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Kansei Engineering and Product-Service Systems (KEPSS) Integrative Framework for Customer-centered Experience

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Abstract. This study introduces a conceptual integrative framework of Kansei Engineering (KE) and product-service systems (PSS) for customer-centered experience, known as KEPSS. Product or service alone is sometimes difficult to judge. With respect to more complex mixture of product and service experience, more comprehensive method is required to understand the total customer experience better. Usability or functionality with full of cognitive process is insufficient. Recent study shows that affect or Kansei is found to be stronger customer feedback due to perceived product and/or service performance. Hence, this study highlights the importance of customer emotional satisfaction (affect/Kansei) incorporated into the improvement of a bundle of products and services for customer experience. A holistic customer experience is deemed to be a critical success key. An illustrative example is provided to show the applicability of the proposed framework. Hence, by taking into account more complex offer consisting of combined products and services which indulge customer emotional satisfaction and delights, this study provides both potential theoretical and practical contributions.

Keywords: Kansei Engineering, Product-Service Systems, Customer Experience

INTRODUCTION

Full utilisation and usability for product and service is expected by user and customer. How to address and fulfil what the user and customer expecting is a big challenge. The exploration of customer experience through in-depth study of active participation of multidisciplinary experts has been proposed in extending the product-service system (PSS) methodology [1]. Customer expect goods and services holistically, involving both cognitive and affective impression and satisfaction. Product or service providers should understand the customer expectation, especially those combined services, goods, support and knowledge. Again, a holistic perspective of customer towards full customer experience will drive the emergence of complex product or service system [2].

As the customer expectation and need become more complex, according to study by Hartono & Raharjo [3], the fulfilment both cognitive and affective satisfaction is a must. The offering of physical product or intangible service alone is considered insufficient. Market needs a set of products and services, called as PSS. In today's market, a more customer-focused goods combined with services, supports, and customer self-services is available widely. With more complex PSS, then more comprehensive human's understanding and perception is expected. According to Khalid and Helander [4], human has a coupling system named as cognitive and affect. Cognitive is something related to rational thinking and perception, whereas affect deals with emotion and impression. Affect is deemed to be a dominant factor in making decision (including in a business transaction). Referring to study by Hartono & Tan [5] and Prastawa et al [6], affect is positioned to be more important than cognition in the context of human-service interaction.

Affect is known as Kansei. It deals with customer emotional feeling and impression. Through Kansei Engineering (KE), the appropriate and representative Kansei is linked to perception of product or service experience. Hence, Kansei is set to be a linear function of perceived product and/or service performance. One of the superiorities

of KE is that its ability and flexibility to engage with other techniques or tools to enhance its performance to understand Kansei better or its proposed improvement strategies better. The Kano model, SERVQUAL, TRIZ, and Quality Function Deployment (QFD) are some techniques used and combined with KE [7]. The various service settings and contexts also enrich the uniqueness of KE, such as logistics, hotels, tourism, and sustainability. Hence, proposing Kansei need and satisfaction in the PSS will create a distinctive competitive value. It offers a marketable set of products and services incorporating the emotional needs of customer.

This study has two objectives as follow. First, it is to propose a conceptual framework of KEPSS. Secondly, it is to provide an illustrative example showing the possible applicability of the proposed framework.

BRIEF LITERATURE REVIEW

This section consists of brief literature review of Kansei Engineering (KE) and Product-Service Systems (PSS) and how they are integrated. KE is a backbone of the study, whereas the PSS design will complement the refinement of stimuli properties or attributes and understanding of overall customer experience.

Kansei Engineering

Kansei Engineering (KE) has been extensively used in product and also service design and development. This KE is deemed to be appropriate in understanding customer emotional needs (known as Kansei) as a response due to the perception of product or service performance. This method, inherently, focuses on the importance and role of emotion in analysing the existing product or service, and also proposing some ideas for improvement. In addition, this method can be used to develop a new product or service based on the collected Kansei. These two approaches are found to be common in KE methodology. In a general model, Kansei is a function of perceived service or product attributes (see [5]).

The complex customer experience and interaction with various service and product attributes is a challenge. However, KE has an ability to engage with methods and contexts which humans are involved using their five senses [8]. In other words, products or services will be more of effectively emotionally perceived once they are linked to visual, auditory, tactile, olfactory, and gustatory domains. Visual domain is said to be the most dominant.

A generic KE methodology is provided in Fig. 1. It starts with the selection of product or service domain. It is suggested to consider a complex human-product/service interaction. Next, it goes to the spanning of Kansei or affect and product/service properties. Kansei can be explored through the identification of adjective-formed wordings representing the emotional needs of customer. Emoticon may be used to enhance the justification of Kansei. Engineering characteristics or components are used to represent the product/service properties. The Kansei response and perceived product/service properties are linked. Validity and reliability tests are done to see the appropriateness of Kansei model. At the last stage, a valid mathematical model of Kansei is presented.
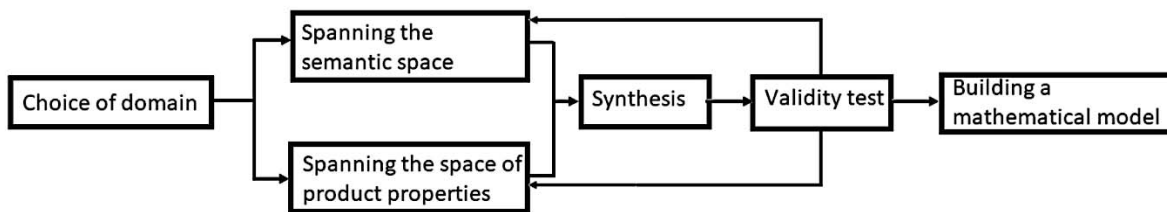
FIGURE 1. Generic KE methodology ([9] in [7])

Due to more complex human-system interaction and also the growth of quality tools, the KE methodology has been extensively modified. The incorporation of TRIZ (Theory of Inventive Problem Solving), Kano categorization, the confirmatory mechanism for "true-meaning" of Kansei, and sustainability into KE in services have done conducted in the recent study [7]. Potentially, KE methodology is still open for extension as long as the human emotion is encouraged in the human-system interaction and experience.

Product-Service Systems (PSS) in Overall Customer Experience

When it comes to the complex environment and interaction, product or service alone is difficult to judge. Combined with more competition and customer dynamics, a mixture of product and service is quite often found as an offering. A combination of product-service offering is called as Product-Service Systems (PSS). Customers tend to seek for the desired value-in-use and benefits. Inherently the addition of services into products has been done since 1980s, known as "servitisation". In order to gain its feasibility to the customers, an active participation between designer, customer, and provider should be taken into consideration. More importantly, due to different nature of products and services, the proposed adequate integration should be carefully taken at the first stage [10]. Apart from "servitisation" of product, there is another term "productisation" of service which also highly relevant in creating a concept of PSS.

The motivation of PSS is that to increase values to customer and provider, by minimizing the resources, adding possible functions and features to a certain product or service offering. More practically, more economical combined products and services will be provided by companies to facilitate customers to co-create their interaction and experience without buying or owning the products [11]. Generally, there are three approaches to PSS design, i.e., (i) Function-based PSS, (ii) Value-added PSS, and (iii) Evidence-based PSS. Function-based PSS promotes new functions to the existing products. Value-added PSS adds new features to the existing products, whereas evidence-based PSS highlights the big data analytics in supporting the actual saving. According to Baines et al [12], there are three types of PSS, as follow: (i) Product-oriented PSS. It is promoted by a manufacturing company by adding supplementary services to its products sold in a traditional market, (ii) Use-oriented PSS. It is selling the use of products instead of owning them, and (iii) Result-oriented PSS. It is a combined offering from various companies.

When it links to KE methodology, all product or service attributes (named as PSS attributes) should be promoting one of PSS approaches, either it functions- or value- or evidence-based PSS.

PROPOSED CONCEPTUAL FRAMEWORK

This conceptual framework (shown in Fig. 2) is the extension of KE frameworks applied in services (see [5], [7]). A recent study by Hartono [7] stresses on the true meaning of Kansei and sustainability for services. It also brings along the improvement mechanism for robustness. Nevertheless, according to KE flexibility, it can be enhanced. Due to complex customer experience and encounter in services and products, hence, a more comprehensive framework KE taking into account PSS is proposed.

It starts with customer experiences due to a bundle of products and services of a company. It is called human-system interaction design phase. Then, it flows to the overall customer experience. It may include customer cognitive, affective, or social responses.
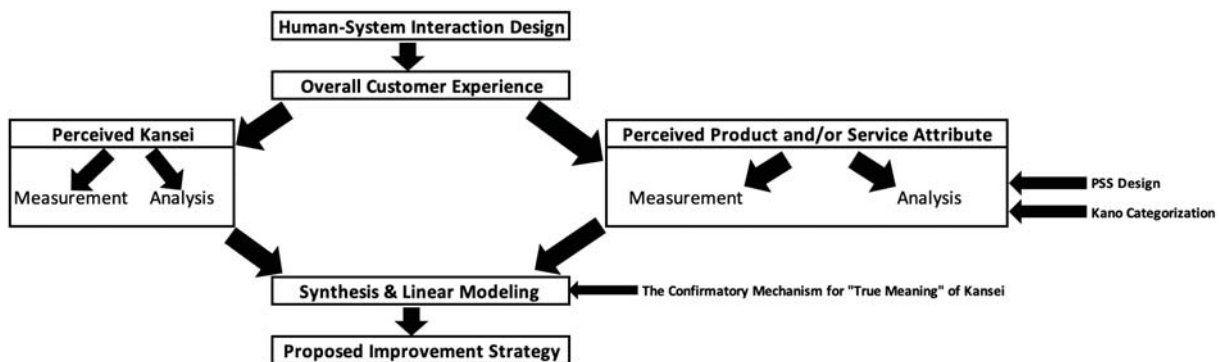
FIGURE 2. Conceptual Framework of KEPSS

More specifically, it goes to the measurement and analysis of perceived Kansei (as the representative of customer emotional need and perception) and perceived product and/or service attributes (as the representative of Kansei stimulus). Recall, Kansei is a function of perceived PSS. With an assumption of linear relationship, Kansei is set to be a dependent variable, whereas the perceived PSS attribute is independent variable. Kano categorization is inserted as a way to filter the performance level of each PSS attribute.

In validating the formed Kansei linear model, the confirmatory mechanism for "true meaning" of Kansei is proposed [7]. Afterward, the improvement strategy is formulized through one of the available options such as brainstorming, Focus Group Discussion (FGD), literature review, and in-depth interview. Tools such as House of Quality (HOQ) or TRIZ may be considered to finalize the structure of improvement strategies.

ILLUSTRATIVE CASE STUDY AND DISCUSSION

This illustrative case study is adopted from Hartono [7] with some modification as the illustrative example of how the KEPSS framework can be applied. This case study is about the analysis and improvement of international airport services. Basically, services in an international airport are not for service alone nor product alone, but it is a combination of services and products. The utilized SERVQUAL model is modified by considering the adjustment with PSS approaches. SERVQUAL model is used to understand the experience component (EC) and how it is related to experience requirement (ER). The adjustment of SERVQUAL dimension into PSS dimension is shown in Fig. 3. The new adjusted SERVQUAL-PSS dimensions are those service quality attributes with additional features or functions.
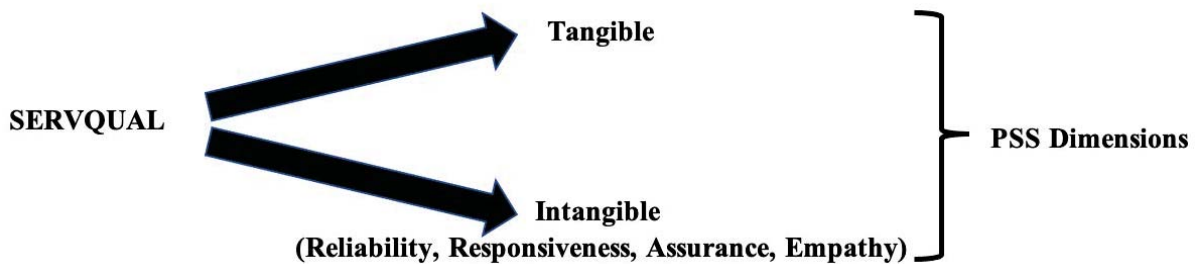

FIGURE 3. SERVQUAL and PSS Dimensions

The PSS properties and dimensions are shown below (see Table 1). There are 8 PSS attributes accompanied by their respective PSS approach at each attribute.

TABLE 1. PSS Properties and Approach

Code	PSS Properties	PSS Approach
PSS_1	The modernity of airport building and lobby (added features: shape, color)	Value-based PSS
PSS_2	The hygiene of airport (added features: toilet, seating, canteen, trollies, ATM center)	Value-based PSS
PSS_3	The availability of airport facilities (added features: toilet, seating, canteen, trollies, ATM center)	Value-based PSS
PSS_4	The neatness of airport staff (added features: uniform, freshness, body language)	Value-based PSS
PSS_5	The check-in mechanism (added features: on-time time slot)	Value-based PSS
PSS_6	The delay notification (added features: last call, auditory and visual information)	Value-based PSS
PSS_7	The performance of staff in handling customer concern (added functions: courteousness, friendliness, promptness, responsiveness, proactiveness)	Function-based PSS
PSS_8	The security of airport (added features: lost and found, parking lot, baggage claim)	Value-based PSS

The Kansei words as the representative of emotional needs are happy, friendly, satisfied, clean, trusted, delighted, nice, and modern. According to linear regression analysis, there are two significant linear models, i.e., (i) Satisfied = 3.164 + 0.212 PSS6 (with a significant value = 0.001, R-sq = 0.614), and (ii) Clean = 3.23 + 0.229 PSS6 (with a significant value = 0.031, R-sq = 0.526). Using the "true meaning Kansei confirmatory mechanism" for validation purpose, the valid Kansei model is that "Satisfied = 3.164 + 0.212 PSS6". The Kansei "satisfied" has a strong correlation with the attribute "the delay notification". This attribute is also having an "attractive" Kano category (see [7]). Thus, the attribute "the delay notification" is deemed to be the most critical PSS attribute to be prioritized for improvement. It is understandable that the delay notification including the waiting time, last call, auditory and visual information is very sensitive to passengers. It is to promote the clarity and certainty. With respect to PSS approach as well, an improvement strategy is proposed, i.e., installing a better IT system to provide

prompt, intensive, and clear notification through video and audio message in the airport and a gentle reminder to all passengers who are concerned through short message service.

CONCLUSION

This study discusses one of the superiorities of Kansei Engineering (KE) methodology, which is to engage with other potential techniques or methods in understanding and modeling customer experience better. Also, it stresses the efficiency of the KE methodology use. Here, Product-Service Systems (PSS) design is integrated to KE methodology. The motivation is that product or service alone is insufficient in representing the offering by a company; there will be a mixture between product and service. Thus, this integrated model of KEPSS will help the service-product provider in understanding the entire customer experience better.

However, this study is limited to the real application of complex service-product setting. Moreover, a generic model of KEPSS should be more explored and elaborated. Another method to enhance the KEPSS model such as multi-layer Quality Function Deployment (QFD) is proposed for future study.

ACKNOWLEDGMENTS

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