;

an aggregation tool that facilitates the creation of groups of people interested in co-residence and their meeting with the estate developers able to build such villages;

a display window for the various proposals and opportunities for creating co-residential villages;

a point of reference for the creation of professional networks (architects, urban planners, social facilitators…) able to contribute to the creation of new communities.

The second issue concerns the identification of suitable areas for creating co-housing communities in areas that are promising from a city planning angle, undergoing significant transformation and regeneration, well-served and linked to the main city.

Cohousing Ventures, part of INNOSENSE PARTNERSHIP, offers professional assistance to members of cohousing.it who have already formed a co-residence group of at least 10 families living or wishing to live in the same area. Services offered (at the best market conditions) include:

finding a suitable area,
compatibility checks on an area or building for restoration,
looking for other project participants,
community development support,
preliminary and executive participatory planning,
legal assistance in setting up the co-operative venture,
fixing terms with builders,

presenting plans to Local Councils.

The third and final problem area concerns the process of residential community development, i.e. organising demand. This is the most important task of the Foundation and in practice a question of managing an assisted, facilitated process lasting 6-9 months, by which a group of people and families builds up their own co-housing vision and project (how to live in co-housing, what to share, how to manage shared services and so on).

The shared plan, outcome of a dozen or so meetings, on-site inspections and actual co-designing workshops, covers all the characteristics and requirements of a residential co-housing village:

the layout of dwellings and spaces (with a special eye to green areas and shared facilities),
service and property management modes,
the standard of building and quality of materials,
ecological building and sustainability aspects,
overall set up and management costs.

Only on completion of the preliminary shared plans do the families and individuals sharing the project jointly commit themselves financially to realising the building project. This will be completed over the following couple of years, either directly or in partnership with the property developer who offered the area and will oversee the building work.

To undertake this task the Fondazione Cohousing Italia (Italian co-housing foundation) uses specialised social facilitators, service designers, and specialist consultants in engineering management, finance and property rights. The Foundation calls on professional collaboration from Cohousing Ventures for the initial architectural planning of shared spaces and for project management.

The first all-Italian adventure in Co-housing is called “Urban Village Bovisa 01”: just a few steps from the Politecnico di Milano, in an ex factory, a community of around 30 dwellings is being developed with 700 sm. of shared space to plan.

The residential community building process started on 17th June 2006, bringing together all the families and people interested in the project. A large space in the heart of the Bovisa neighbourhood, the Scighera, was chosen as the meeting place for participatory planning: a place for socialising, relationship building and cultural production. Here, the would be co-housers initially got together and began reflecting on the cultural aspects of living together.

The participatory process is co-ordinated by a project manager and run by social facilitators who show participants how to reach a consensus in decision making. Its main purpose is to involve those interested in building a shared vision of the community, and help create a group identity based on shared values. Process participants initially came together around a discussion table, using interaction techniques such as brainstorming and workshop sessions.

At the warm-up stage a representative group method was used as it is useful in building shared community values.

A two day workshop was planned for the following meeting, with the aim of reaching a shared idea of the future living scenario. During the workshop the co-housers identified the activities they wish to share and how these could be located in the communal spaces in Bovisa, giving some idea of how the community wants to use this space. During this phase, participants used one of the tools created by the group of service designers to facilitate the users' choice of activities: activity cards. These consist of a pack of 65 cards, divided into 4 macro areas (conviviality, take care, organisation, time for…) and 15 categories (let's eat, leisure, open the co-housing to the external, courses and culture, children, animals, building neighbourliness, useful and necessary, management, work, mobility, hobbies, sport, well-being, green space), where the poetic nature of the communication appears. The graphics of these "playing cards" were thought up to highlight people's actions and gestures: by only lightly sketching places we wanted to take actions out of their physical context, giving them greater importance and enabling people to sketch the physical location in their own minds. It was interesting to observe how the "activity cards" spurred all the community members to discuss and express concrete preferences.

The final meeting of the first stage was a technical meeting where the architectural planners were invited to answer queries.

The group building process is basically divided into two stages: the "visioning" stage that we have just been talking about, and the planning stage, which is yet to come. The first part of the facilitation project has in fact just finished: families have financially committed themselves and have enrolled in the co-designing stage. This includes site planning, shared service and facility design and the planning of private spaces, and consequently the definitive building offer and the contract of co-operative association.

7 The role of design of services

As far as the Unitè d'Habitation is concerned, the residents have created a community for rather pragmatic reasons, which was consolidated over time. The initial thrive to occupy and live that space was not linked, though, with the idea that presided over Le Corbusier's work idea, even if the residents afterwards have incorporated his ideas for the creation of leisure facilities as a way of promoting a higher level of sociability.

In the Italian case, teamwork has been fundamental to the positive start-up of "Urban Village Bovisa 01". The designer role has been undeniably important in approaching this new theme, not only in designing tools, but also in laying guidelines and visualising the whole process.

Both the process and the tools were tested by the designers themselves and by the whole work team during a cycle of preliminary meetings held in

the Politecnico di Milano. During these meetings the linearity of the process and the effectiveness of all the tools (from the classic "post-it" to the more original "activity cards") were assessed, in order to decide the methodology of using them with the would-be co-housers.

For example, we initially intended to leave a pack of "activity cards" with each nuclear family so that the co-housers would have time to weigh up all 65 possible activities. This possibility was then discarded because we realised it was important to get people talking about the idea of sharing, to express concrete preferences and discuss them together in order to reach a shared decision.

The "activity cards", like the other working and visualisation tools, are part of a "toolkit" created by designers to facilitate dialogue between users, and between users and professional planners. It is a set of organisational support tools that leave people free to express themselves, along with the task of planning part of project together.

Since we do not study a subject, but we study problems, and problems cross the borders of any subject or discipline, to design a toolkit for co-housing we examined the techniques and tools usually used in participatory planning processes, with the intuition that a kit would facilitate the building of the first Co-housing community.

Conclusions

An important question is whether the post-materialist tendency is strengthened or weakened in the rich part of the world, and whether collective housing is a resistance to consumerist lifestyles. Such lifestyles seem to be challenged by tendencies towards individualism, hedonism and consumerism.

There are many lessons about community to be learned from these cases, particularly from the cohousing model based on collective living, as well as from some of the European housing experiments done during the first half of the 20th century, that can be incorporated into current housing solutions.

The city urbanistic project belongs to a group of actors, which might be lead by an urbanist. In the same way, the project of the architectural spaces that steer and allow a deeper social involvement within the living space belongs to the architect. Notwithstanding, it's the role of the designer to conceive the services, together with the users, and it is also his role to be the strategist and the mediator in this process.

The originality of the model lies in its approach, in that while analysing analogous complex bottom-up projects, we can see a similarity in the problem solving process. The idea of stylising good practices so as to facilitate their reproduction is not new, but what are new are the tools and methods that the service design discipline is coming up with to make social innovation more easily reproducible in answer to the crisis in welfare.

Four concepts guided us in writing this paper: reproducibility, habitability, sharing and democratic design. Four key words that when placed side by side taste of social innovation.

Because, the designer's capacity to understand (and foresee) what is new, to recognize the signals emitted by emerging ideas and behaviours, makes him a particularly well placed ally to help society to create a new way of living and a new relation with the material culture. By observing these communities and promoting and spreading their ideas of social innovation, design should work simultaneously like a filter and a catalyst, building scenarios of potential futures, conceiving and developing systems of products, services and information to increase their efficiency and accessibility. That is, in this social context, design must work as a strategic instrument, and designers as "solution providers".

We would like to conclude by saying that the new challenge for the design of services can be identified precisely in the word "reproducibility", with the idea of reproducing complex forms of organisation such as a Co-housing project can be.

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