

# Design as the Integrator in Service-Product Systems

- with cases on Public Bike Rental Systems -

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**Abstract:** In continued efforts to provide users with fuller experiences, one major trend is the blending of products and services. From extensive critical literature study with relevant cases, broadly, two major approaches seem to exist in this area: 1. PS (Product-to-Service), 2. SP (Service-to-Product). The former generally indicates adding more services to existing products, whereas the latter generally refers to making services tangible and/or visible in the form of a product. However, one important deficiency in dealing with service issues around the product was found: the ‘integration’ between the actual product design and service elements for supporting a new service-product system. That is the rationale behind this research, an attempt to investigate the possibility for the integration of product design and service factors which can be embedded in the design of the product itself in a new service-product system.

This research attempts to identify the relationship between service and product in two different approaches, viz. PS (Product-to-Service) and SP (Service-to-Product). Furthermore, it aims to establish the role of design in the integration of service and product, and to suggest the Design-led Service-Product (DLSP) model as guidance for a new service-product system development.

From the five critical case studies on public bike rental systems, this research identified various features consisting of the service-product system and the role of design regarding each feature to support the DLSP model. The DLSP model refers to the integration of a core service and specially developed products for the system. In DLSP, design is an essential tool rather than a promotional or supplemental element. Therefore, it can be utilized as a basis of a new service-product system development process.

**Key words:** *Product-to-Service; Service-to-Product; Industrial Design; Integration; Design-led*

## 1. Introduction

### 1.1. Background

The current approaches to service-product combined systems include product-to-service and service-to-product. The former introduces service elements to existing products such as maintenance service, while the latter attempts to add tangibility to otherwise intangible service, such as packaging for computer software (Jung &

Nam, 2008). Having identified design opportunities in service-product systems in the previous research (Jung & Nam, 2008), this paper attempts to propose a process model for integrating service and product through design in the context of public bike rental system.

## 1.2. Aims

The aims of the research are:

- To review different approaches to the blending of service and product
- To identify how service and product is integrated in public bike rental cases
- To establish the current and possible role of design in public bike rental cases
- To refine the process model for the design-led service-product integration

## 2. The Blending of Product and Service

### 2.1. The Notion of Service

In this research, the notion of Product-to-Service (PS) and Service-to-Product (SP) are important in establishing the current practice in service-product combination. However, before discussing the concept of the two approaches, it is important to note that the concept of ‘service’ in each approach is different. As defined by Smith (1997), the service concept is ‘the bundle of goods and services that are sold to the consumer and their relative importance’. Despite its frequent usage, little has been written about the service concept itself and its important role in service design and development (Goldestein *et al.*, 2002). Nevertheless, it is generally accepted that service is intangible and experience-oriented (Clark *et al.*, 2000; Johnston & Clark, 2001; Radford, 2004; Kuczmarshi *et al.*, 2005; Kundu *et al.*, 2007).

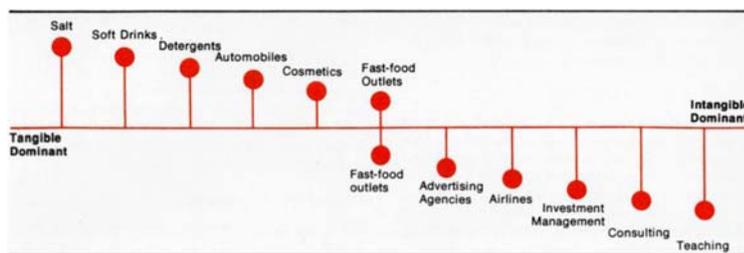


Figure. 1 Market entities (source: Shostack, 1977)

Within such boundary conditions, the service concepts in the two approaches differ in role and scope. Shostack (1977) claimed that market entities can be categorized at a point on a continuum between tangible dominant and intangible dominant as shown in Figure 1.

The service, in tangible dominant entities (PS) such as automobiles and cosmetic, denotes benefits or values ‘added-on’ to the existing product (e.g. the maintenance service for changing filters on a water purifier).

However, in intangible dominant entities (SP), key characteristics of service are intangibility, perishability, non-ownership, inseparability of production and consumption, and variability (Kundu *et al.*, 2007). Needs of customers may be taken into account as small variations in the core service, or through modularization. Different combinations of modules can satisfy the customization systemically (Valminen & Toivonen, 2007). Examples of this may include technical information system, financial scheme, advice, and consulting service.

With this difference in the notion of ‘service’ between the two approaches, the concept and characteristics of PS and SP are described in the next sections.

#### 2.1.1. Types of Service Product Systems

#### 2.1.2. Product-to-Service (PS)

According to Mont (2002), PS (Product-to-Service or Product-Servicization) is “a marketable set of products and services capable of jointly fulfilling a user’s need”. Other similar terms include “product service combinations”, “product servicization”, “integrated product-service offerings”, “integrated product and service engineering”, and “servicizing” (Sundin, 2007; Lindahl et al., 2007).

The definition of PS as being “jointly fulfilling” a user’s need seems to suggest that service and product could be somehow ‘integrated’. However, use-related services such as point of sale (POS), advice for operation, maintenance services, and take-back services are regarded as important service factors in this area (Jung & Nam, 2008). This means that the service is subordinate to product in the PS model.

Frambach (1997)’s identification of product services as being ‘additional services and benefits supplementing tangible product support’ is viewed. Williams (2007) proposed different types of service factors in PS: 1) product-oriented services (e.g. maintenance contract, advice and consultancy), 2) use-oriented services (e.g. leasing or sharing), 3) result-oriented services, (e.g. mobility). This again confirms that the service factors pivot around the existing product in the PS model, making the service supplementary to the product, rather than ‘integrating’ product with service on equal ground.

Jung & Nam (2008) presented Woongjin Coway’s water purifier as a typical example of PS. Woongjin Coway offered a home-visit maintenance service such as changing filters and cleaning on a regular basis. This example clearly shows that the product and service ‘jointly fulfilling’ users’ needs means the service factor is a supplementary tool to increase the product appeal in the PS model.

### **2.1.3. Service-to-Product (SP)**

In contrast to PS, SP (Service-to-Product, or Service-productization) is usually referred to as being making the service offering more ‘product like’ (Valminen & Toivonen, 2007). The intangibility of service makes it difficult for the customers comprehend and/or recognize its value, because the customer cannot perceive it by sensory means. Thus SP focuses on associating tangible features to intangible service offerings (Radford, 2004). These could be in the form of packaging of software, methodology, pricing and facilities. It puts emphasis on the ‘delivery’ of services and making intangible service visible and stable in various ways (Jung & Nam 2008). Therefore, the ‘product’ part of SP could be a mere tangible presentation of a service offering, making product subordinate to service. This is opposite to the PS model while being identical to it in the sense that one element is a supplement to the other, rather than the integration of the two elements.

An investigation into the current approaches to the service-product combined systems established that there was currently a lack of research on the true integration of service and product. This suggests that an academic investigation into the integration of service and product through design might be a compelling attempt.

An example of the SP model could be the promotional products used by KTF, a Korean mobile communication service provider (Jung & Nam, 2008). KTF attempted to use product design for their service by launching several products, including an umbrella, a diary and a memo cube. The purpose of ‘Good Time’ umbrella is reinforcing the service with offering a tangible element. The KTF’s case is even more so with seemingly unrelated products to mobile telecommunication such as the umbrella. The ‘tangibility’ of the umbrella is associated with creating an image for the service hence more indirect and less ‘integrated’ with the service than, for example, the packaging for computer software.

## **3. Service-Product Integration in Public Bike Rental System (PBRS)**

### 3.1. PBRS as a model for Service-Product Integration

Public Bike Rental System (PBRS) revealed yet another approach to dealing with combining service and product. In this approach, the link between service and product was the strongest and most intertwined with each other. Unlike the other two approaches (PS and SP) discussed earlier, the ‘integration’ of product and service may be possible in this model. There are specially developed products (e.g. bicycles, kiosks, ID cards) to support the service scheme (bike rental service) in the system (Figure. 2).

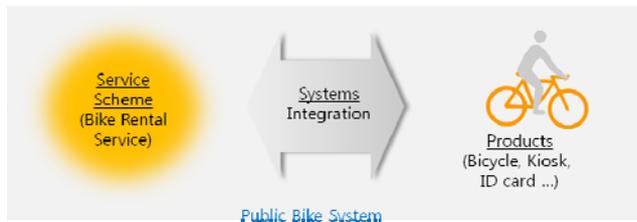


Figure. 2 Public Bike Rental System composition

The reasons why PBRS was selected as a good example of a service-product combined system are because; 1) products are the key elements in delivering service in PBRS, 2) PBRS has the potential to utilize design as a powerful medium through which the service scheme can be realized and improved, and 3) the products which are

elements of PBRS were especially designed and developed according to the system development process.

### 3.2. Case Studies

Five cases were selected for PBRS; 1) Conscience Bike System, 2) SC Happy World Ltd., 3) LG CNS, 4) IP Decaux, and 5) Hanwha S&C and INNO Design. The five cases were the representative available such cases at the time of data collection in S. Korea, as PBRS was still in an infant stage. The five cases were deemed appropriate for the research since they had very different project characteristics in relation to participants and stakeholders, together offering a variety of issues.

#### 3.2.1. Conscience Bike System

The Conscience Bike System emerged as a result of a campaign run by Songpa District Office in Seoul to encourage the use of the bicycle, which is local government policy, in 2007. 200 ready-made bikes were donated by the local Lions Club for the purpose, and the bikes were simply painted yellow. There were no specialized products for the system, and no regulation to control the system. The local people were to freely borrow the yellow painted bicycles from unmanned bike-stands and to return them voluntarily (Figure 3). As a result, this system failed within three months, because half the bicycles had been stolen and the others were used only by the few who used the bikes as if they belonged to them without returning the bicycles.



Figure. 3 Process for Conscience Bike System

The service scheme in this case is very crude on the verge of being virtually non-existent. The bikes were simply put in place without any security measures to protect them from theft or damage for anyone to take and return at will. The products that supported the service were aptly crude for the poorly planned and ran service scheme.

The bike was a commercially available model, so people could not distinguish it from personal ones. Like the service scheme itself, the products did not have any security locks or tracking devices to protect the bicycle and to maintain the system. A more effective service scheme would have required special products (e.g. the developed bicycle, kiosk) to support the bike rental service. Both the service and products would have benefited from design inputs.

The case also reveals an opportunity for design to influence service retrospectively. Good design contains considerations for the user and its context. This would mean that the service scheme itself could be influenced or even improved by good product design. For example, if a security feature was designed-in on the system, the theft that threatened the very existence of the service itself could have been prevented or at least significantly reduced, thereby improving the service scheme. Conversely, this would also mean that if design was considered with the service at the planning stage, the 'design' part would have enhanced the quality of service. In fact, it could be stated that the service, product and system should have been 'designed' together from the beginning.

### 3.2.2. SC Happy World Ltd.

After the Conscience Bike campaign, the District of Songpa established other public bicycle rental system (PBRS) in S. Korea. The development process for the new system as a pilot scheme was design-led since the Chairman of SC Happy World Ltd. was a designer. He directed at every stage of the development process.

The impetus for a new system came from two main sources, viz government policies (e.g. considering high oil price, CO<sub>2</sub> emission, and 'U-city' (ubiquitous city)) and the problems with the existing rental bike system based on free. For enhancing the use of PBRS, Songpa attempted to establish a road network for the bicycle.

At the initial stage, possible problems and basis solutions were defined by means of design and technology as the designer and system developers participated together from planning stage. Subsequently, many scenarios regarding the use of the system were developed by the designers and system developers.

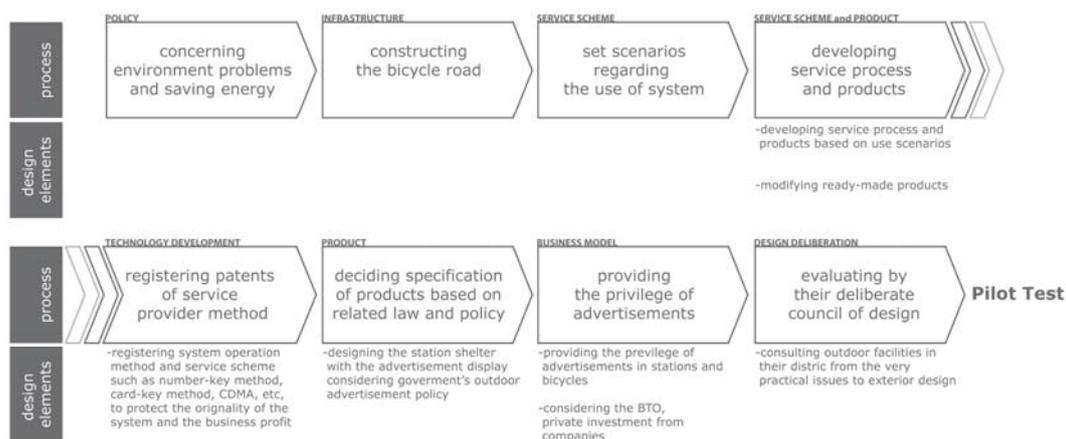


Figure. 4 Process for case of SC Happy World Ltd

The service scheme and products were developed based on the use scenarios. Most products (e.g. kiosks, locking system, and ID card) were created for the new system, except for the bike. As for the bike, a ready-made product was modified to suit the purpose, since this process was for a pilot system of only 30 bicycles. The bike had little or no differentiation compared to personal ones. This would be a weakness as a public facility, since it missed the chance to achieve a kind of symbol of the new public system by design. After the PBRS in Songpa was assessed by their design evaluation committee, the PBRS was launched as a test pilot. However, lots of people

did not know how to use the system. The system provided instructions, rather than improving the product itself for more ease of use. This is much closer to a passive solution compared to the innovative service-product system.

In SC Happy World Ltd. case, the strong feature was that designer participated from the planning phase of development process. All stages were preceded with designer and developers. As a result, this system was well-structured, for example web-site offering information on PBRS and specially developed products including a kiosk with security lock system and ID card. However, this case did not consider the bike's usability and affordability. It caused the many people did not recognize the new system.

### 3.2.3. LG CNS

Yuseong which is one of districts in Daejeon has started to boost the use of bicycle as a new public transportation system from 2003. The PBRS in Yuseong was developed by LG CNS. LG CNS planned and directed the whole system development including service scheme and products (Figure. 5).

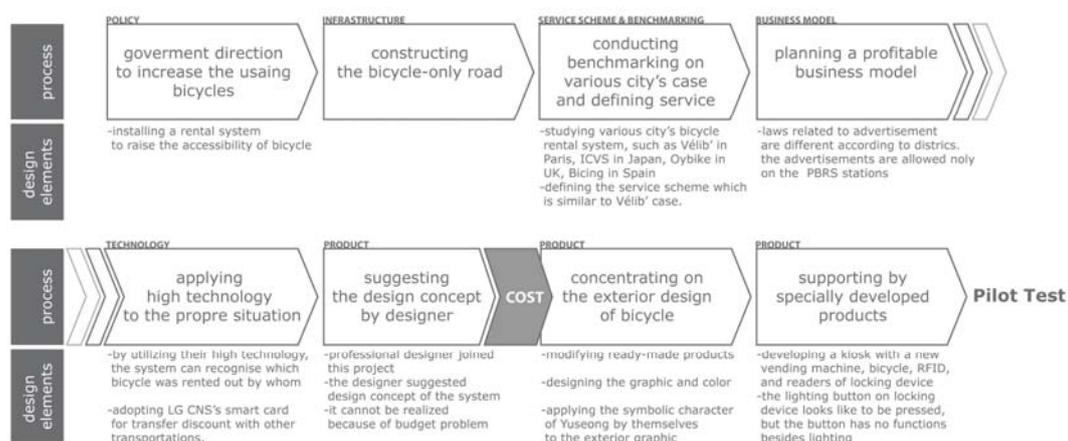


Figure. 5 Process for case of LG CNS

At the planning phase, design concepts of the system were suggested by the designer (Figure 6, left). However, it cannot be realized because of budget problems for balancing between production cost and the quality of the service. Finally, just the exterior design such as the graphic and color were considered (Figure 6, right). The bike in this case was applied the symbolic character of Yuseong by themselves to the exterior graphic. For the same reason with case of SC Happy World Ltd., Yuseong's PBRS also missed the chance to achieve a symbol of PBRS by its unique design.



Figure. 6 A concept by a designer's suggestion (left) / The bicycle exterior design in Yuseong's PBRS (right)

This PBRS was utilized with technology due to LG CNS as an IT company. The company's high technology was applied to solve problems which can be occurred in various possible situations. This condition can improve the quality of service, and users can satisfy the service-product system. However, most product components of the

system were developed by modifying ready-made products, because this project was aimed to field test including only tens of bicycles and two stations. This cause that modified products cannot fully reflect the user's needs in the system. For instance, the bicycle with a basket which used in this system, it appeared feminine, so that the bike could not attract male users.

In this light, the LG CNS would have focused on design. Design is critical to establish the system's whole concept and consistency. Design can be core key to have service process, software, and products be in one context with consistency.

### 3.2.4. IP Decaux

IP Decaux is the subsidiary company of JC Decaux in S. Korea. JC Decaux has various experiences of PBRS including Vélib' in Paris. IP Decaux imported the system in S. Korea, and is modifying this system according to S. Korea's circumstance. Therefore, their development process is so simple, since IP Decaux just utilized the JC Decaux' system.

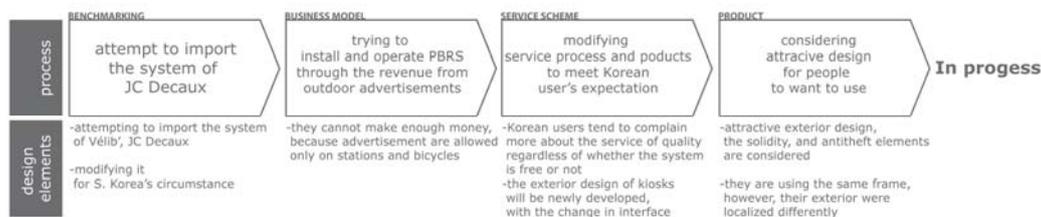


Figure 7. Process for case of IP Decaux

Above all, the service scheme was modified, since the expectation and behavior of users also differ from each other. Korean user's expectations of service tend to be much higher than European's. Korean users used to complain more about the service quality regardless of whether the system is free or not. Because of this, the service process needs to be modified to meet the local user's expectation. Subsequently, the products including bicycle, and kiosk were developed based on the modified service scheme.

In the case of Vélib', there was special design to distinguish it from others. The bike of Vélib' was developed with unique exterior and the siren which sounds when the bike was not returned within 24 hours. The exterior design of products (e.g. handle cover, a mud flap, and a wheel) was changed to express the city's atmosphere. By having specialized product, the system can catch the public's eye and introduce the new system to public as well as can help antitheft elements. This system differentiation is important in case of public facility. With the PBRS was recognized as new transportation system, environment for PBRS was improved such as bike rider's safety as car driver gave more attention to bike. Design's role is very significant to gain high recognitions as new culture.

### 3.2.5. Hanhwa S&C and INNO Design

Hanhwa S&C is an IT solution company, and INNO Design is a famous design consulting firm in S. Korea. Unlike other cases, this project was focused on marketing and brand value of PBRS and users than technology issue. This system development is still unfinished, so that system composition of this case is not established. While development process was being in progress, the specification of service and products were established according to the general outlines of the service scheme were suggested.

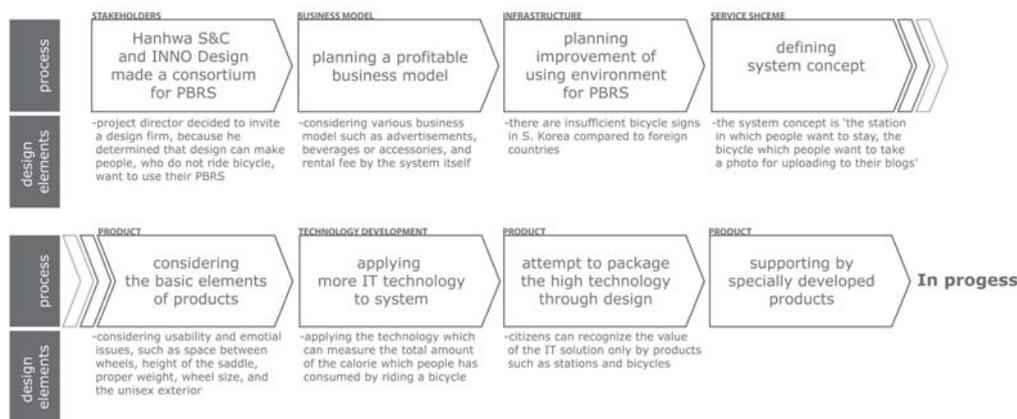


Figure 8. Process for case of Hanwha S&C and INNO Design

In this case, the system concept is 'the station in which people want to stay, the bicycle which people want to take a photo for uploading to their blogs'. After defining the concept, the basic elements of products were developed. At first, the bicycle was developed considering usability to be easy to ride for anyone (e.g. weight of the bicycle, the wheel size, and the unisex exterior). Also, this concept affects the advertisement on the products. For example, cheap advertisement on the bicycle will not enhance user's pride, and so will be restricted to high name-recognition brands. Design concept is important to direct whole system development including the profit source, the product housing, and product specifications.

After defining the design concept and product's outline, IT technology applied to this system. Inside technology is very expensive, but the citizens cannot see and touch the value of the technology. Therefore, Hanwha S&C and INNO Design attempted to package the high technology through design. For example, IT technology can measure the total amount of the calorie which people has consumed by riding PBRs's bicycle, then design can show it as an iconic symbol. Design can be a delivery media to make people feel the value of technology through tangible products. Design is the touch between the system and citizen.

#### 4. Conclusion : Design as an Integrator of SPCS

##### 4.1. The Role of Design in Service-Product Integration in PBRs

The public rental bike system (PBRs) consists of; 1) core service (e.g. rental service) which is the value and goal delivered to user ultimately, 2) products (e.g. bike, kiosk, security device) which convert the intangible value into being tangible, and 3) technology (e.g. tracker, transfer discount with bus or subway) which connects service scheme with products, and improves the quality of service scheme. As discussed in cases study, the main elements (e.g. core service, products and technology) of PBRs have been under the influence of design.

Firstly, design's participation at the system planning stage of process is critical for successful settlement of new system. Above all, in the early of the development process, the main concept for service system need to be established. Subsequently, the service scheme need to be developed based on the defined concept by design. In the case of Hanwha S&C and INNO Design, elements such as service scheme, products, and even profit source were developed in a context with consistency, since whole processes were conducted based on defined concept which established at the early stage. In contrast, the Conscience Bike Campaign had nothing well-structured, since the process did not have a strong and clear direction to develop specific service factors. In the end, such stage caused poor quality of service scheme and products. Therefore, design's participant should be expanded to

whole development process. When the service concept is defined, the whole process can be conducted with consistency. Furthermore, it can be opportunity for strong identity of new system.

Secondly, designing specialized products are effective to establish the identity of new system. Also, the products based on usability and affordability can be more powerful tool to inform the new system by product itself. In the case of SC Happy World, the system has no significant impact on generating the new PBRS as new transportation to citizens, although the system was innovative. If this case modified the bike properly to deliver the service, the products itself would have had high recognition to citizens. In contrast, the case of JC Decaux, Vélib' became new culture and new type of transportations in Paris, since the system had their own products which were specially designed, even considering for local circumstance. The products need be improved to acquire strong identity, especially in case of offering new system. The well-designed products can be effective way to inform the new system itself to public. In this light, design can be opportunity for user to understand as new culture as well as symbol of public system or local representative.

Lastly, design can be touch point to convert the intangible service and technology into being tangible. The value of technology which is for high quality of service was shown through products' design in PBRS. In the cases of LG CNS, their own high technology was applied to solve most problems. However, the products in this system did not show inside technology, in the end, the products could not satisfy the user's expectation. In contrast, in the case of Hanwha S&C and INNO Design, inside IT technology was packaged through design. Their products were developed as users can see and feel their high technology. Design can be delivery media of the value of the system including offered service and supported technology. Therefore, the system developers should be concern not only attractive exterior design but also design which reflective the system itself.

The role of design in PBRS; 1) Design's participation from the planning stage can direct the whole process with definite concept, 2) Specialized products by design can be strong identity of new system, and 3) Design can convert intangible service into tangible value. The development process for PBRS needs to be developed considering such design's role.

#### **4.2. The Design-led Service-Product (DLSP) Process**

As discussed before, core elements of the PBRS have close correlation with design. However, as shown in case studies, the degree of design's participation and effect were various in each development processes, since there was not the development process for integration between service and product based on design. Although the importance of design in process was recognized in some cases, the utilizing design as a strategy tool was difficult. In this light, the Design-led Service-Product (DLSP) process is a new model which is for developing the new service can be realized by specialized product by design differentiation.

Figure 9 is a modified Stage-Gate process for the service-product combined system. The basic structure of DLSP process was derived from a typical five-stage, five-gate stage-gate process which was provided by Cooper & Edgett (1999). For establishing the new process, all process of studied cases was analyzed according to typical stage-gate process, and reorganized with priority given to the strong points in each case.

The process goes through 8 stages from problems and needs identification to post launch review, and there are activities regarding design at each stages. In the DLSP process, design is utilized as an integrator to fulfill the user's satisfaction and to help the system's successful settlement. The interesting point is that this DLSP model has the process of 'Post launch review'. The launch is not the last stage in offering service system, since service

needs constant monitoring and assessment to make sure that it is still addressing relevant consumer needs in the most efficient and effective way possible.

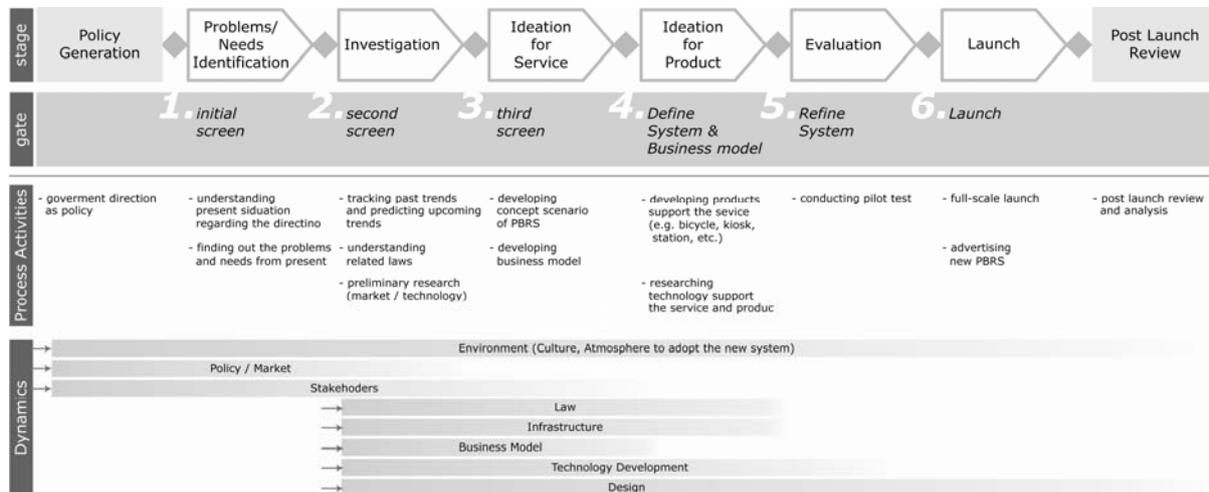


Figure 9. Design-led Service-Product (DLSP) process for PBRS

#### 4.3. Further Research

This research attempted to establish the role of design in a service-product system. However, the cases for analysis of the design opportunities were restricted to public bike rental systems. For this reason, it is hard to generalize the DLSP model to other service-product systems in different areas. For example, the supporting features (e.g. such as environment, policy, law, business model, infrastructure, technology, stakeholders) can be changed according to other area's characteristics. To cover many service-product systems in broader areas, more case studies in different areas except public transportation systems are needed for further research.

#### 5. Reference

- [1] Clark, G.L. *et al.* (2000). Exploiting the service concept for service design and development, In: Fitzsimmons, J., Fitzsimmons, M. (Eds.), *New Service Design*. Thousand Oaks, CA.: Sage, pp.71-91
- [2] Frambach R. T. *et al.* (1997). Proactive Product Service Strategies: an application in the European Health Market, *Industrial Marketing Management* 26, Elsevier Science Inc. pp.341-352.
- [3] Goldstein, S. M. *et al.* (2002). The Service Concept: The Missing Link in Service Design Research?, *Journal of Operations Management* 20, pp. 121-134.
- [4] Johnston, R., Clark, G. (2001). *Service Operations Management*. Harlow: Prentice-Hall
- [5] Jung, M, Nam, K (2008). Design Opportunities in Service-Product Combined Systems, *Proceedings of Design Research Society 2008 Conference*, Sheffield, U.K.
- [6] Kuczmarshi T. D., Johnston Z. T. (2005). Service Development, in Kenneth B. Kahn (Eds.), *The PDMA handbook of new product development* (pp.92-107), New Jersey: John Wiley & Sons, Inc.
- [7] Kundu S. *et al.* (2007). Implications for Engineering Information Systems Design in the Product-service Paradigm, in Shozo T. & Yasushi U. (Eds.), *Proceedings of the 14th CIRP Conference on Life Cycle Engineering*, Waseda University, Tokyo, Japan, London: Springer-Verlag, pp.165-170
- [8] Lee, W. S., Kim, B. Y., 2008, Designed by KTF: A Telecoms Case Study, *Design Management Review*, vol 9, no 1. Boston: Design Management Institute

- [9] Lindahl M. et al. (2007). Integrated Product and Service Engineering versus Design for Environment-A comparison and evaluation of advantages and disadvantages, in Shozo T. & Yasushi U. (Eds.), *Proceedings of the 14th CIRP Conference on Life Cycle Engineering*, Waseda University, Tokyo, Japan (pp.149-154). London: Springer-Verlag
- [10] Mont O.K. (2002). Clarifying the concept of product-service system, *Journal of Cleaner Production* vol 10. pp.237-245
- [11] Radford J. (2004). *Service Productization*, Reproduced by Microsoft Corporation and Epicor Software Corporation with permission from JB Radford LLC.
- [12] Shostack G. L., (1977). Breaking Free From Product Marketing, *The Journal of Marketing*, vol. 41, American Marketing Association, pp. 73-80
- [13] Smith J. H. (1997). Production Strategy Concepts. *Technology Management And Entrepreneurship*, Engineering University of New Brunswick. Website:  
[http://www.unb.ca/jhsc/resourcectr/TME\\_courses/tme3113/production/](http://www.unb.ca/jhsc/resourcectr/TME_courses/tme3113/production/), accessed May 2008
- [14] Sundin, E. (2007). Design for Integrated Product-Service Offerings-A case study of soil compactors, in Shozo T. & Yasushi U. (Eds.), *Proceedings of the 14th CIRP Conference on Life Cycle Engineering*, Waseda University, Tokyo, Japan (pp.149-154). London: Springer-Verlag
- [15] Valminen, K., & Toivonen, M. (2007). Improving competitiveness and performance through service productization? A case study of small KIBS companies participating in a productization project, *Service Engineering and Management Summer School (SEM 2007)*. Helsinki University of Technology. September 10.
- [16] Williams, A. (2007). Product service systems in the automobile industry: contribution to system innovation?, *Journal of Cleaner Production* 15. pp.1093-1103.
- [17] Cooper R. G., Edgett S. J. (1999). *Product development for the service sector*, Basic Books, A Member of the Perseus Books Group, New York