The development of Kansei-based mining model for robust service design

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M Hartono[1,2]

[1]Department of Industrial Engineering, University of Surabaya, Surabaya, Indonesia

E-mail: [2]markus@staff.ubaya.ac.id

Abstract. This study proposes a model which shows the importance of Kansei Engineering (KE) methodology in supporting the design of robust services. The KE methodology is enhanced by the Kansei-based mining process, SERVQUAL, and Kano categorization in order to conceptualize robust service design and development. Due to complexity and contextual based, Kansei words as emotion representative are usually formed in fuzzy and abstract terms. It may lead to ambiguous and unclear meaning. Mapping and structuring more representative Kansei is needed. Hence, through Kansei mining system, historical data includes customer Kansei feedbacks are critical. KE model incorporating Kansei mining process followed by expected contribution which captures more organized and captured Kansei of product and service experience is proposed and discussed.

1. Introduction

Affective design or also known as Kansei Engineering-based (KE-based) product design and development has received much attention from both researchers and practitioners. Incorporating customer affective needs into product design elements will fulfill and increase customer satisfaction, especially the emotional satisfaction. Not only in product design, KE also applies to service design and development [1]. Kansei Engineering (KE) has shown its ability and superiority in capturing, identifying, and mapping customer affective/emotional needs into design characteristics [2][3]. This method has been used ranging from physical products to service attributes, e.g., shampoo bottle, audio system, virtual kitchen, hotel services, logistics services [1][2][4][5]. Related to services, this study shows the milestones of KE application in services [5], and current research direction (see Table 1). This current research is, inherently, to enhance the KE methodology in representing an entire service experience.

Table 1. Milestones of KE application.

Study	Contexts/Tools/Methods								
	General	Servqual	Kano	TRIZ	Culture	Sustainability	Logistics	Robust	Mining*
[1]	√	√	√						
[4]	√	√	√	√			√	√	
[6]	√		√						
[7]	√	√	√						
[8]	√								
[9]	√	√	√		√	√			
[10]	√	√	√		√				
[11]	√						√		
[12]	√	√	√	√		√			
Current	√	√	√						√

**new direction*

Referring to KE research mapping (see Table 1), there is an opportunity to extend KE studies through service contexts and methods. It is quiet challenging to map customer emotional needs/expressions/emotions, namely Kansei, to perceptual design elements. One of critics is that how to get representative Kansei, though many studies are still using wordings [2][3][4][5]. Kansei words have been widely used to represent the emotional needs of customer and user. It is still relevant. In addressing correct and perfect Kansei is not easy. It is a challenging part in the entire KE methodology. To collect Kansei, at present, majority of research utilizes observation, survey, literature review, in-depth interview, and ethnography study [1]. Kansei collection, called as spanning the semantic space, is the first step in KE methodology. Due to limited budget, sample size, and time, the validity of Kansei is questioned. How can we obtain the truly representative and valid Kansei? Hence, to understand the customer affective needs (also called Kansei words) accurately and then to match them with design characteristics is really challenging.

In some cases, it is very difficult to grasp and interpret the customer Kansei due to linguistic factors and cultures. The impact is that the Kansei will be relatively short-lasting, imprecise, and ambiguous. Moreover, the Kansei applied to certain industry or product in a country will not be compatible to that of other countries, even though the Kansei is the same. Thus, in this study, in matching and refining Kansei structure, Kansei mining system is introduced. Reuse of knowledge from past sales records, product specification, and customer reviews will bring potential benefit for this mining process. This is linked to KE methodology for robust design and development. Some methods related to service quality and robust design are embedded to refine the KE methodology. It is expected that this study will provide a practical guideline for service provider to promote more in-depth understanding of customer emotional satisfaction and ways to satisfy them.

2. Kansei Engineering, Kansei-based mining, and Robust Service Design

Kansei is referred to emotional or affective needs. It is translated to be emotional state or psychological feelings of customer due to product experience or service encounter. Kansei is one of literatures to describe emotions and feelings of customers related to product design, marketing, and psychological aspects for service encounters. According to Nagamachi [3], affective design is the inclusion of representation of affect and psychological state (e.g., subjective impression, visual perception, and emotional response) in the product and service design.

Kansei is a function of perceived product and service experience in the KE methodology. Kansei can be captured by human five senses [3]. KE uses Kansei words to express customer affective needs and emotional states. Then, these Kansei words will be translated into perceptual design elements. Next, it will be moved to designer's side. It is quite often the designers have no underlying understanding of the relationship between customer Kansei and design elements. Hence, mapping out and highlighting the difference between customer Kansei and design elements are critical.

Due to complexity and contextual based, Kansei words are usually formed in fuzzy and abstract terms. It may lead to ambiguous and unclear meaning. It is also influenced by the psychological condition of respondents. A condition when they are happy or unhappy will give different Kansei regardless the service experience. The question is asked again. What Kansei is appropriate? How to obtain Kansei correctly? Reusing historical data is deemed to be sufficient to facilitate the handling of Kansei information. Also, it gives information regarding the design elements. In other words, this process known as data mining is recognized as a decision supporting tool through efficient knowledge discovery of historical data. Related to Kansei, it is called as Kansei mining system. This Kansei mining system will be proposing to utilize valuable and reliable historical information of customer affect or impression on existing service experiences. Some methods can be used such as Kawakita Jiro (KJ) or affinity diagram, multi-pickup method (MPM), and Kano model and categorization. More direct methods used by marketing such as conjoint analysis with fuzzy systems, focus group discussion, in-depth interview, and similarity-dissimilarity attribute rankings will bring benefit in finding latent customer needs. Those methods are quite related to marketing and customer, which are not directly to engineering characteristics. Thus, there is a gap between marketing and engineering sides. These

approaches are usually used for any product or service design at the very beginning of stage, a new and clean sheet of paper. In facts, most products or even called as new product or service evolves from the current one. Hence, historical data includes customer feedbacks are critical. KE methodology which captures more organized and captured Kansei of product and service experience is required.

In designing service, ideally, it should be ensuring that all service attributes will have significant impacts on Kansei. On the other hand, there will be service traits or noise which are not intended by both customer and designer. Unfortunately, they are sometimes blended in the package of service attributes offered [4]. Robust Kansei service design has been proposed [4] using Taguchi method to determine the optimal service design settings by analyzing the complex relationships between the controllable factors (i.e., service attributes), the uncontrollable factors (i.e., noise factors), and the service quality performance.

3. Framework Development

This framework is modified from the previous works [4] by incorporating the refined step of span the semantic space/Kansei. The refinement of spanning the semantic space/Kansei adopts the concept of Kansei mining system. The entire framework or model of Kansei-based mining for robust service design is provided in Figure 1.

It starts with the choice of service domain, followed by spanning the semantic space/Kansei and the service attribute space. In refining Kansei, some methods of mining system are utilized, such as expert knowledge, online content text mining, or KJ method. According to historical data of Kansei, mapping, identification, refinement, and measurement of Kansei will be conducted. According to Hartono & Tan [1], Kano categorization and SERVQUAL model are included to map the prioritization of service attributes. The satisfaction score is calculated to give the understanding of which service attributes will be followed up for improvement purpose.

Once there is negative satisfaction, it will be the focus for improvement. Assuming that Kansei is a function of perceived service attributes with negative satisfaction and Kano's A & O categories, some potential service attributes will be identified and regarded as WHATs at the House of Quality (HoQ), then translated into engineering characteristics of services (known as HOWs). We apply Taguchi method to find factors and levels which can minimize the noise or error. The final objective is that to achieve robust design-based for service that increases customer emotional satisfaction (Kansei).

4. Discussion and Implication

This study mainly focuses on short/brief literature on Kansei mining system and robust service design. This topic of study on Kansei Engineering (KE) methodology is still interesting due to the dynamics of customer need and satisfaction. Satisfaction today will not be the same with that of tomorrow. More specifically, in terms of customer satisfaction dimension, Kansei or affect will bring more influence on the success of service offer than that of cognition. Model of Kansei-based mining for robust service design has been introduced. It has been modified from the study by Hartono & Tan [1] and Hartono & Santoso [4]. This model should be tested through the real case study to see its applicability. Several innovative service settings can be considered such as e-commerce, logistic, internet provider, online taxi, and online courses.

Kansei related through mining process might be "fast, excited, responsive, happy, and et cetera". Each Kansei will be linked to all perceived service attributes and they are provided in linear models. Through Kano's A & O category, negative satisfaction score and Kansei impact, the critical service attributes will be collected. They are put on WHATs and continued to find HOWs through Taguchi method. The expected result is robust design elements which are sensitive and critical to representative Kansei [4].

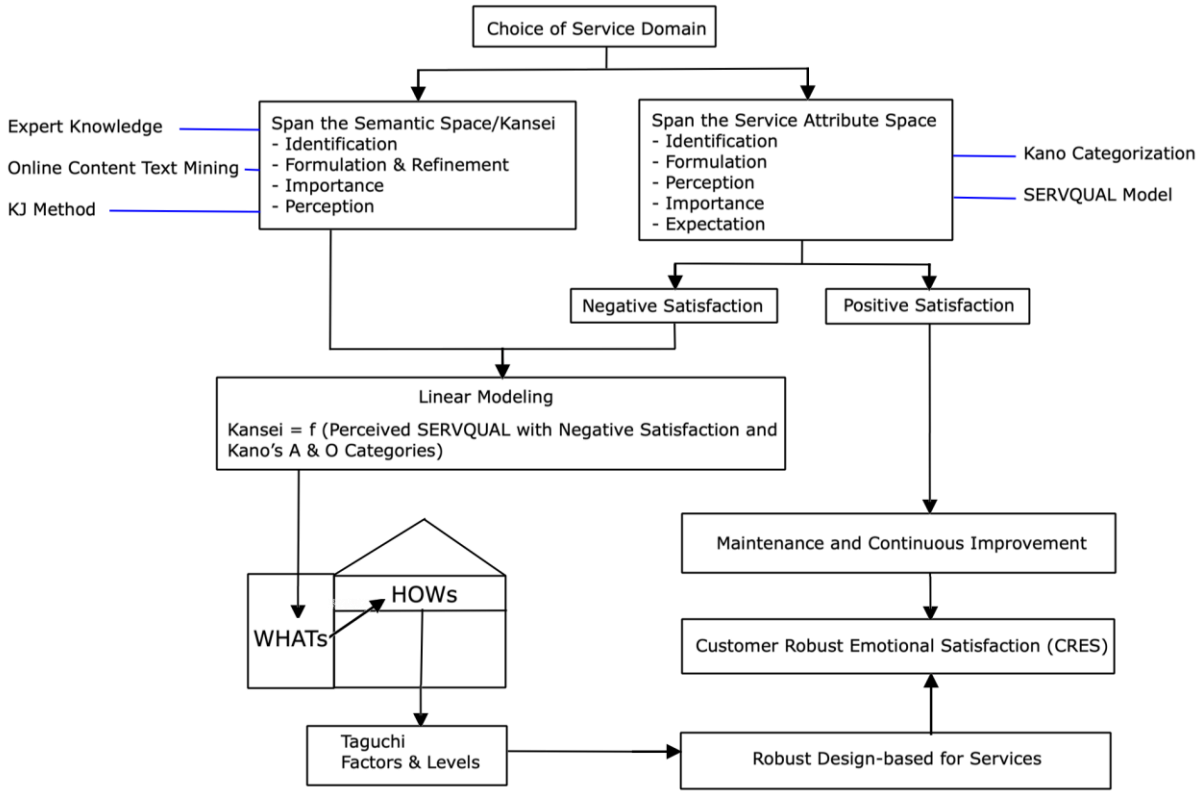

Figure 1. Model of Kansei-based mining for robust service design.

In order to make this model work well, appropriate and sufficient number of samples should be considered. In addition, sample plan whether it is probability or non-probability should be decided. For those who experience certain service well will be targeted as respondent. Some criteria such as duration of use and frequency of use should be considered.

5. Conclusion and Further Research

This study proposes an integrative model of Kansei Engineering (KE) methodology incorporating Kansei-based mining methodology for robust service design and development. The objective is that to refine the Kansei identification and structure as Kansei is the most critical component in any KE studies. The utilization of service quality and management tools combined with statistical tools will provide much benefits both theoretically and practically. Theoretically, this study provides a combined refine Kansei for KE methodology in robust service design. Practically, service provider will be equipped with a guidance to prioritize service attributes for improvement and find the optimal alternative of solutions. Surely, this study is of limited due to validation and verification. For future work, thus, it is required to test the proposed framework into real service sector. A new generation of service industry such as co-working space or e-commerce service will be of high interest.

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