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A DESIGN CASE OF PRODUCT-SERVICE SYSTEMS – URBAN UMBRELLA RENTAL PSS

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1. Introduction

As market competition has been more intense and customers' expectations have been rising, there have been significant efforts to meet this challenge by creating new values. Thus, the value creation paradigm in industry has recently been shifting toward value creation through Product-Service Systems (PSS) where product and service elements are tightly integrated as systems. The PSS was defined PSS as a marketable set of products and services, jointly capable of fulfilling a user's need [Goedkoop et al. 1999]. PSS was also defined as a system of products, services, supporting networks and infrastructure satisfying customer needs and having a lower environmental impact than traditional business models and an integrated body of products and services and communication strategies that was conceived, developed and promoted by (a network of) actors to generate values for society [Mont 2002, 2004] and [van Halen et al. 2005].

PSS includes several product elements and service elements that are closely related to each other. A graphical diagram of the generation of a PSS from a single product is shown in Figure 1. A product P is further divided into several product elements P_i. Some of the existing products elements are selected with consideration of new values V_k, New product elements P_j, some of which could be out-sourced, can be added. Also new service elements S, some of which are co-created services by service receivers and some are provided by service providers, can be designed and connected with product elements in an appropriate fashion to achieve the identified values. As a result, a PSS can be generated [Kim et al. 2009].
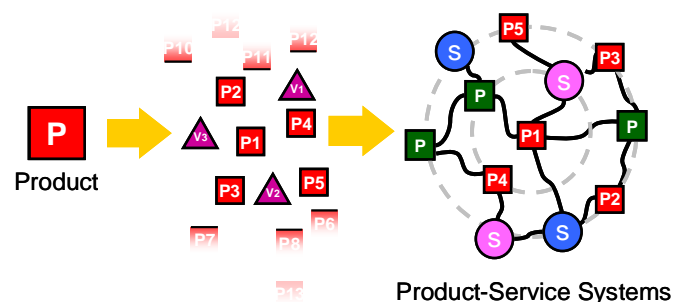

Figure 1. Schematic diagram of PSS development [Kim et al. 2009]

The methodological framework by Morelli proposed the procedural steps for PSS design including value proposition, market analysis, product/service definition, use-case analysis, tentative architecture, test and final definition [Morelli 2003]. Aurich et al. researched the design process of products and services from the view of their life cycles with the concept of process modularization [Aurich et al. 2006]. Shimomura and his colleagues also worked on service design methodologies [Sakao and

Shimomura 2007]. The service model including several sub-models of flow model, scope model, view model and scenario model was proposed, and a receiver state parameter (RSP) was also introduced to describe value and cost. Recently a comprehensive framework for PSS design as well as computer-based support tools has been developed by Kim and his collaborators at the Creative Design Institute [Kim et al. 2011 a]. In addition, to ensure the implementation and a success of PSS in the market, a supporting business model should be identified and considered with the PSS concept [Lee et al. 2011]. This paper presents a PSS design case developed using the PSS design method proposed by CDI where an umbrella rental PSS for urban cities has been developed.

2. Product-service systems design process

The systematic PSS design process is composed of the following 6 major phases: (1) Requirement Identification and Value Targeting, (2) Stakeholder Activity Design, (3) PSS Function Modelling, (4) Function-Activity Mapping and PSS Concept Generation, (5) PSS Concept Detailing, and (6) PSS Concept Prototyping [Kim et al. 2011 b]. Figure 2 shows the schematic diagram of PSS design process.
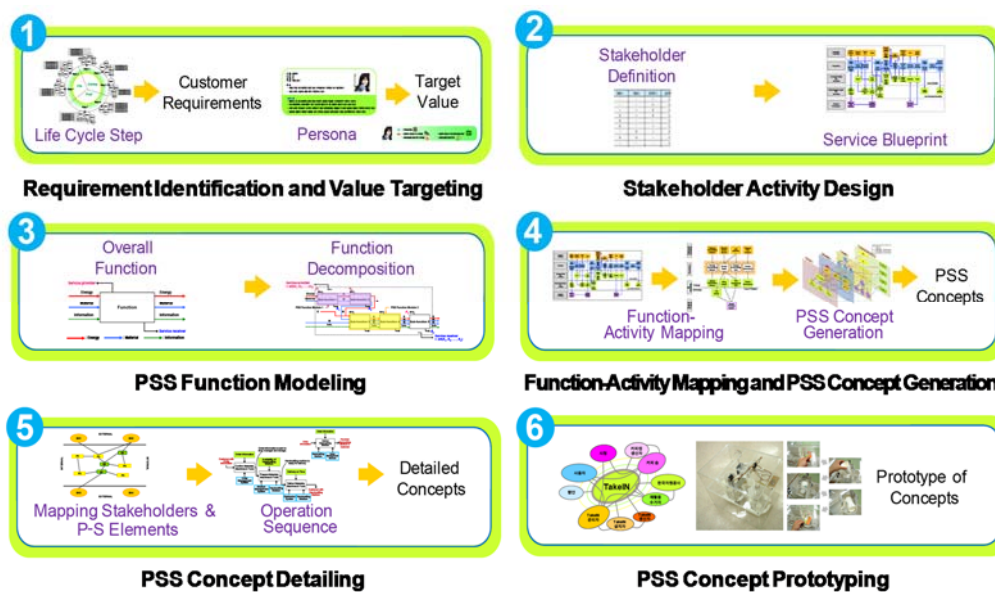

Figure 2. Schematic diagram of PSS design process [Kim et al. 2011 b]

During the PSS design process, a number of specific design steps are conducted to proceed the design process. These design steps are life-cycle step analysis, identification of stakeholders and requirements, value identification based on the value framework composed of economical, ecological and experience values called the E3 values, PSS scenario generation, service blueprint with context-based activity modeling, business model analysis, PSS function analysis and PSS representation with linkage between service and product elements. The abovementioned steps are iteratively addressed during the PSS design process. It should be noted that stakeholders activity design constitutes the essence of the PSS design process where detail activities are modeled using the context-based activity modeling method [Kim and Lee 2011].

3. Case example: Urban umbrella rental PSS

To examine the effectiveness and applicability of the PSS design method, the case study on the urban umbrella rental PSS was conducted. Firstly, the probable scenario associated with the umbrella given in Figure 3 was explored. People might need the umbrellas at the public place in the case of sudden raining. In addition, people might have difficulty of carrying the umbrella when they take on the subway and the floors of a public transportation place such as a subway could be very slippery due to water dropped from the umbrellas.
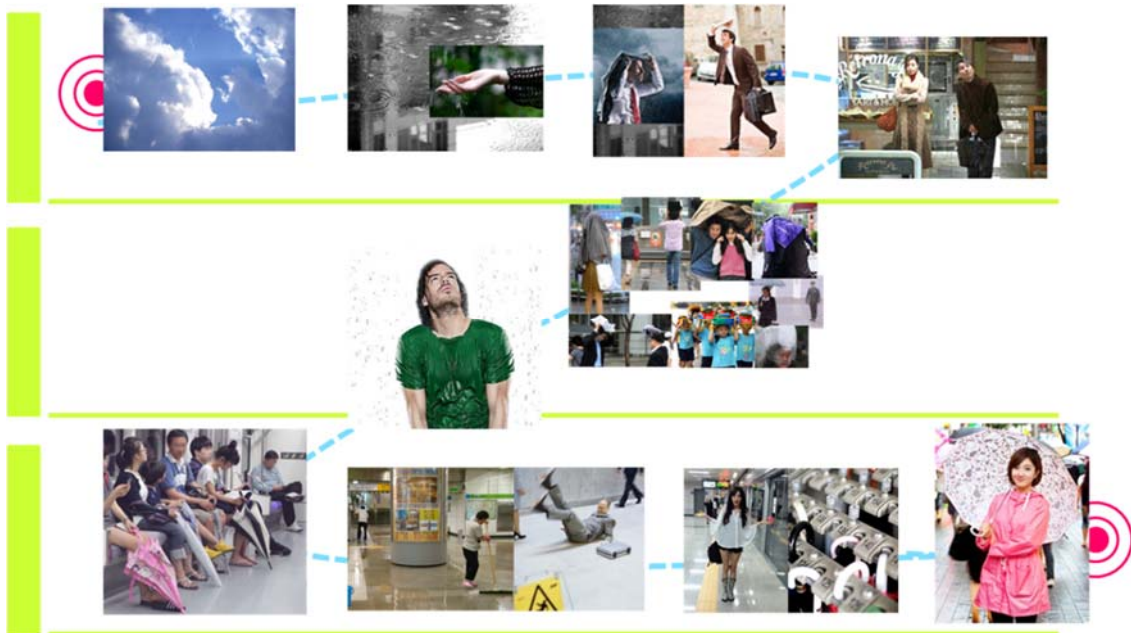
Figure 3. Scenario associated with umbrellas in urban life

After identifying the scenario related to the umbrella, the life-cycle steps associated to the umbrella was analyzed and requirements of various stakeholders were extracted via life-cycle step analysis. The life-cycle steps were divided into pre, during and post phases, and they were expressed as a circular form, which meant the notion of the concept of a repetitive cycle. The identified major stakeholders were an umbrella user, umbrella manufacturer, rental service provider, and so on. In particular, the life-cycle step of 'use' in the during phase was selected as the target life-cycle step, and the associated requirements were identified. After identifying the requirements, E3 values were then allocated to each requirement. E3 values are composed of economical, ecological and experience aspects [Cho et al. 2010]. Figure 4 shows the partial life-cycle step diagram and the requirements of the stakeholder of 'umbrella user' at the life-cycle step of 'use'. For instance, as can be seen in Figure 4, the requirement of 'light and small size of umbrella' had the functional value which can be 'portability' and 'Efficiency' and that of 'It is bothering to carry umbrella when it is not raining' had the active emotion value which can be 'Annoy'.
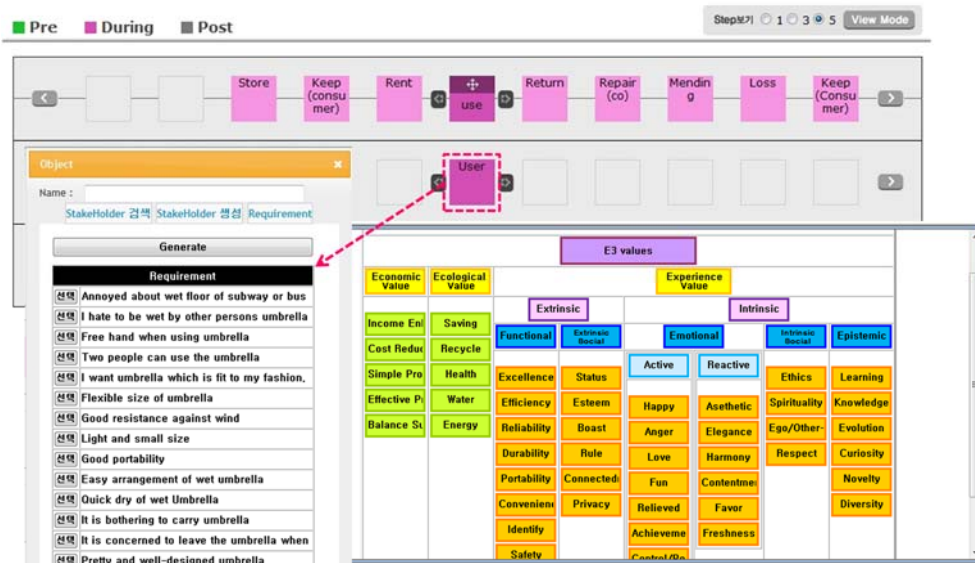

Figure 4. Schematic view of life cycle step, stakeholder, requirement modelling and E3 value framework (life-cycle step: use, stakeholder: umbrella user)

As based on the requirements of using umbrella, the current umbrella rental service in the coffee shop in Korea was under consideration for this case study. Figure 5 shows its scenario. The current umbrella rental service is the bundle service of coffee shop. When a customer needed an umbrella, customer should show the membership card to the staff and the coffee shop was supposed to rent the umbrella without charge. After using the borrowed umbrella, the customer had to return it to the coffee shop where he/she originally borrowed it.

Figure 5. Scenario of current umbrella rental service in the coffee shop in Korea

The scenario of the current umbrella rental service in the coffee shop was also analyzed by building up the service blueprint. The service blueprint is given in Figure 6, and the relationship among activities of related stakeholders was clearly expressed and analyzed. All activities in the service blueprint were modelled by using the context-based activity model, and its example of the activity of 'receive umbrella' is also given in Figure 6.
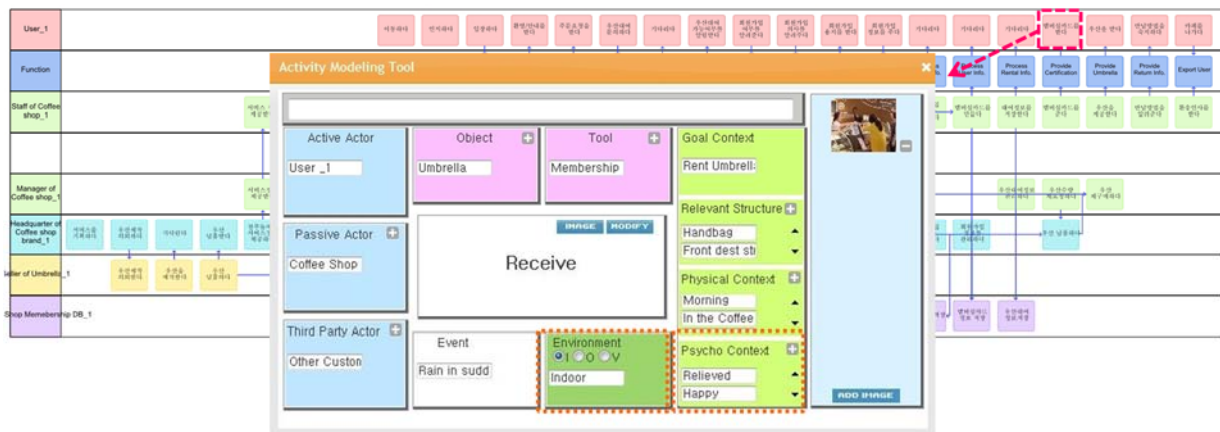

Figure 6. Service blueprint of the current umbrella rental service in the coffee shop and the example of the context-based activity model of 'receive umbrella'

When considering the current umbrella rental service in the coffee shop, the customer should enter the coffee shop to borrow the umbrella. However, he or she has to find the coffee shop and usually feels the pressure to buy any drinks when trying to rent the umbrella as expressed in psychological context (Figure 6). In addition, it is not convenient to return the umbrella to the coffee shop in which the customer originally borrowed it. The borrowed umbrellas were not systematically managed either in the current service.

However, the PSS concept itself cannot guarantee a success in the market. As a business model is a logical description of how a firm does its business with its product and service [Lee et al. 2011], to identify its successful implementation in economic value, a supporting business model analysis of the current umbrella rental service was conducted. The current business model was generated by the Business Model Canvas which was initially proposed by Osterwalder [Osterwalder 2004] and a structured approach to business model using strategy and protocol which is suggested by Lee et al. [Lee et al. 2011]. The existing business model of coffee shop umbrella rental service was facilitated the selection of strategies as Membership, Bundling, Internal Network and Bargaining as given Figure 7.
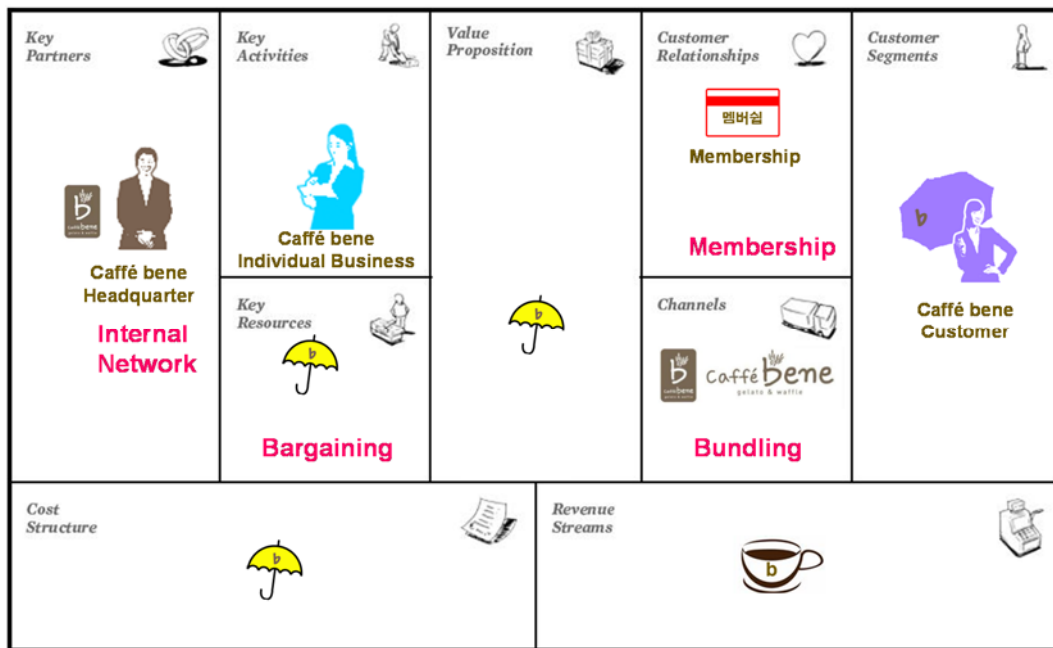

Figure 7. A business model of the current umbrella rental service in the coffee shop

In a perspective of manufacturers of umbrella who supplies the umbrella to coffee shop, to extend the scope of supply and have opportunity for taking new business partner, it was recommended to Sharing strategy which means that expands the channels in the market and several services are performed simultaneously. Therefore, the change of the physical context – location – was considered from the coffee shop to the public place such as a subway station as shown Figure 8.
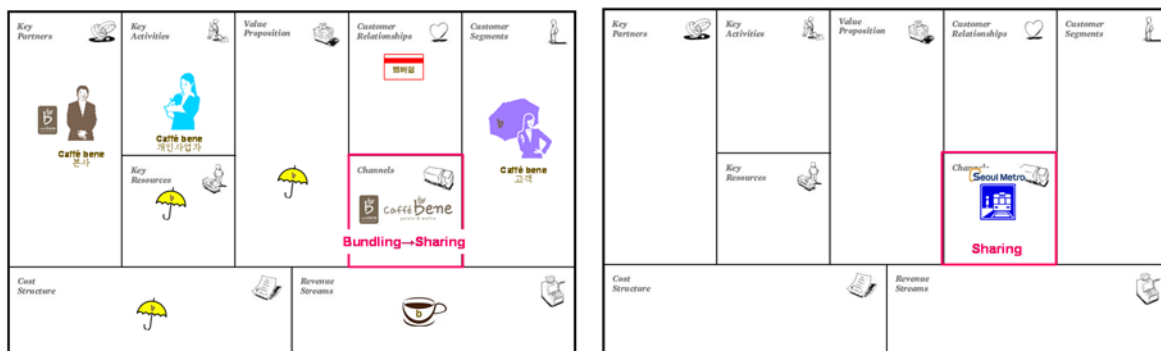

Figure 8. Changing the strategy of channel perspective on the Business Model Canvas

Based on Sharing strategy and an idea of replacing the location context, the location was moved from coffee shop to subway station then other strategies for each perspectives were reclassified as Segment Extension, Solution Network, Outsourcing, Bargaining, Interface, Effectiveness and Ad-based as Figure 9. Besides, the systematic management of the umbrellas was taken into a consideration by

changing the actors of the activities and adding several new activities. With these changes, the designers could enhance the current values and create the new values.
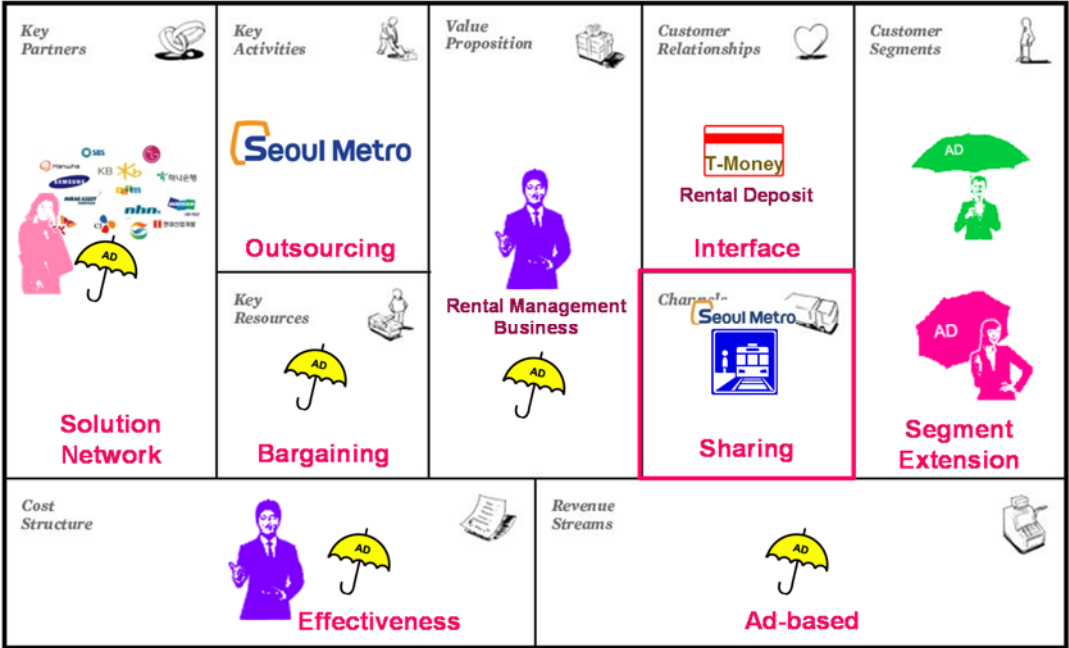

Figure 9. A new business model of urban umbrella rental service

The urban umbrella rental service was proposed for new rental PSS, then the service blueprint of the new urban umbrella rental PSS at the subway station was generated by using PSS support software tool and is given in Figure 10 and 11. In Figure 10 and 11, the lanes of the stakeholders of an umbrella provider (an umbrella provision machine) and a manager of umbrella provision were added, and their various activities were designed. In addition, in order to systematically manage variety information on the umbrella rental process, many activities of the umbrella rental database manager was designed, which were given in the bottom lane of the service blueprint. To effectively conceive product and service elements which realize the diverse activities of various stakeholders, the function analysis on the new umbrella rental PSS was conducted. The associated functions were also added to the second lane of the service blueprint to show their relationship with the stakeholders' activities.

In the urban umbrella rental service, when user faces in a situation required an umbrella, user can borrow an umbrella anytime at the station of an umbrella provision machine by traffic card for rental deposit. After using the borrowed umbrella, user can return any subway station and any time. Even when user gets on or out of the subway, he/she can return or borrow the umbrella for convenient and comfortable time in the subway. Besides, various companies are able to have offline advertisement channel by umbrella rental service by using their logo on the umbrella for free and also Seoul Metro which provides the location enable to provide a co-creation services based on its location advantage that gathers people and takes place potential activities each other.
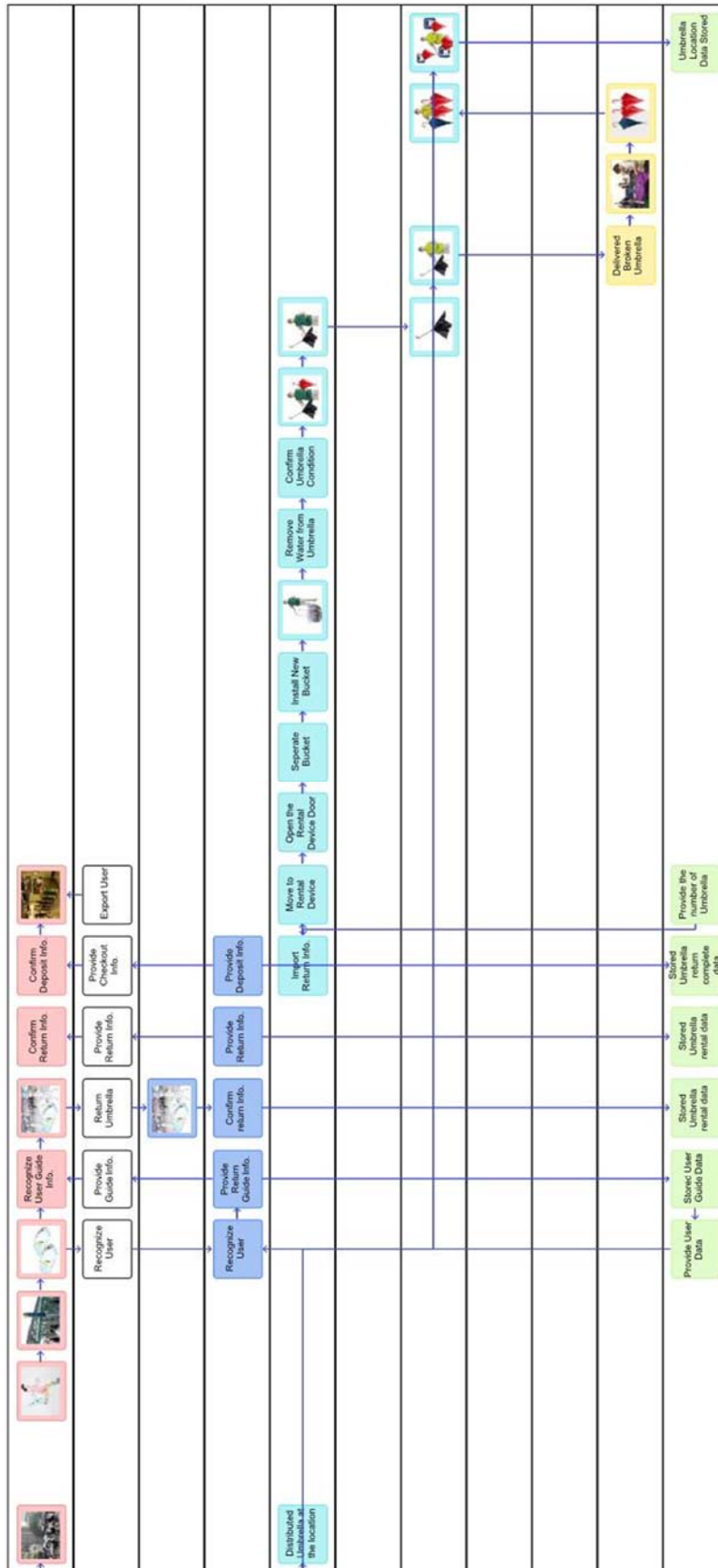
Figure 10. Service blueprint of the new urban umbrella rental PSS at the subway station, a)

Figure 11. Service blueprint of the new urban umbrella rental PSS at the subway station, b)

The final scenario of the new urban umbrella rental PSS at the subway station is given in Figure 12. The scenario includes the concept sketch of rental stations. After defining the service element, the concept of affordance was used to conceive the product elements having the specific affordance features such as 'access-ability', 'receive-ability' and 'provide-ability'. It could effectively the identified affordances without blocking the stream of the subway users. This conceived PSS could solve the problems discussed in the beginning of this case study and enhance the values of stakeholders.
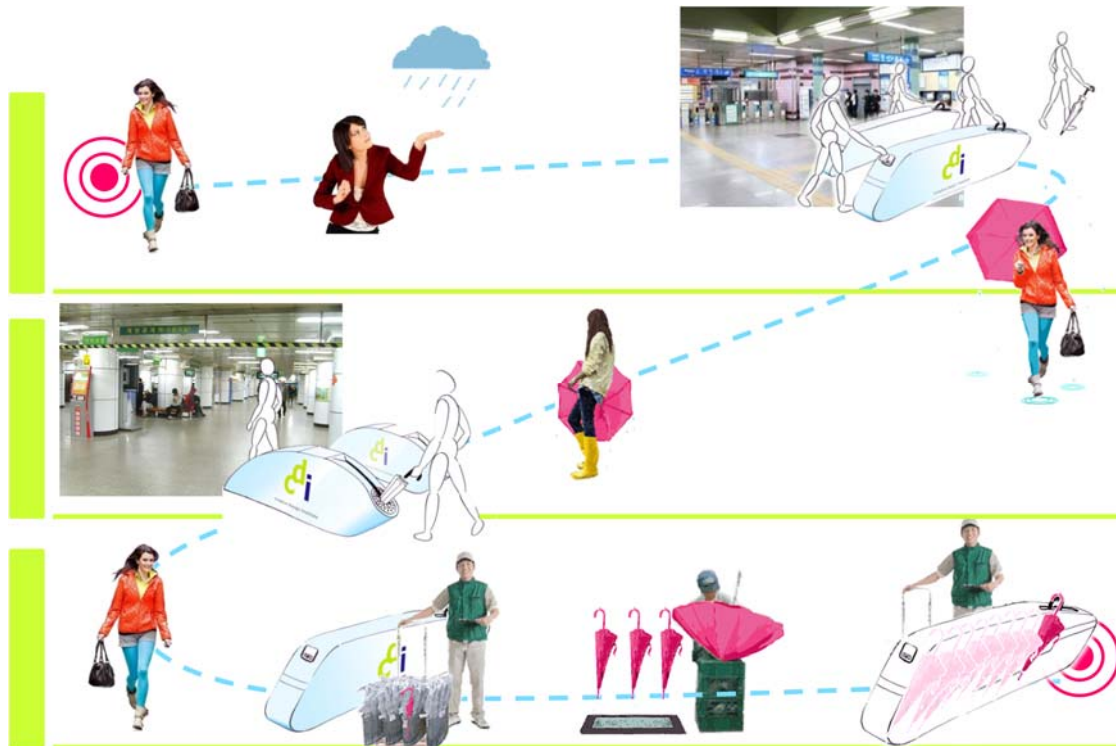

Figure 12. Scenario of new urban umbrella rental PSS at the subway station

4. Conclusion

This paper presented the case study on the new urban umbrella rental PSS at the subway station based on the systematic PSS design process which was developed in the PSS Design Consortium. Various design methods such as the life-cycle step analysis, identification of stakeholders and requirements, value assignment based E3 value framework, PSS scenario generation, service blueprint and PSS function analysis were used to proceed the PSS design project. After identifying the requirements related to the current umbrella rental service at the coffee shop in Korea, the new urban umbrella rental PSS at the subway station was designed by changing the physical context and adding various stakeholders and activities based on the analysis of a business model. The Business model canvas and strategies of the structured approach were applied to generate new business model and guarantee a success and possibility of the business. The new rental business expanded the customer segments for delivering values and business range for manufacturer. In addition, the new urban umbrella rental service was generated on the service blueprint with stakeholders and associated its activities. The diagrammatic scenario of the new urban umbrella rental PSS were also given. The resulting PSS could effectively enhance the stakeholders' diverse values by designing critical activities and associated structures.

References

Aurich, J. C., Fuchs, C., Wagenknecht, C., "Life Cycle Oriented Design of Technical Product-Service Systems", Journal of Cleaner Production, Vol. 14, 2006, pp. 1480–1494.

Cho, C. K., Kim, Y. S., Lee, W. J., "Economical, Ecological and Experience Values for Product-Service Systems", Proceedings, Design and Emotion, Chicago, 2010.

Goedkoop, M. J., van Halen, C. J. G., te Riele, H. R. M., Rommens, P. J. M., "Product Service Systems: Ecological and Economic Basics", Report for Dutch Ministries of Environment (VROM) and Economic Affairs (EZ), 1999.

Kim, Y. S., Lee, S. W., "Service Design for Product-Service Systems Using Context-Based Activity Modeling", Proceedings, Association of Societies of Design Research Conference, Delft, November, 2011.

Kim, Y. S., Lee, S. W., Koh, D. C., "Representing Product-Service Systems with Product and Service Elements", Proceedings, International Conference on Engineering Design (ICED11), Denmark, August, 2011.

Kim, Y. S., Lee, S. W., Lee, J. H., Han, D. M., Lee, H. K., "Design Support Tools for Product-Service Systems", Proceedings, International Conference on Engineering Design (ICED11), Denmark, August, 2011.

Kim, Y. S., Wang, E., Lee, S. W., Cho, Y. C.,"A Product-Service System Representation and Its Application in A Concept Design Scenario", Proceedings, CIRP Industrial Product-Service Systems Conference, Cranfield, 2009.

Lee, J. H., Shin, D. I., Hong, Y. S., Kim, Y. S., "Business Model Design Methodology for Innovative Producct-Service Systems: A Strategic and Structured Approach", Proceedings, International Conference on Engineering Design (ICED11), Denmark, August, 2011.

Mont, O., "Product-Service Systems: Panacea or Myth?", Ph.d. Dissertation, Lund University, 2004.

Mont, O.,"Clarifying the Concept of Product-Service System", Journal of Cleaner Production, Vol.10, 2002, pp. 237–245.

Morelli, N., "Product-Service Systems, A Perspective Shift for Designers: A Case Study: The Design of A Telecentre", Design Studies, Vol. 24, No. 1, 2003, pp. 73–99.

Osterwalder, A., "The Business Model Ontology-A Proposition in A Design Science Approach", PhD Thesis, Ecole des Hautes Etudes Commerciales, Universite de Lausanne, Lausanne, Switzerland, 2004.

Sakao, T., Shimomura, Y., "Service Engineering: A Novel Engineering Discipline for Producers to Increase Value Combining Service and Product", Journal of Cleaner Production, Vol. 15, 2007, pp. 590–604.

van Halen, C. J. G., Vezzoli, C., Wimmer, R., "Methodology for Product-Service System Innovation", Royal Van Gorcum, Netherlands, 2005.

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