Investigating pleasurability of a scenario of a sustainable product-service (framework)

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ABSTRACT

Recently, product service systems (PSSs) have caught the attention of policy makers and designers as a possible strategy for environmentally sustainable solutions. The PSS, which combines tangible products and intangible services that fulfils customer needs, has been believed as a new approach that improves environmental impacts significantly. However, there is insufficient evidence proving that this system maintains customer satisfaction on the basis of functionality, usability and pleasurability.

This article aims to deliver a framework and a methodological approach on how customer satisfaction relates to sustainable product service systems. A top level of satisfaction, pleasurability, is selected based on the assumption that functionality and usability of PSSs remain the same or even have better performance because of long term responsibilities of service providers.

Qualitative research methodology based on case study approach and in-depth interview will be used to observe toy libraries as the example of existing product service systems in Australia. The framework and the research methodology provided in this article are the preliminary stage of an on-going doctoral research.

Conference theme : Human and natural environments
Keywords : product service system, pleasurability, toy library

1. BACKGROUND

The Earth's quality has been deteriorating significantly in the last century due to a massive exploitation of its resources for human consumption. The future of the Earth will become even worse if this exploitation remains the same. Previous research shows that in 50 years the world population will double and the environmental impact per capita will increase by a factor of 5 (Weaver, 2000). Another research done in 1997 by the Earth Council, which uses the Ecological Footprint as the indicator shows that, in average, the world population is already lacking the capacity to fulfil its requirement on the basis of food, shelter, travel, and other energy requirements. Using the parameter of the area required per capita (hectares per capita), the average land required by a person to fulfil his/her consumption is 2.8 hectares while the Earth capacity is only 2.1 hectares/capita (Earth Council, 1997).

With regards to this situation, improving the environmental impact of each of human activities is very crucial. A growing concern in reducing the environmental burdens has emerged in almost all sectors, including product design activities. Eco-design, or environmentally conscious product design, has been implemented by designers for a couple of decades particularly for the improvement of products regarding material content and energy consumption.
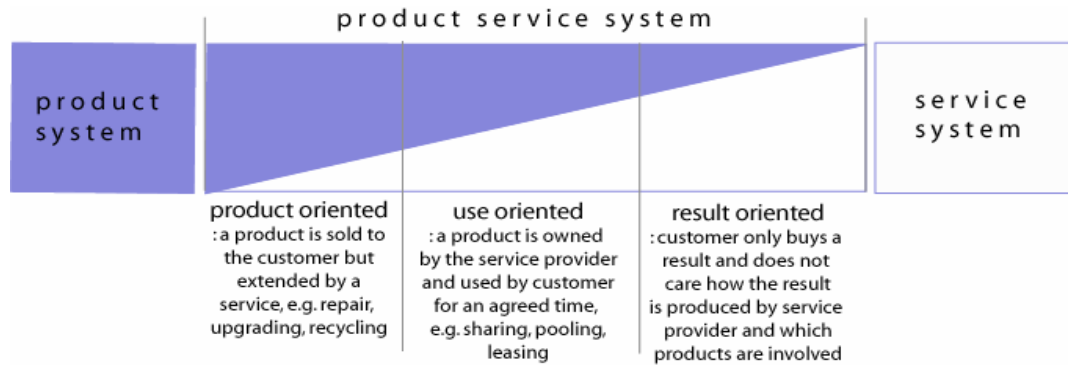
Tischner et al. (2000) define that there are three different approaches of Eco-design based on how effectively the design will improve the environmental impacts, which are Eco Re-design, Eco-Innovation and New concept, service system. Eco Re-design refers to an improvement of existing products in order to reduce the environmental impacts. Eco Re-design is also named as Design for Environment (Fiksel, 1996; Otto & Wood, 2001). Eco-Innovation is a completely new approach to product design in which the environmental concerns are the most important point to consider. New concept - service system is the fundamental improvement of systems of product services which attempt to satisfy the environmental concerns in an attractive way.

The last category of Eco-design, new concept - service system, is still rarely implemented even though many researchers believe that this approach is the most promising way in reducing the environmental burdens (Goedkoop, van Halen, te Riele, & Rommens, 1999; Jelsma & Knot, 2002; Mont, 2002; Vergragt, 2000). Goedkoop et al. (1999) called this category as product service system (PSS), which means "a marketable set of products and services capable of jointly fulfilling a user's need" (Goedkoop et al., 1999, p. 18). Ashford and Thomas (2004) gave a more comprehensive definition as follows:

> … an innovation strategy, shifting the business focus from designing and selling physical product only, to designing and selling a system of product and services which are jointly capable of fulfilling specific client demands. The fundamental basis of this innovation is a shift in focus from selling products as a result of industrial production to selling the functionality and satisfaction that they offer through a marketable range of mutually dependent products

and services that are equally capable of fulfilling the same client demands but with less environmental impact (p.51-52)

Tukker (2004) has categorized PSS into three different types which are product-oriented PSS, use-oriented PSS and result-oriented PSS (See Figure 1). Product-oriented PSS does not change the product system but it improves its service system to enable a product to be more sustainable. Use-oriented PSS changes the system by diminishing the use of resources by encouraging sharing, renting and leasing ideas when a group of people are using a product system. Result-oriented PSS changes the system radically by allowing users to receive the function only, and external service providers create the functions by sustainable modes of production. Tukker (2004) claims that while product-oriented PSS only gives incremental environmental benefits (20% reduction), use-oriented PSS gives quite significant benefits (minimum of 50% reduction) and result-oriented PSS gives even higher benefits (75-90% reduction).

Source : Adapted from (Tukker, 2004)

However, research also shows that PSSs do not automatically reduce the environmental impacts. The environmental benefits can only be evaluated case by case. As a result, it is important to ensure that the system designed will minimize the environmental impact or keep the environmental sustainability. Some evaluation tools are developed to assess the environmental impacts of PSSs, some are intregrated with evaluations of other factors such as the effects of the economy, customer acceptance and business strategy. Factor X is used to evaluate and control the reduction of global material flows of a product system (Factor 10, http://www.factor10-institute.org/seiten/fac.htm#). Factor 4, for example, is a standard to the reduction of environmental impacts of 75%. Other tools, such as four-axes model (Goedkoop et al., 1999) and the Sustainable System Triangle (SST) (Brezet, Bijma, Ehrenfeld, & Silvester, 2001) are used to evaluate environmental impact among other criteria.

Furthermore, Mont (2002) maintains that to be sustainable, PSSs should be designed based on several criteria. For instance, the system should be competitive; the system should satisfy customer needs; and the system should have a lower environmental impact. This system should propose choices for the customer between selecting a service system solution that minimizes environmental impact and the ownership of a product. The service providers and producers should increase their responsibility to engage with the whole product life cycle, from the production to the disposal phase. Mont (2002) also argues that the goal of the PSS should reflect the reduction of environmental impacts based on these means: it should offer a closed loop material cycle, it increases the dematerialisation (decrease in material usage) and it provides solutions which integrate all the system elements with high efficiency.

A lot of attempts have been done to create sustainable PSSs in Europe and North America since late 1990s. Goedkoop et al. (1999) listed 140 PSSs in Europe and assessed a selection of 10 systems, which then were evaluated as potential systems that improve environmental impacts. SusHouse project in 2000 created sustainable product service systems for food, shelter and clothing services in 5 European countries, namely Germany, Hungary, Italy, Netherlands, and the United Kingdom, which resulted in positive feedbacks from its stakeholders in terms of ecological sustainability (Vergragt, 2000).

However, most of the current PSSs are created based on environmental and economic considerations and are driven based on regulations and corporate strategy. As a result, most of the evaluation of how good is the performance of the product service system is highly emphasized by the producer's point of view. Goedkoop et al's four axes model (1999), has factually evaluated PSSs based on four criteria, which are ecological impact, economic effect, identity and strategy, and customer acceptance. The customer acceptance assessment has been evaluated based on marketability and willingness of the customer to buy the PSS. Similar to Goedkoop's evaluation, the SusHouse project (Vergragt, 2000) has evaluated these systems based on environmental assessment, economic analysis, consumer acceptance and stakeholder strategy. The consumer acceptance evaluation is focused on the user acceptance of scenarios built on the particular PSSs.

What is lacking in the customer acceptance criterion is how the PSS satisfies user demands. The definition of PSS given by Ashford and Thomas (2004) above shows that functionality and satisfaction are the key points of the product service system. Thus, it is very important to ensure that PSSs will provide as a high satisfaction level as possible for the users.

Adopting Jordan's model regarding user satisfaction (Jordan, 2000), there are three levels of user satisfaction, which are functionality, usability and pleasurability. Functionality is the ability to "perform the tasks for which it is intended" (Jordan, 2000, p.5). Usability is the degree in which a specific target group can utilize a product to achieve certain objectives effectively, efficiently and satisfactorily in a certain context of use (ISO 9241 DIS 1994). Pleasurability is defined as the condition of consciousness or sensation induced by the enjoyment, delight and gratification (Tiger, 1992).

The supposition built prior to this research is that the functionality and the usability of PSSs will be at least the same as, or even better than the product system. Based on current product-service systems, most of PSS concepts which have been developed and evaluated have the same or even better functions because of better services provided, and technological application (Cooper & Evans, 2000; Goedkoop et al., 1999; Tischner, Verkuijl, & Tukker, 2002; Vergragt, 2000). Furthermore, the usability of PSSs is usually maintained to be the same as the product systems by providing well-planned and supportive infrastructure as well as regular maintenance as a result of long-term and legal responsibility of the service providers (Tischner et al., 2002).

The top level of human satisfaction based on Jordan's model is pleasurability. Jordan defines pleasurability as "the emotional, hedonic and practical benefits associated with products" (Jordan, 2000, p. 12). Moreover, he argues that pleasure can be considered as the means a product has to deliver potential advantages. This argument can be interpreted as the unfeasibility in achieving pleasure while a product is no longer privately owned. However, Tiger (1992) maintains that pleasures can be achieved when people have interaction with others and share their activities in a society. Based on this argument, product service systems can also fulfil user needs and satisfaction based on different types of pleasures.

This article is a result of the first part of a PhD research in investigating sustainable product service systems in Australia. As the initial stage, it focuses on the development of a theoretical background and a research methodology. The purpose of this article is to construct a framework and a research methodology of how pleasurability should be achieved in sustainable product service systems. The framework consists of the various possible criteria that should be considered in the sustainable product service systems and the way they achieve pleasurability. The methodology will define process and techniques for investigating and achieving the above purpose.
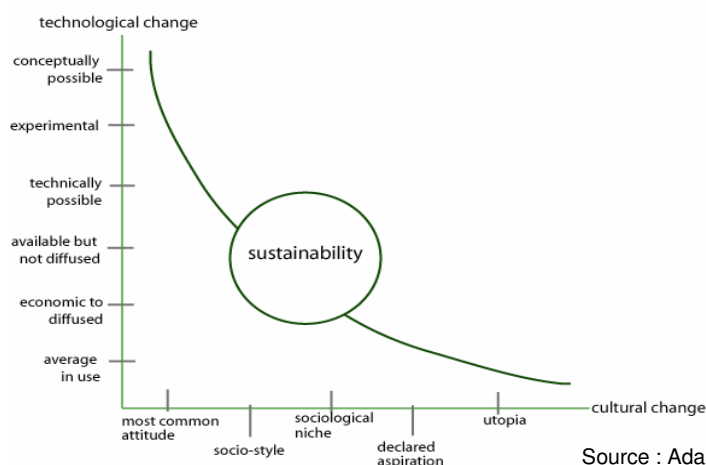
2. THEORETICAL FRAMEWORK

2.1. Sustainability
Manzini and Jegou define environmental sustainability as follows:

> the systemic condition by which human activities, at a wprldwide and regional level, do not disturb the natural cycles they are based on beyond the resilience limits of the ecosystem these cycle constitute, not, at the same time impoverish the natural capital to be inherited by future generations. (Manzini & Jegou, 2003, p.37)

They argue that, in addition to environmental sustainability, it is important to consider social sustainability where principles of fairness and responsibility towards the future are achieved in human activities without any conflict. To shift the society into a sustainable situation, Manzini and Jegou argue that a social learning process should be encouraged. This learning process is important to adopt new orientation in terms of sustainability even in a radical way.

Manzini and Jegou (2000) describe the concept of sustainability based on innovation in technological and social and cultural aspects. They maintain that a radical improvement of environmental impact can only be reached if industrial societies consider dramatic improvement of environmental performance by utilizing new technology and adopting a new way of behaviour in terms of consumption.

Source : Adapted from (Manzini & Jegou, 2000)

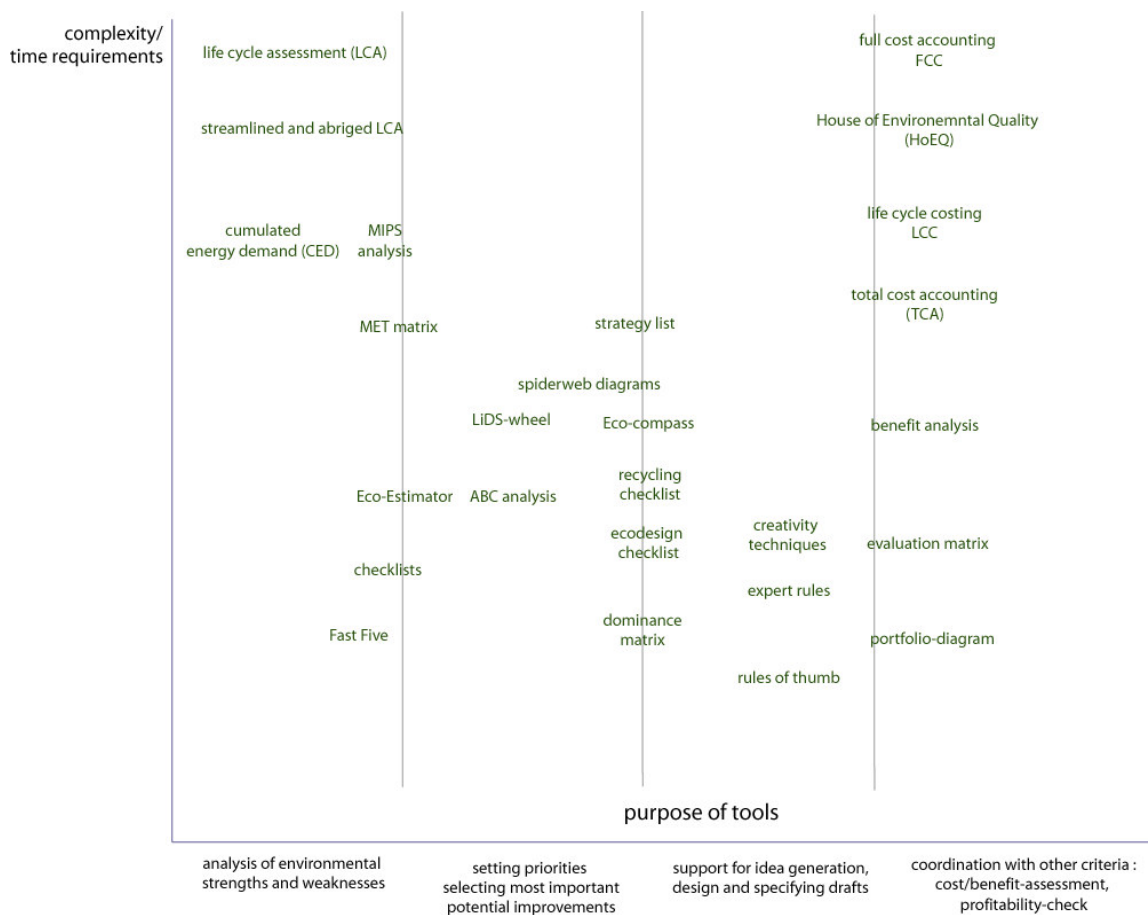**Figure 2 : Sustainability as the technological and cultural innovation**

Based on the area where sustainability applies (See Figure 2), it can be seen that it is necessary to adopt a sociological niche in consumption behaviour. It should be noted that the more users are attached to the traditional idea of ownership the more difficult it is to encourage them to shift their consumption behaviour to accept the idea of PSSs. This leads to a need to create scenarios that comfort users in accepting the product service system.

Tischner and Verkuijl (2002) observe that PSSs have a big opportunity to replace product systems in the applications having the following criteria :
1. comparatively expensive product price
2. low utilization and frequency of product use
3. wide possibility of using supplementary products that have higher quality
4. not-fully equipped appliances in households
5. gap between service and products in terms of quality and price
6. high expenses in repair and maintenance.

2.2. Techniques and tools of environmentally sustainable design
In Figure 3, Tischner and Dietz (2000) give a matrix that classifies the tools of environmentally sustainable design based on their complexity and their purposes. These tools are used by PSS designers in order to evaluate the performance of existing product service systems. MIPS (Material Input Per Service Unit) analysis, for example, is a tool used to interpret Factor 10 or Factor 4 criteria (Schmidt-Bleek, 1999). Some tools need comprehensive evaluations which leads to high time consumption, and some tools try to simplify the environmental evaluation but then integrate other assessment criteria, such as economical analysis or profitability, into them.

source : (Tischner & Dietz, 2000, p. 65)

Figure 3 : Tools for Ecodesign

Goedkoop et al. (1999) developed a four axes model that evaluates qualitatively four criteria, namely: environmental impacts, economic effects, identity and strategy, and customer acceptance. The environmental impacts are judged based on the qualitative measure of effectiveness and efficiency of natural resource use, energy consumption and other environmental burdens during its production, as well as use and disposal phases. Brezet et al. (2001) utilize the Sustainable Systems Triangle to evaluate PSS based on holistic approach of the improvement of user practice, infrastructure and device in terms of environmentally sustainable changes. I found that these two models can be categorised in the evaluation matrix area of Tischner (See Figure 3) and they are relatively less time consuming and they give more comprehensive analysis based on various criteria.

2.3. Model of pleasurability

Tiger (1992) mentions that pleasure is "a point on a continuum". Consequently, there is no single definition about it. As has been discussed previously, Jordan (2000) defines pleasurability as an emotion which relates to a product while Tiger argues that pleasurability should be observed both physically, such as taste and sensory, and theoretically, such as ideas, arts, and communication.

Tiger categorizes pleasure into four categories, which are physio-pleasure, socio-pleasure, psycho-pleasure and ideo-pleasure. Physio-pleasure is the pleasure that relates to sensory experience, such as the sensation of taste, smell, and sensual and general experiences that give a physical feeling such as the feeling as a result of massaging, exercising, sun-bathing or music listening. Tiger also notes that while physio-pleasure is an insufficient feeling of pleasure, it is useful because it is undeniable. Socio-pleasure is a shared joy occurring in a group of people when they interact to each other. An important part of socio-pleasure is morality because people usually dedicate their part of activities to a social group having rules and norms. Psycho-pleasure is principally an individual gratification of performing and accomplishing activities, which usually happens because of the existence of other people and the awareness of the reality. Ideo-pleasure is an enjoyment obtained from a mental experience and it is usually received from any of theoretical entities, activities and nature.

Pleasure is a unique personal experience, however, unless physio-pleasure, other types of pleasure can occur because of the interaction with other people or the real world. Socio-pleasure happens when a person interacts and has common activities with other people and psycho-pleasure occurs when a person can prove her/himself that (s)he can accomplish a task and may show this achievement to other people. Ideo-pleasure shows how a person can be delighted to assert his/her values in his/her activities and experiences. These values are usually constructed by norms and rules in the society or the family.

In this research, pleasurability will be observed on the basis of individuals' experiences in their social context. As a result, the research will focus more on socio, psycho and ideo-pleasures.

3. PROPOSED METHODOLOGY

3.1. Study

The investigation of pleasurability in sustainable product service systems in this research will focus on the systems that have an opportunity to improve the environmental sustainability significantly. The predetermined criteria of this kind of systems are adopted from Tischner and Verkuijl (2002) and Cooper and Evans (2000), which are :
- Significant reduction of the number of products used/produced
- Currently low utilization for private ownership (to create higher user participation)
- Technical lifetime is much longer than use lifetime
- Significant added value obtained by shifting products to services.

Based on these criteria, a study of toy library systems will be carried out. A toy library is a use-oriented PSS which lend educational products and toys for children. Similar to a public library, a toy library offers a variety of toys, games, and educational aids for different ages or development areas. Usually, users have to pay membership fees and may pay monthly fee or rental fee (Tischner et al., 2002).

Toy libraries have been existing in many countries, and there have been a lot of toy libraries in Australia. Most of City Councils in New South Wales, Australia have toy libraries with different facilities. In addition, there are some private organizations which also run toy libraries (The Bub Hub, http://www.bubhub.com.au/servicestoyhirensw.shtml).

A toy library is a product-service system which meets the opportunity to replace a product system and may lead to improve environmental impacts. If every family makes the choice to hire toys and games instead of owning them, there will be a significant reduction in toys and games used and purchased. For example, in Randwick City Council, 10% of the population (of about 11.850 children based on survey in 2001) are children from 0 to 9 years old (http://www.randwick.nsw.gov.au/ about_randwick/demographic_profile/population.php). If they share their toys and games from the Library (there is one toy library in this city council), a significant reduction of products usage will occur.

Toys and games are usually used in a very limited time, especially if the children have very few siblings or even do not have ones. Different age of children use different toys and games for their educational and entertainment purposes. Most likely, toys and games are specifically designed for a target age, such as from 3-12 months, from 1 ½ - 3 years, from 3-5 years and so forth. The different purposes and developmental areas of children make toys and games have low utilization or low user participation. Moreover, toys and games usually have been designed for long lifetime but it is used for only couple years which makes their technical lifetime not fully optimized.

Toy libraries can give added value because these libraries usually offer various programs, such as public lectures, kid's club or parents forum that offer children and parents to meet each other and to built social activities. In addition, libraries can be a place to effectively exchange information and to disseminate ideas and knowledge within the community.

3.2 Methodology

To observe how a toy library can fulfil pleasurability in users, a comprehensive study will be carried out. An interpretivism philosophy has been chosen because there are multiple external realities related to the interpretation

of pleasurability (Carson, Gilmore, Perry, & Gronhaug, 2001). In addition, this research tries to investigate how pleasurability can be achieved in the context of toy libraries in Australia.

Furthermore, the research methodology used is qualitative in nature and involves the hermeneutics approach. The hermeneutics approach is considered as the most appropriate perspective since hermeneutics often interpret the experiences and observations by trying to go beyond the observed phenomena and see the relationship of observable behaviour by "read(ing) between the lines" (Carson et al., 2001).

Two methods are selected to answer the research question, which are: case study approach and in-depth interview. Both methods are used to collect evidence in order to show the relationship between pleasurability and sustainability in product service systems, in the context of toy libraries. Each method has its own purpose and both are use to achieve cross sourcing which is an effective way of triangulation (Gillham, 2000).
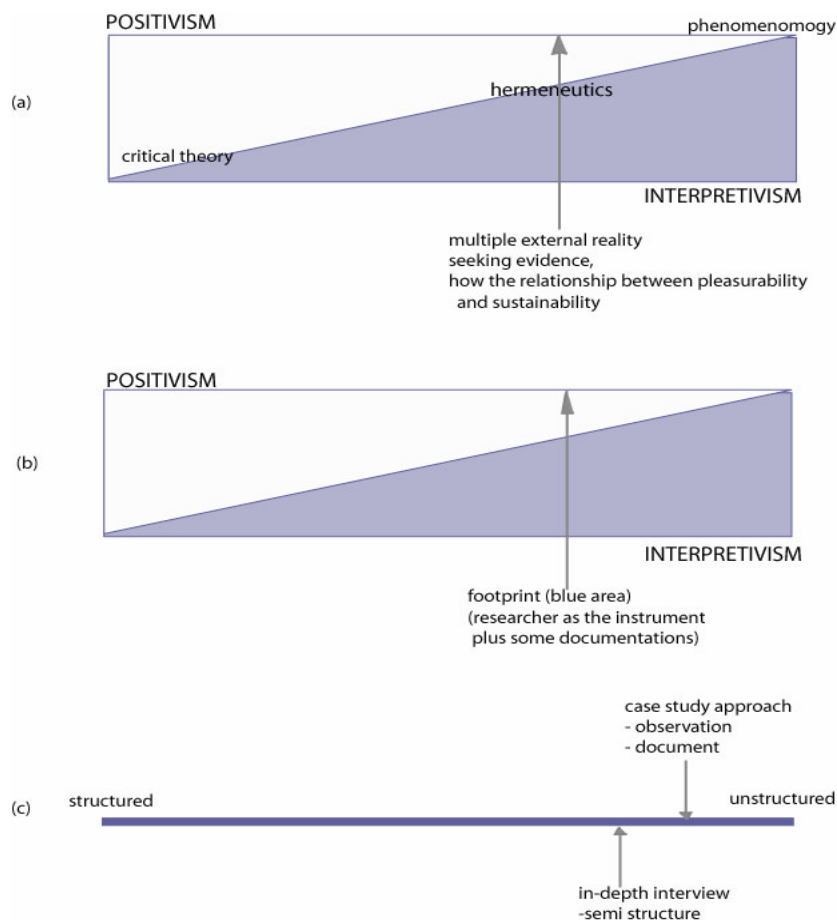
The case study used will be an explanatory approach, which incorporates observation and document collection from several toy libraries in New South Wales, Australia. From this observation and interpretation of documents, in-depth interview will be performed, focusing on some particular interesting phenomena that link sustainability and pleasurability. In-depth interviewing will be done with several different stakeholders, such as parents, designers (of public facilities and toy and educational products), and librarians as the service providers.

The stakeholders selected are people who already are in a kind of sociological niche in terms of consumption behaviour. The hypothesis used in the initial stage of observation is that people who use a toy library have already been thinking about other modes of consumption, which is use-oriented rather than own-oriented.

3.3. Framework
Figure 4 demonstrates the framework of the research in terms of its philosophy, research position, and the nature of data. The philosophical background of this research is interpretivism; and only few assumptions are set prior to the study. The two assumptions used are :
1. Pleasurability is the top level of user satisfaction (referring to Jordan's model) and functionality and usability of the to library system observed (which are the basic and intermediate level of user satisfaction) are at least the same as or even better than the preference of owning private toys and games. In other words, the toy library system has achieved an acceptable level of functionality and usability.
2. A toy library system has these characteristics : it gives significant reduction in the number of products used/produced, it has currently low utilization for private ownership, its products' technical lifetime are much longer than use lifetime, it has significant added value obtained by shifting products to services.

Source : adapted from (Carson et al. 2001)

Figure 4 : Framework of research

These assumptions are given to narrow down the focus of the research topic, and they are not fundamental theory; they can be used as a guide but they are not meant to be tested. The research will focus more on the reflection of the experiences and evidence obtained through the observation and the study. Based on this study, a theory is aimed to be built. As a result, induction method is used with a balance of deduction method, in order to help in preventing the study from creating a very different theory to what has been expected.

In the in-depth interview and case-study approaches that will be used in this research, the researchers are the instruments of research, as a result, the research position will be most of the footprint of the study. Additional data from documents are used to add to the overall study.

The nature of data used in this study is mostly semi-structured. A literature review done earlier has helped in structuring the required data as well as helping the study to be less time consuming.

4. FURTHER WORK AND SUMMARY

Based on the above theoretical background and the framework of the study, an observation will start immediately. Several cases of toy library will be selected, a documentation process will be performed and target users for the in-depth interview will be selected.

No conclusion can be made in this preliminary stage, but a summary can be drawn.

A product service system is believed to reduce the environmental impact while it also improves the effects of the economics. It has positive impact on identity and business strategy and it gains customer acceptance. However, since there is no adequate information claiming that existing PSSs improve or maintain customer satisfaction, this research is then carried out. Qualitative research methods based on the interpretivism philosophy has been chosen., Case study approach and in-depth interview will be utilized during this study as the two main methods.

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