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What is PSS design? – Explained with two industrial cases

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Abstract

This contribution presents results of applying a PSS (Product/Service System) design method to two cases in industry – one from manufacturing industry and another from service industry. The method is a structured and comprehensive design method that the author's group has developed and is now called SPIPS. The method is shown effective to support designers with derive relevant improvement solutions. Then, brief discussion will be given about PSS design. The contribution will also show a stream behind SPIPS, originating from QFD (Quality Function Deployment).

1. Introduction

PSS (Product/Service System) [1, 2] has been gaining attention from industry and academia [3]. Simply put, it focuses on value, especially value in use, rather than product or service characteristics, and thus provides designers with a higher degree of freedom. PSS seems to have potential of further dissemination to both industry and academia [4]. Therefore, this contribution aims at giving leverage to more understanding of PSS, especially of PSS design [5] as compared with (physical) product design.

To design a PSS, a new method is required to support those who engineer a PSS effectively and efficiently. The author's group has developed a structured and comprehensive PSS design method [6]. It is now called SPIPS (Toward Solution Provider – through Integrated Product and Service Development). The method addresses both service activities and physical products as measures providing value, and adopts a design-object model which represents critical concepts such as value, costs (sacrifice), functions either of products or of service activities, and entities [7].

This contribution presents some empirical results obtained from designing a PSS with SPIPS. The results are from two cases - one from manufacturing industry and another from service industry. Then, it
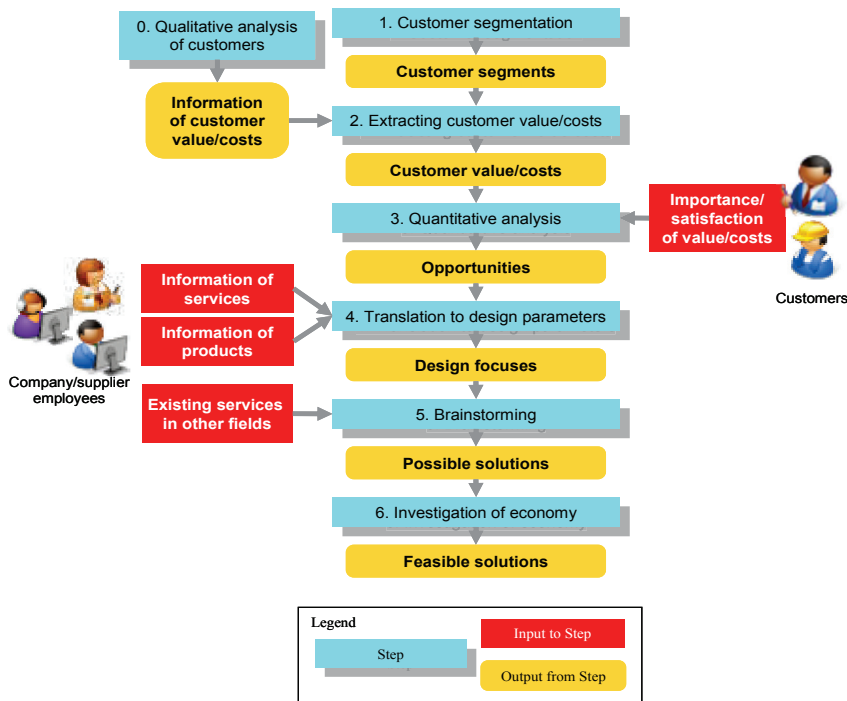
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will give brief discussion to help readers understand what PSS design is. The contribution will touch upon a stream behind SPIPS, originating from QFD (Quality Function Deployment) [8], which is a customer oriented method originally developed in Japan.

2. SPIPS – a PSS Design Method

The author's group developed SPIPS [6] based on a method to identify opportunities and a service evaluation method. As depicted in Figure 1, they consist of seven steps (from 0 to 6). Step 4, named "translation to design parameters", is among the core steps. It uses the information from customers and specialists from the provider's side. The former information is represented by quantitative importance/satisfaction on the given customer value/cost, and can be collected by a simple questionnaire. The latter is either about services or products provided by the company, and can be gathered using matrices similar to those used in QFD.

Once the design focuses are obtained from Step 4, brainstorming with employees with specific knowledge and responsibility will be held as Step 5. This is followed by Step 6, which is investigation of economic feasibility of possible solutions generated from Step 5. Finally, feasible solutions are produced. Since some steps, especially Steps 1, 5 and 6, are quite familiar to companies in general, the new essence of these working steps exists in Steps 2, 3, and, particularly, 4. Thus, these steps have proper contrivance; while they are familiar to widespread ways of working in companies in general, they are adapted to addressing PSS.

Note: "Output from Step" in the legend is also an input to the next step (except for the final output).

Fig. 1. Procedure of SPIPS (Original source: [6])

3. Application in Manufacturing Industry

3.1. Results of application

This Germany-based company provides investment machines that are expensive and quite complex with control by computer on the global market. The results of applying SPIPS to this firm are summarized below. See [6] for more details.

From Step 3, the top three important value was: 1) Quality of final product - This refers to the quality of the final product given to the machine user's customer. 2) Available operation time of machine - This means the percentage of time that the machine is available for work. 3) Immediate availability of machine - This reflects the need for having the machine able to run just at the moment that a job needs to be done. In contrast to "available operation time of machine", requiring this property means that the machine is available when needed; this property does not care about the whole ratio of time when the machine is available.

In Step 4, the characteristics of products/services were described. I.e. each value was deployed into design parameters, which were verified by those employees of the firm. The constructed model was so large that 173 design parameters (and 31 entities, meaning physical products or service persons) were included. The importance of design parameters was obtained as well; "malfunction frequency", "extend of malfunction", and "time for setup" were the most important.

In Step 5, we focused "immediate availability of machine". In the functional model for this value, we referred to a function "repair machine breakdown", which was deployed in the functions "get contacted", "offer response time", "find problem", and "find solution". From those design parameters such as "hotline availability", and "technician availability", it was understood that not merely the availability of the support line but also that of staff with sufficient technical knowledge is crucial. This analysis allowed the generation of a solution for making responses from such staff quicker. Other solutions derived include machine and operation with less-frequent malfunction and machine with self-maintenance functionality.

3.2. Discussion

It is actually the modelling scheme that allowed the team to seek measures from both physical products including software and service activities for realizing value for the target receiver. The model represents the ways of both physical products and service activities to realize value in the same manner. The "machine with self-maintenance functionality" (by a physical product) and "making responses from expert staffs quicker" (by service activity) were generated indeed from the same part of described functions. This is impossible without the object model based on value. It should be again emphasized that what was intended to be delivered is value, not only quality, for instance. This shows at the same time the model provides a higher probability for the team to discover more options.

4. Application in Service Industry

4.1. Results of application

This company provides an accommodation service in Abruzzo region, Italy. This hotel has three-star certification, and is characterized by various efforts to reduce environmental impacts. The hotel management regards the environmental consciousness as a sales point to the guests, wants to reduce the environmental impact and develop a new attractive service for the guests. See [9] for more details.

We carried out an on-site customer survey about guests' requirements, namely value and costs on the guests, through delivering questionnaires to them. The collected information includes the importance of some forty (40) value/cost prepared. The results include classification of customers into twelve (12)

categories according to their trip purposes (business or others), ages (younger, middle, or elder), and genders (female or male).

As step 0, a Persona was generated for a receiver, the hotel guest of elder women on business trips. They are relatively environmentally conscious. The final goal of the target Persona was set to be getting prepared for her forthcoming business meeting. Relaxation was identified here to be a goal. Parameters affecting this goal were selected; "adequate heating and/or air-conditioning", "good lighting", and "energy saving". The first three in the summer are rephrased as cool and light with less energy. In the step 5, the current realization structure of the service was referred to. The existing hotel building has a shutter on the outside of a window to prevent the sunlight and heat from coming into the room. When it is in use, it gets cooler due to its performance to prevent the heat transfer. However, natural light does not come into the room, either. There exist special films attached on the window to shield a specific range of radiation frequency (e.g. [10]). Installing these films on the window of the rooms contribute to decrease the energy usage by air conditioners for the rooms. This redesign option will achieve the change of all the three value mentioned above (cool and light with less energy).

One more characteristic Persona was generated as step 0. This is for elder males on business, who put lower weightings on environmental value than the other categories. It was also confirmed that both of those Personas put a high weighting on the value, "freshness of towels and bed linen". Now, the current realization structure for this value is referred: At present, the hotel give choices for the guests to decide whether to wash the towels used in the bath rooms or not. This system could give a higher satisfaction level to several environmental value such as "reduced release of pollutants into the environment". In addition, this will be beneficial for the more environmentally consciousness Persona. However, this service structure does not work for the second Persona, who is less environmentally conscious, since they would use fresh towels every time rather than use un-washed towels. Thus, the new service named "Cash-back per non-wash" was proposed. This would allow guests not only to decide whether they have towels washed or not, but it would also give some form of discount to guests per a non-cleaned towel. This option would additionally decrease the economic cost of stay.

4.2. Discussion

This case also demonstrated the advantage of SPIPS as compared to a typical product design method. SPIPS targets the "state changes" of a user while the functions of physical products and provider's activities are media. On the contrary, the user's behaviours and state changes are not the primary target in a typical product design. This is relevant to challenges of Ecodesign (e.g. [11]), which is a kind of product design. A typical Ecodesign of product targets the environmental burden while fulfilling a requested function of a physical product without attempting to address the user's aspects.

5. Concluding Discussion

In answering the question – what is PSS design?, it is design toward value of stakeholders by utilizing various alternatives – either product or service, as exemplified in the cases. This means that PSS design provides designers with new degrees of freedom and covers an earlier phase of design that is not addressed in design of pure physical product. The latter further implies the importance of information to be available in design about product usage or service delivery. SPIPS realizes this idea and thus can be recommended for further use. Other methods are available to support PSS design (see e.g. [5]), one of which aims at identify user activities and reveal opportunities for new services [12].

PSS design is needed due to various new conditions of such as competencies and disciplines (shift from value of product ownership to value of utility), and interventions or touch points (changed types of exchanges between provider and user, etc) [13]. Especially from the viewpoint of Ecodesign, conventional methods can benefit from this "demand-side approach" [14].

Future works include descriptive analysis of PSS design (e.g. [15]). This is surprising that very little research to reveal and describe PSS design has been conducted. On the other hand, implementation of a PSS design method to a real life environment at a company is of interest, since this can be an urgent need of a firm (and it is actually the case at one of our industrial partners [16]). From the scientific viewpoint, theoretical investigation of environmental influences of PSS is interesting (see [17]).

Acknowledgements

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