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The design of Product/Service Systems from a designer's perspective [1]

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Abstract

In the age of globalisation and information technology, corporate strategies are challenged to bring production in line with a complex demand, which requires a substantial shift from production of goods to the provision of knowledge-intensive systemic solutions. Such solutions usually consist *product-service systems*, i.e. a marketable set of products and services capable of jointly fulfilling a user's need. Given their strategic relevance, such solutions have rightly been widely discussed in management and marketing disciplines.

In the Design discipline instead, the methodological implications of the design of PSS, have rarely been discussed even though design components play a critical role in their development.

This paper aims at contributing to the debate about a new role for designers in the definition of innovative PSS. The paper illustrates the design process of a service (a urban telecentre), emphasising the main methodological problems arising in the process and introducing the methodological tools used to understand the nature of the service.

The findings from the research project reported in this paper are expected to provide element for discussion in the debate about the methodological implications of the expansion of designers' competence: from the design of industrial products to the definition of the technological, cultural, organisational and social aspects of the design of a PSS.

Introduction

In the new era, markets are making way for networks, and ownership is steadily being replaced by access. Companies and consumers are beginning to abandon the central reality of modern economic life – the market exchange of property between sellers and buyers. (Rifkin 2000: 4)

Rifkin's analysis of the ongoing separation between markets and property is based on the deduction that the main objects of exchange in the new era are no longer material products, but cultural-intensive services. *Exchanging goods is less important than sharing access to services and experiences between servers and clients*, Rifkin (2000: 52) argues. Such a perspective shift requires companies to re-focus their activities from the production of products to the provision of knowledge intensive systemic solutions (Butera 1990), (Bucci 1992), (Manzini 1993), based on a different mix of products and services. The consequences of such a shift are quite clear to management and marketing disciplines, which have already

extended their cultural domains from production to consumption processes (Albrecht and Zemke 1985), (Normann 2000).

Although the relevance of *sharing experience between servers and clients* emphasises the role of designers in the definition of the value of transactions in the new age, such a large cultural change has rarely been discussed within the design community. One of the reasons for the notable absence of the design discipline in such a debate is the common view that designers' activities usually deal with material artefacts (whether industrial products, spaces or architectures), rather than on systemic solutions including services. However some scholars such as Manzini, have repeatedly emphasised the need for the design discipline to consider the extension of its domain to include product/service systems (PSS) (Manzini 1993a and b).

The contribution of designers to the definition of PSS would offer a better insight into several aspects, including the technological potentials of PSS focused business and an enhanced comprehension of users' behaviour and attitudes with respect to new products, technologies and services. Most importantly, the design approach would be critical in the translation of cultural and social needs emerging in the new economic system into a set of concrete elements that characterise the experience to be *exchanged* by clients and servers in a PSS.

On the other hand the extension of the design domain from product to services implies a cultural change in the design perspective and requires that the designers put themselves in a different position with respect to old competencies (such as technological and cultural competencies) and new ones (such as socio-economic and managerial competencies).

The *TeleCentra* research project has proven to be an excellent opportunity to explore such a disciplinary shift in the design domain. This paper describes and discusses this project, which focuses on the design of a specific PSS: an urban telecentre.

Product/Service Systems: What are they? Why they are relevant to designers?

PSS emerge from the need for companies to extend their mission from the production of material products to the definition of knowledge intensive solutions targeted to specific consumption sectors. Goedkoop et al defines a PSS *as a marketable set of products and services capable of jointly fulfilling a user's need.* (Goedkoop, van Halen, Riele and Rommens 1999: 18)

The element of novelty, from the design perspective, comes from the service component of the PSS:

[...] Services do not qualify as property. They are immaterial and intangible. They are performed, not produced. They exist only at the moment they are rendered. They cannot be held, accumulated, or inherited. While products are bought, services are made available. In a service economy, it is human time that is being commodified, not places or things. Services always invoke a relationship between human beings as opposed to a relationship between a human being and a thing. (Rifkin 2000: 84)

Because PSS are generated by the convergence of different actors during the use phase the *experiential* attributes of the PSS need to be thoroughly planned. This makes the design of PSS particularly relevant to designers.

The focus of PSS on the consumption system requires that the traditional domain of design activities, logically located between the domains of technological innovation and management, be extended to new cultural domains, where a thorough understanding of consumption processes is possible (Figure 1).

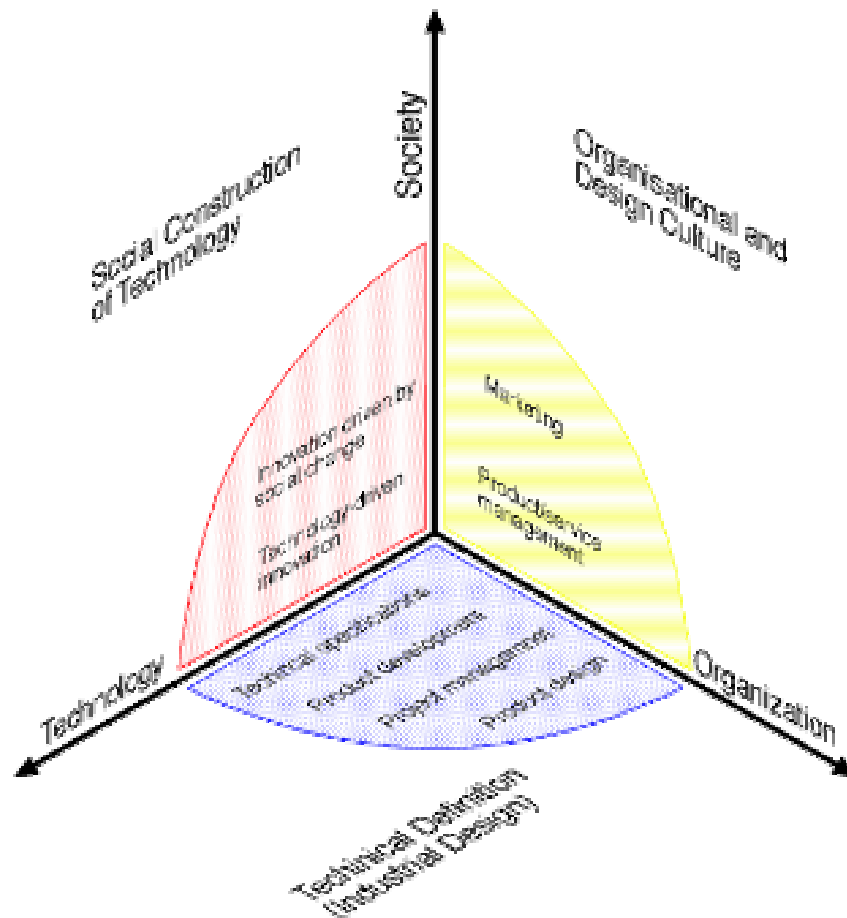


Figure 1 Traditional and new domains for designers' activities

The new logical location of design activity introduces new challenges:

- a) If the relationship between designers and users takes place during the direct contact with the users, the interaction between users and the service needs to be accurately planned, in order to address service needs, this means that a new design management methodology needs to be introduced, to manage the pre-definition phase of the PSS.
- b) Users shape the service, as well as designers and service providers do, this requires a better understanding of users cultural, social and technological frames
- c) If the service is a diachronic event, new tools need to be introduced, in order to control and address the sequence of such events.

The following section reports on the TeleCentra research project in order to provide the elements for a discussion on such challenges.

The case study

The PSS developed in the project is a telecentre, that is a service that provides office space and related facilities to be let for very short periods of time (from an hour upwards) for work activities.

The service is located in a central area of Melbourne, close to the CBD; therefore its potential users are those who visit the CBD from outer urban areas or other cities rather than telecommuters.

The process described in this paper refers to all the phases preceding the commercial phase. At present, the TeleCentra service is not yet available on a commercial basis.

The design process

The design process of the telecentre consisted in an iterative sequence of phases in which problems generated solutions, which in turn, redefined new problems. The process was articulated in the following phases:

Value proposition. Definition of the needs to be fulfilled by the PSS

Definition of target users. Definition of a profile of prospective users

Analysis perceived competitor services. Analysis of the competitor services.

Product/service concept. Definition of the conceptual structure for the PSS

Use-case analysis. Analysis of several conditions of use on the basis of the available research and information. The hypotheses generated in this phase are used to define key functions, requirements and priorities

Prototype architecture. A prototype service is proposed in this phase, on the basis of the indications in the previous phases

Test. The tentative architecture is tested in order to generate use patterns and other indications on the effectiveness of the tentative solution

Final definition. Redefinition of the tentative architecture.

Value proposition

The value proposition is a short synthetic sentence that defines the main function of the PSS in terms of the function it is going to perform and the added value proposed by the new PSS. The value proposition of the TeleCentra is expressed in the following statement:

A system of physical and virtual tools and facilities that support nomadic workers and virtual work teams by providing both an access point to a virtual office and a temporarily inhabited physical space close to the Melbourne CBD.

The service's added value with respect to existing services of this kind is determined by:

- 1) the **geographical location**; unlike other telecentres TeleCentra is located close to the Melbourne CBD; and

2) its **characteristic of being a temporarily inhabited space**; the concept of inhabiting the space refers to a professional and customisable space, alternative to the traditional office space, in which particular activities can be undertaken, such as isolated work (away from the distractions of the office) and meetings.

Users' analysis

A survey and a series of interviews helped identify and describe different profiles of potential users. Among them the most interesting profiles were those of telecommuters (i.e. people who divide their work activity between their home office and their corporate office) and nomadic workers (i.e. people working from many different locations).

A profile of those two categories of workers emerges by the interpretation of the data gathered through the filter of a set of criteria, which, according to Bijker (1995, : 122-127), define the *socio-technical framework* of each group:

Goals, (the needs each group wants to satisfy in relation to specific aspects of their work activities)

Key problems, (the problems to be solved for each group in order to achieve their goals)

Problem solving strategies, (the strategies each group believes to be admissible and effective in solving the main problems)

Requirements to be met by problem solving strategies, (the admissibility and effectiveness criteria for problem solving strategies)

Current theories, (theoretical knowledge supporting the activity of each group in setting goals, identifying and selecting problems and proposing admissible problem solving strategies)

Tacit knowledge, (practice based knowledge upon which each group relies to set goals, identify and select problems and propose admissible problem solving strategies)

Testing procedures, (procedures each group uses to evaluate the effectiveness of each problem solving strategy)

Design methods and criteria, (methods and parameters used for proposing technological solutions to emerging needs)

Users' practice, (users attitudes towards the existing solutions to the present needs)

Perceived substitution function, (products, services or sets of functionalities each group believes to be replaced by the proposed PSS)

Exemplary artefacts (products and services that are used as models in developing new solutions. Often deriving from the perceived substitution function)

The analysis of these parameters reveals specific needs, problems, problem solving criteria and tacit knowledge related to nomadic work (Table 1).

	Telecommuters	Nomadic workers
Goals	Better time management for office and personal activities. Telecommuting as a choice.	Compensating physical distance with logical contiguity. Nomadic work as a necessity.
Key problems	Reducing redundancies and optimising resources when working in two different locations.	Finding dedicated working spaces. Making data and reference material available in every possible location.
Problem solving strategies	Have adequate facilities to work at home. Large portable memory support (Zip disks, CD ROM) to transfer files. Creating similar environment at home and in the office.	Reducing volume and weight of the material transported in nomadic movements. Use of a laptop or reliance on local Internet connection to retrieve personal files and reference material.
Requirements to be met by problem solving strategies	Software, reference material and previously saved files must be available and usable by both home and office computers.	Availability of software, reference material and previously saved files in every work location. When using Internet connection large bandwidth connection is needed.
Current theories	Telecommuting is an alternative to traditional office work that is suitable for those who cannot commute every day.	There are no theoretical references to describe nomadic work.
Tacit knowledge	Desktop usage. File transferred using floppy disks or email attachment. Minimal knowledge is required to perform day-to-day information management operations.	Laptop usage as the ideal solution to achieve complete independence. More problems solving capability is required for technical problems when far from the office. Files and personal information are retrieved through the internet using complex file transfer procedures
Design methods and criteria	Dedicated space to work at home.	Minimal infrastructure to support nomadic work. Transportable storage (eg small luggage) is needed for paper documents. File storage supports (eg Zip drives, CD ROM) must be compatible with the standard facilities available in Internet cafés, telecentres, airport lounges.
Users' practice	Familiarity with those applications that are needed for working in both locations.	Familiarity with the most known applications for managing and exchanging files included Internet-based applications.
Perceived substitution function	The traditional working environment.	When nomadic work is a necessity, rather than a choice (eg salesmen) there is no perceived substitution function.
Exemplary artefacts	Office workstations and professional settings.	

Table 1 A profile of telecommuters and nomadic workers, according to Bijker's criteria. (Bijker 1995)

Perceived competitor services

The perceived competitor services of TeleCentra are chiefly the result of the increasing use of IT as a support to work activities. In some cases these services stem indirectly from this phenomenon. For instance, the increased connectivity between geographically remote locations makes possible the decentralisation of many office-related functions. (Morelli 2001).

The analysis of competitors has been undertaken by applying the same criteria used in the user's analysis. It is assumed, indeed, that technological infrastructures and services included in the analysis are themselves the result of the interaction between different actors and different socio-technical frames. By applying (where possible) the same analytical filter the researcher aims at gaining a better understanding of the socio-technical frames of the actors who shaped such services (Table 2). Furthermore, this filter makes it possible to comprehend existing models to which TeleCentra customers refer.

Competitors Criteria	Serviced Offices	Internet Cafés	Neighbourhood Centres	Airport Lounges
Goals	To accommodate medium term office activities and reducing their capital costs	To provide access to the Internet for Web surfing, mail and chat. Mainly designed for tourists.	To provide cheap access to local (not necessarily computer literate) community.	To provide access and basic working space to businessmen, between their flights
Key problems	Need for medium term temporary offices in central metropolitan areas.	Large bandwidth access. As many workstations as possible	Reduce costs of infrastructure and connection, in order to reduce usage fees	Travels should bring about minimal disruption of working activities.
Problem solving strategies	Provision of space plus accessory services (e.g. reception, secretarial assistance)	Reduced space for non computer-performed functions.	Second hand computers. Avoid cutting-edge technology.	Computer and working space contiguous to lounge and waiting areas
Requirements to be met by problem solving strategies	Professional services, technical assistance. Privacy.	Quick connection. Low privacy concerns. Fast and reliable billing system. Basic software applications.	Acceptable level of access and connection speed. User friendliness. Basic technical assistance	Professional settings, privacy, basic technical assistance, Basic software applications, convivial and relaxing environment.
Current theories and tacit knowledge	This service increases small and large business' flexibility	Internet replaces expensive phone calls when travelling.	Need to expand computer literacy and Internet use in disadvantaged communities	Increased connectivity reduces working problems for remote workers, when travelling.
Design methods and criteria	Shared facilities and services, representative spaces. Computers are not necessarily included in the service	Small cubicles to accommodate a computer. (sometimes) coffee area.	Adaptation of spaces and infrastructure designed for other functions.	Cubicles for computer-related and private working activities. Meeting spaces contiguous to lounge and waiting areas
Users' practice	Use of the services offered as in traditional offices.	Users are supposed to be familiar with basic Internet applications	No particular knowledge is needed.	Users are supposed to be familiar with the basic hardware and software applications
Perceived substitution function	Ownership of the office space and related office services	Telephone (for communication). Home computer.		Telephone (for communication) traditional office space.

Table 2 Analysis of the perceived competitor services according to their related socio-technical frames

Definition of the product/service concept

The previous considerations provide indications about the needs to be fulfilled by the telecentre, however there is no indication about the actual solutions to be offered with this particular PSS. Furthermore, the above analysis does not provide any indication about what the telecentre could become in the future.

The conceptual definition of the components of the telecentre must be articulated according to such short and long term perspectives. In the short term the project will focus on a simple

system of products and services that satisfy the basic demands for support from nomadic workers. Such a system should include physical and virtual elements. The main attributes of each component should also be listed in this phase.

Use case development

Use cases are *short stories* about hypothetical users' behaviours. The behaviour of possible TeleCentra customers was deduced from the analysis of existing telecentres and from the brainstorming sessions in which the value proposition and the PSS definition were formulated. Use cases are employed to articulate problems in such a way that assists in generating a list of specific requirements.

Use cases were described in a standard format including an actor's name (usually indicated by a common personal name), a short description of a flow of events and some indication about pre-conditions (i.e. conditions that have to be true before the flow of events start) and post-conditions (i.e. conditions that have to take place at the end of the flow of events).

The development of the use case generates a list of products and services included in the system. The following section clearly demonstrates the capability of this technique to generate a set of requirements needed in the PSS.

An example of a use case is outlined below.

Use Case 1

Title: John wants to edit his CV

Actors:

- John, when using the telecentre to edit his CV
- The receptionist welcoming, informing and billing John
- The room assistant, assisting John

Flow of events:

- John enters the telecentre
- The receptionist welcomes John
- The receptionist informs John about available workstations
- The receptionist introduces John to the room assistant
- The room assistant guides John to the workstation
- John logs in and works on his CV
- =====Time spent by John working on his CV=====
- John finishes his work, saves the file and approaches the billing person (it could be the receptionist)
- The receptionist updates John's membership card (that helps John keep track of his use of the telecentre)

Pre-Conditions: John is a registered user of the telecentre (he has a login and password that allow him to access the telecentre's network and computers)

Post-conditions John has a saved copy of his edited CV in his online directory on the telecentre's server (or on a floppy disk).

A schematic representation of the interaction between users and products and services included in this particular scenario is outlined in Figure 2.

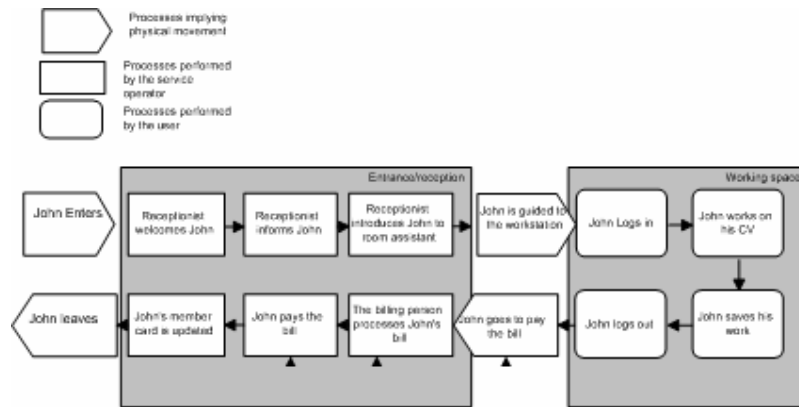


Figure 2 Flow chart of user interaction with products and services for Use Case 1

Figure 2 represents the service cycle and provides information about:

- 1) Processes
- 2) Performer of the process
- 3) Physical location of the process

However the representation in Figure 2 only includes the elements of the service cycle that are visible to the user. A more comprehensive representation of the service cycle includes intangible elements and technical and maintenance services provided to maintain the quality of the service. The blueprint for the service cycle related to this scenario is represented in Figure 3.

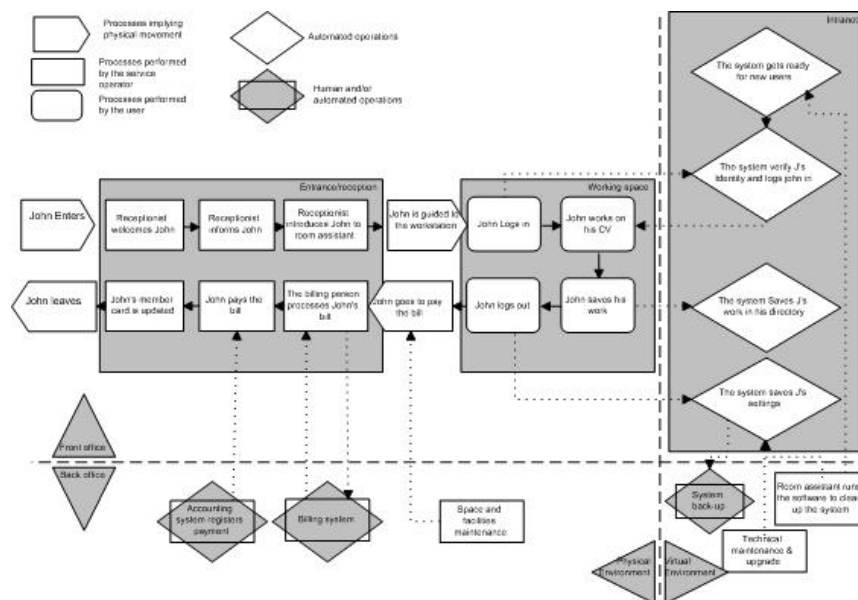


Figure 3 Complete description for Use Case 1

Functional requirements for the telecentre (i.e. requirements about product and service components needed for the system to perform the required functions) can be directly deduced by the use case. Figure 4 is a schematic representation of the requirements logically inferred from the use case, representing the main elements, their characteristics and their interaction.

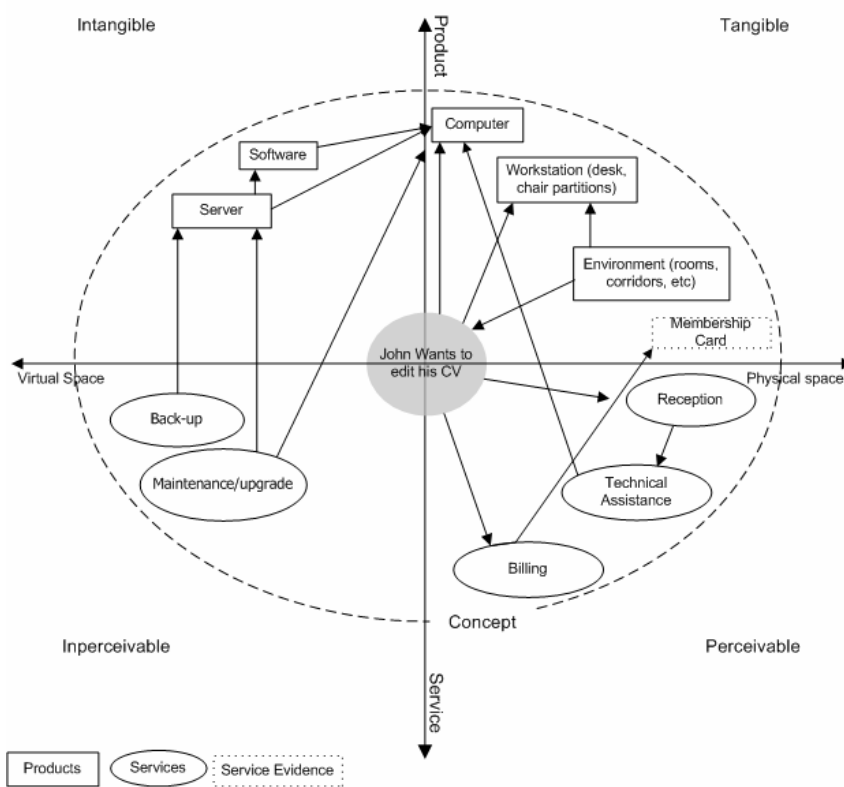


Figure 4 Schematic representation of products and services for Use Case 1

The iteration of several use cases similar to the one described above provides a list of functional requirements and related attributes as in Table 3. Budget constraints and technological limitations require a prioritisation process for the inclusion of components and the improvement of the attributes.

Functional Components	Priority	Attributes	Priority	Comments
Spaces for computing, including Internet connected workstations	High	Separate enough to guarantee privacy, at the same time; located in a way that makes team work possible, when necessary. Large enough to allow for working with paper documents and other cumbersome working support.	High	Commercially available office furniture was used. The model for this space was <i>the Den</i> . (Duffy and Powell 1997), ie an interactive but semi-autonomous open space. Settings and colours of the space had to be <i>familiar</i> to the customers.
At least one separate office (to be used by home based business to meet clients or recruitment interviews)	High	Professional setting, Internet connected.	High	
Spaces for laptop users	High	It must be equipped with Internet access and access to printers and the local server.	High	
Graphic workstation	High	Access to scanner, colour printer and large monitor.	High	
		Advanced graphic design software.	Medium	Budget limitations, depending on demand.
Spaces for meeting	High	At least 8-10 people.	High	
		Multimedia facilities and Internet access.	Medium	Budget limitations, depending on demand.
Fax, photocopiers, b/w and colour printers, scanners	High	Located in shared spaces, easy to access and to use.	High	
		Automated meters and payment systems.	Medium	Budget and technological limitations.
Phone Lines	High	Available in every work station	High	
Desks for <i>casual</i> visitors with their laptop or who do not need a computer	High			
Internet-connected server	High	Secure access.	High	
Technical assistance	High	Available full time	High	
Memory space for personal files	Medium	Small space, connected to the service.	High	
		Large, fee-based file and personal management service.	Medium	Technological limitation, a system needs to be designed for this specific purpose.
		Secure access.	High	
Training room	Medium	Classroom equipped with several workstations.	Medium	Already available, use depending on demand.
A reception space and service	High	Fast information service.	High	
Payment system	High	Based on membership. Make it possible for users to keep track of their usage of the service.	High	
		Automated.	Medium	Budget and technological limitations.
Devices for large memory support (eg CD burner, Zip drivers)	Medium			Budget limitations.
Synchronisation devices for palmtops	Low	Based on Infrared or Blue Tooth technology.	Low	Low percentage of laptop users, technological limitation.
Small Café or <i>water cooler</i> space for casual meetings	Medium	Close to the working area, but separated, in order not to disturb other workers.		Space limitations.
Small shop for stationery	Medium			Depending on demand.

Table 3 Functional components, attributes and priorities of a tentative architecture

Prototype architecture

In this phase the requirements deriving from the use cases and scenario development are translated into a prototype architecture of the service. The generation of a prototype architecture is based on the definition of functional components of the service and their attributes.

The choice of building to be occupied by the telecentre was driven by the availability of spaces. The prototype service was located on the first level of a building and distributed over four rooms, across which the various functions were distributed. The floor plan of the telecentre as designed in this phase is reproduced in Figure 5.

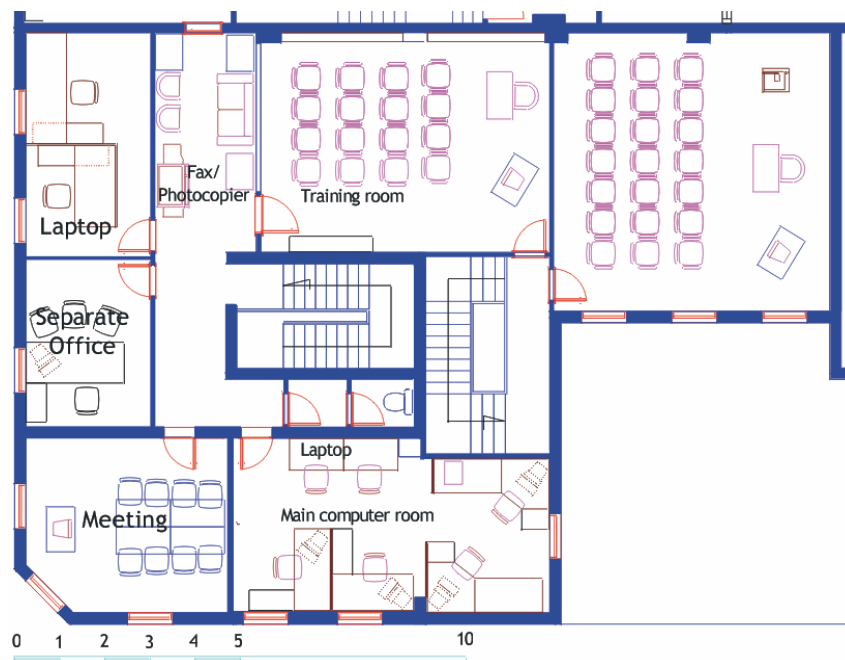


Figure 5 First TeleCentra floor plan

The reception area and a large training room were located on the ground level. Some of the shared facilities were located close to the working space (eg fax, printers and scanners). Others were placed closer to the reception area to facilitate supervision and access from users who were not using the telecentre's computer work spaces.

Access limited by membership would preserve the professional characteristics of the environment and to avoid improper use of the service. Membership cards would record customers' login details and service usage.

Customers would have the option to pay for the card in advance at a discounted price, in order to encourage return visits to the telecentre. Depending on budget availability, the card could be replaced with an electronic card that records all transactions at the telecentre (photocopies, usage, fax, phone calls, etc). Membership cards can be defined as *service evidence*, i.e. an element that is visible to the consumer, but not critical to the sequence of events that constitute the service. According to Shostack (1982) the role of such elements is essential for the client to recognise and judge the value of the service (like bus tickets).

The economic restrictions imposed by the project budget were not the only reason why the adoption of an automatic payment system was excluded in the first phase of development. In

fact, it was also important that new clients found a familiar and friendly environment in which the direct contact with the telecentre personnel could help in the understanding of the various opportunities offered by this kind of service.

Test phase

The telecentre was opened for 6 months to run a test phase. During this period, the telecentre's service was offered at a discounted price to prospective users. Furthermore, some groups of people were invited to use the telecentre as *testers*, in order to verify some of the functions. Information brochures about the telecentre were distributed in the local area (especially in hotels and serviced apartments) and through some organisations.

The test phase focused on some critical design aspects, such as:

Facilities usage (What facilities and functions were used most often?)

Performance (Do all the services offered perform at acceptable levels?)

Continuity (Does the process flow smoothly for each of the services offered to customers?)

Communications (Do clients find all the communication needs they require to work independently?)

- The test phase introduced some strategic issues upon which to focus, such as:
- Improvement of the functions in the computer room
- Redesign of the separate office
- Improvement of the facilities available in the meeting room
- A more professional image to be communicated to customers in order to generate an environment closer to the concept of a *club*.
- Improvement of the reception space
- More efficient infrastructure (Internet connection, photocopiers, fax)
- Staff training and coordination
- More transparent billing system
- Improved communication between the functional units
- Design of a computer interface to *empower customer use*, i.e. to facilitate the use of the services offered.

Final definition of the service

In this phase the service had been defined to the point where the project team believed the telecentre was sufficiently developed to be launched commercially. Several changes were included in this phase. The main change consisted in moving the telecentre to new premises where technical problems with Internet access, phone network and reception management

could be solved. A larger and more comfortable separate office and a larger meeting room were also available in the new location.

The functions of reception, booking and coordination of the working space were unified and managed by the same personnel.

Some features of the new premises (such as a small courtyard and a kitchen) were used to emphasise the character of a *stress-free environment*, in which users could attend their meeting or get their professional work done in a quiet and relaxed setting.

Such a characteristic required that the value proposition be readdressed, providing a new attribute of the physical and virtual services to be offered. The marketing campaign designed for the telecentre also addressed this characteristic, which seemed to add considerable value to the service.

Discussion

In this section some aspects emerging from this case study, which are relevant to the designer's perspective, will be discussed. The section will focus on three main points:

- 1) The generation of a design management methodology for the pre-use phase of a service;
- 2) The analysis of socio-technical frameworks converging in the PSS;
- 3) The definition of methodological tools to control the flow of events and to represent attributes and components of a service.

Product design VS service design: a comparison

To what extent can product design and development methodologies be exported into the definition of a service?

As seen before, products and services are produced and defined according to different timeframes: while products are relatively well defined in their physical structure before they come in contact with the user, services are defined by the interaction with the user. Existing product development methodologies do not focus on post-sale phases, while the development of a service takes place mainly in the use phase that should be carefully planned and managed, as proposed by Ramaswamy (1996) (Figure 6).

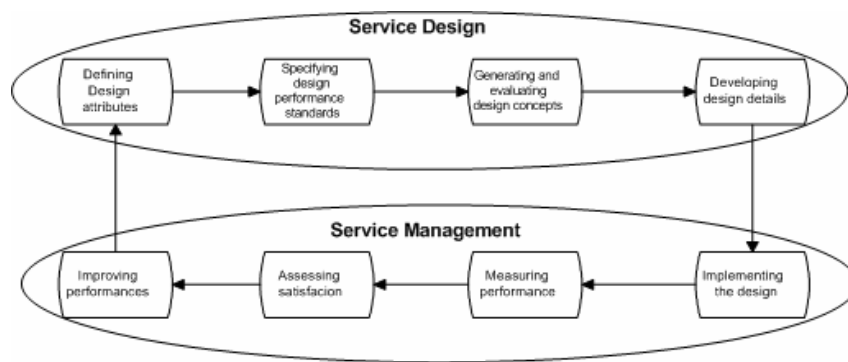


Figure 6 The service design and management process as proposed by Ramaswamy

Furthermore, the existing product development methodology cannot be simply transposed to service design because of the very nature of the service, in which the immaterial component has a critical role. The process described in this paper is an iterative sequence of problematic and propositional phases. The problematic phases aim at acquiring as much information as possible, in order to implement the conceptual and operational structure of the service, while the propositional phases are temporary configurations of the service (). Problematic and propositional phases generate a process of co-evolution, which qualify service design as a design exploration activity (Maher 1996; Maher 1996). Although this case study only refers to the pre-definition of the service, the management phase can be interpreted as the prosecution of such an exploration with the involvement of customers.

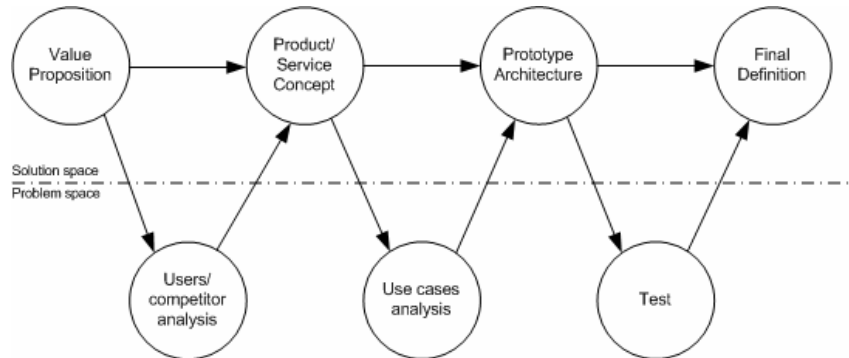


Figure 7 The evolution of the design process in the TeleCentra project

The co-evolutionary approach developed in this project may offer suggestions for the development of innovative product-development strategies. In the age of product customisation the definition of the product is the result of a co-design process involving producers and end-users. Such a relationship, argues Rifkin (2000: 108), is more like that between server and client than a seller and buyer and customisation could be better managed if it were regarded as the contracting of a service. From this perspective, the co-design of products/services should be based on intense feedback and redefinition loops similar to the sequence of analytical and propositional phases of the TeleCentra project.

PSS and Socio-Technical Frameworks

The method used to generate a profile of the possible TeleCentra users is based on the assumption that PSS are socially constructed entities, which result from the interaction of the socio-technical frameworks of the actors involved in it.

Once possible users were identified, their profiles were compared with the socio-technical framework of other actors involved in the telecentre, including the system of technological infrastructure and products used. Figure 8 is a graphical representation highlighting actors, technological infrastructure, products and services that contribute to shape the service. Each actor either interacts directly with the service (e.g. telecommuters, nomadic workers) or interacts indirectly by providing products and services.

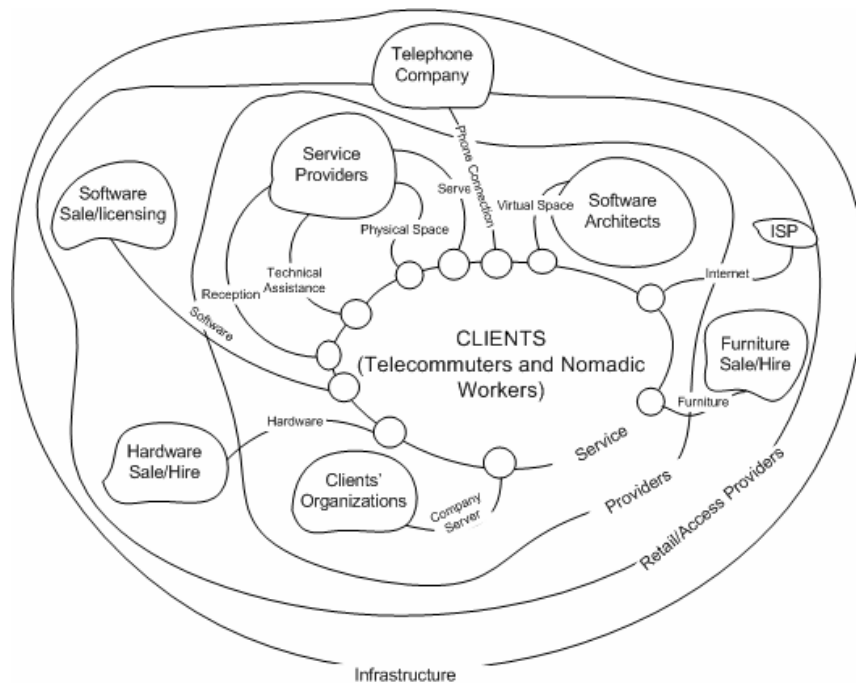


Figure 8 A graphic description of actors, products and services involved in the TeleCentra service

It is worth stressing that technological products and infrastructure have been considered as active agents in shaping the service, as they transfer the socio-technical framework of the actors that generated them. The limits of Internet applications, the limitations due to security concerns and the problems derived from the building configuration, are explained more clearly through this approach.

This approach is suggested by social construction studies, which introduce the concept of *heterogeneous actor network* as a methodological tool to understand innovation phenomena implying strong links between social actors and inanimate objects (products and technological systems). Callon (1989) suggests such a conceptual tool to conduct an analysis that in every stage of the development of the PSS focuses on the continuous co-evolution of the socio-technical framework of the various actors. The TeleCentra project approach, focuses on such networks, rather than looking for a clear definition of the PSS as a system, which would imply the definition of the system boundary and environment and further logical and analytical work.

From the designer's perspective this approach is useful to identify the inevitable social implications of an innovative PSS, without having to borrow the whole complexity of more traditional sociological analysis.

Controlling events, components and attributes of a service

The design activity mainly consists in a projection into the future. In fact some languages (e.g. Italian) use the word *project* to denote such activity.

Whilst product design has developed several methods to control such projection, because of the specificities of services, those methods cannot be automatically transposed to service design. It is difficult, for instance, to use product design methods, focused on material qualities, to control some services' immaterial attributes, related to time and social and cultural relations.

The use case approach in the TeleCentra project was an attempt to control such variables.

This approach is borrowed from computer system studies, where it is used to predict users' behaviour and represent the interaction between users and the system (Cooper 1999), (Leffingwell and Widrig 2000). Similar methods based on the description of use case scenarios, have also been used by design firms for the development of design concepts (Covington and Hannah 1997).

Use cases are aimed at generating scenarios that represent the possible future configurations of what is to be designed. Once a use case was generated, the next stage in the project consisted in producing a schematic representation of the use case. Such a representation contains indications about material elements of the service (e.g. sequence of spaces, products used) and immaterial attributes, such as time sequences, interaction, actors involved, accessorial operations.

Such a schematic representation is the *blueprint* of the service. Indeed such a representation makes it possible to communicate the service concept in a simple way.

The importance of the generation of the service blueprint is clear when some situations are considered, such as franchising, in which the service needs to be replicated in several locations and contexts.

Several representational techniques have been considered in the project, which derived from computer science studies (in particular graphical representation used for use cases in the Unified Modelling Language and the Petri Nets method), from marketing studies (Shostack 1982), and previous design studies (Pacanti 1998).

The representations used in this project contain elements derived from such studies, with the addition of indications that are critical to the designer's activity, such as information on physical and virtual spaces, perceivable and unperceivable elements and attributes [2].

Because of its focus on design and the capability to represent future scenarios, the use case method can also be applied to broader strategic design studies aimed at representing short and long-term futures. Studies on sustainability for instance, may use this approach to articulate *Design-Orienting Scenarios*, which are being used to generate and evaluate possible and desirable futures in certain consumption areas (Young 2001), (Manzini 2001).

Conclusions

The description of the design process in the TeleCentra project provides suggestions and tools for the operational aspects related to the expansion of the design domain from the design of products to the definition of new services. It is clear, from this project, that service design implies a multidisciplinary approach in which designers have a critical role in a wider design team. It is also clear that the different nature of services with respect to products challenges the traditional designer's competencies and requires a new methodological approach, which borrows methods and tools from other disciplines.

This paper addresses some of the operational aspects of such a new challenge for designers. Several aspects still need to be explored by a more extended design practice in this domain. It is clear however, that more thorough research in this area is particularly relevant in a historical moment in which the shift from a mature industrial phase to what Rifkin (2000) defines 'the age of access', requires a thorough rethinking of the role and nature of products themselves, and consequently a strategic repositioning of the design profession.

References

Endnotes

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[2] A more detailed description of the methodological exploration for the generation of a service blueprint is in Morelli, N. 2002 (forthcoming).

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