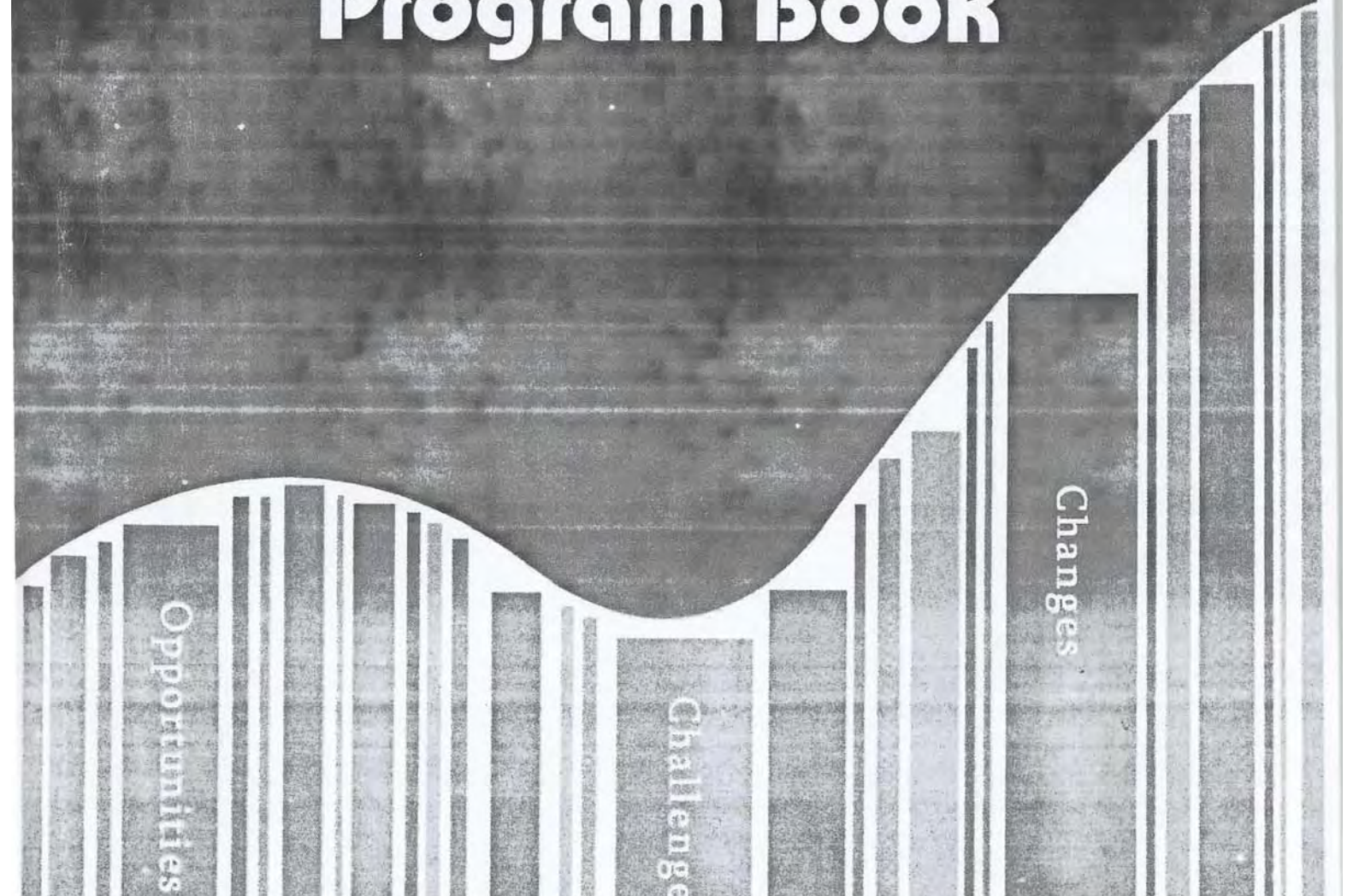
IEA2009

17th World Congress on Ergonomics

August 9-14, 2009 Beijing, China

Program Book



Content

Welcome

Sheng Wang, Congress Chair

On behalf of the International Ergonomics Association (IEA), the Chinese Ergonomics Society (CES) is pleased to announce that the 17th Congress of the IEA is going to be held on August 9-14, 2009 in Beijing, China. The Congress is hosted by the CES with support of Ergonomics Society of Taiwan and Hong Kong Ergonomics Society, Chinain the true spirit of Changes, Challenges and Opportunities.

As a rapidly developing city, Beijing is a great showcase of changes, not only in the physical landscape, but also in the way people responds to the challenges that these changes demand.Beijing also offers immense opportunities for human factors and ergonomics intervention in environmental and socio-technical system functioning. We therefore invite you to witness for yourself by attending the IEA 2009 in this historic and cultural city of Beijing. As an exotic city with more than 3400 years of history, Beijing is world-famous for its splendid beauty and culture. It is also a hub for Chinese international exchanges, including cultural, economic and political. Today, all eyes are on Beijing as we also host the 2008 Summer Olympic Games.

If this is your first visit to Beijing, we have a lot to offer you – from scenic sights, cultural experience, delicious cuisine, to warm and friendly people. Our generous hospitality will surely enchant you. We hope you will make new friends while revisiting old acquaintances. We promise you a great Congress in a beautiful location, and a pleasantly helpful team that demonstrates Chinese partnerships.

Sheng Wang
Congress Chair

David Caple, IEA President

The International Ergonomics Association (IEA) welcomes you to the 17th Triennial Congress hosted in Beijing, China. The IEA is a federation of ergonomics societies from 42 countries and involves over 20,000 members. Every three years we join with a society for our Congress. It is with much pleasure to work with the Chinese Ergonomics Society together with the Ergonomics society of Taiwan and Hong Kong Ergonomics Society, China for the 2009 Congress.

The theme of this Congress is "Changes, Challenges and Opportunities". The IEA has been actively seeking partnerships with other professional associations, international agencies and research partners to strengthen the growth of our domain.I am delighted to welcome these partners to our Congress and I encourage your participation with them during the Congress.

This Congress will enable presentations by, and interaction with, the leading ergonomics researchers and practitioners from around the world.The IEA has 26 Technical Committees each representing areas of the ergonomics domain. We welcome all members to join and participate in their seminars, workshops and presentation sessions.

Finally, I welcome you to enjoy the wonderful hospitality of our Chinese hosts in this vibrant city of Beijing. You will have a wonderful time.

David Caple
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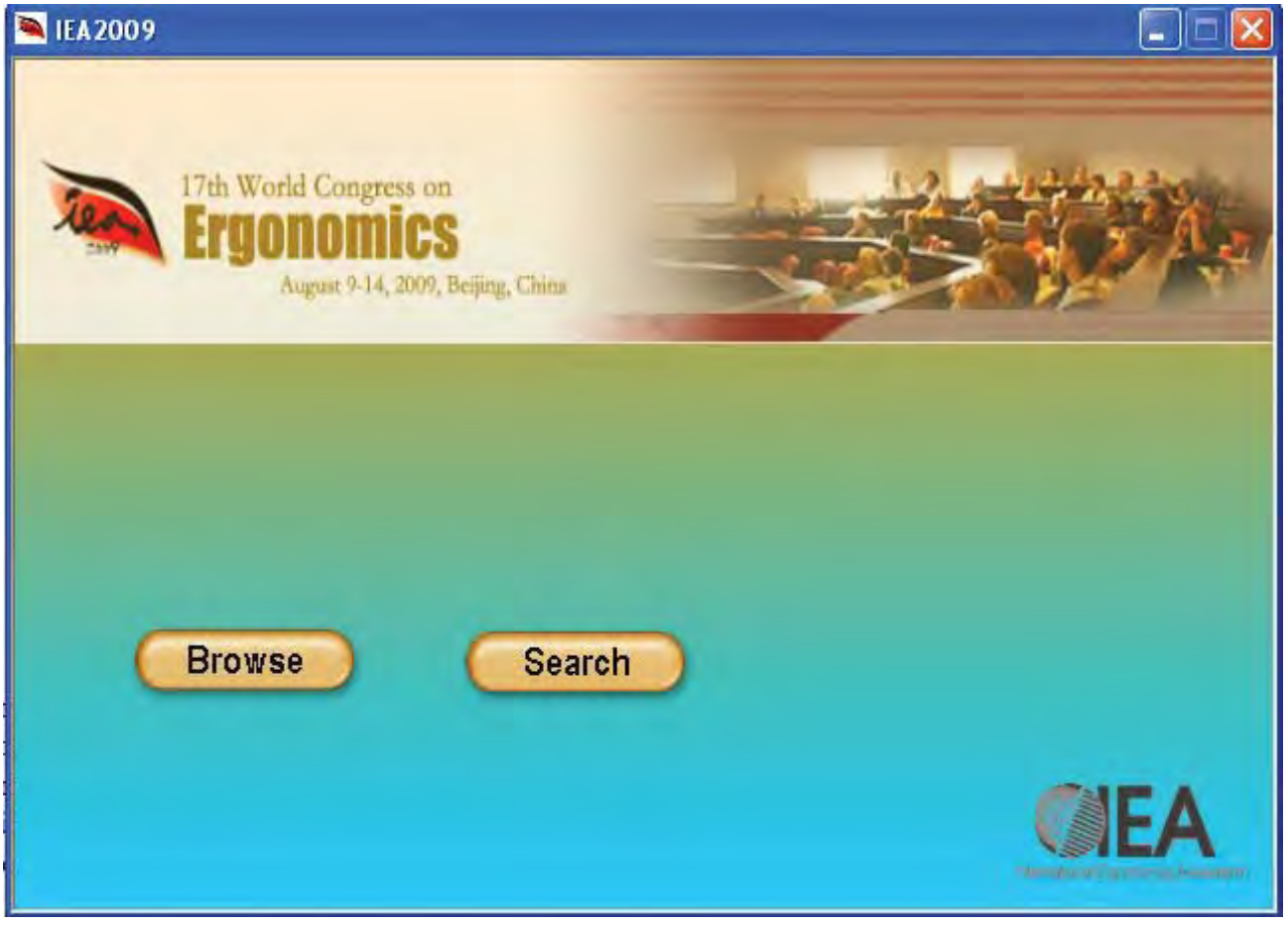
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A proposed framework of *Kansei* Engineering application in dealing with customer emotional needs in services

Markus Hartono*, Tan Kay Chuan
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Abstract

Many studies on product designs have been widely conducted with a focus on functionality rather than human emotions. However, customers today are very dynamic and no longer focus only on functionality needs. Emotions increasingly, play an important role in purchasing decision. In dealing with customer emotional needs, *Kansei* Engineering is proposed. This approach captures customers' desires and feelings (emotions/*kansei*) concerning products and translates these emotional needs into concrete product design.

Kansei Engineering has been applied extensively in product design, but not in services. A service is an intangible product. It is the fastest growing sector in today's businesses. Some prominent tools such as Quality Function Deployment (QFD) and Kano's Model are often used in services, but not incorporating customer emotional needs. In addition, some attentions have been widely used in investigating customer emotional satisfaction in services. However, there is not a formal methodology that can account for customer emotional needs. Therefore, to fill in these niches, this paper provides a proposed framework of *Kansei* Engineering in services.

The proposed framework incorporates QFD and Kano's Model as methods which focus on customer satisfaction. By applying Kano's Model, customer needs are exploited through a questionnaire, and, service attributes are classified. QFD is then used to transform customer emotional needs into engineering characteristics. In addition, other models such as Bayesian Network (BN) and Markov Chain are utilized as well. The latter two models are useful to promote prediction and diagnostic inference with a probability view point due to the dynamics of customer emotional needs. The use of such supporting models will enhance the ability of the *Kansei* Engineering methodology to meet a sudden change or trend of customers' emotional needs. Essentially, the proposed framework will start and end with customers to achieve customer emotional satisfaction.

In order to demonstrate the applicability of the *Kansei* Engineering approach in service design, this paper provides an illustration. A simple literature survey was conducted at a university field. A majority of the students spend most of their time on campus. Why do students spend so much time at the university when they can better spend their time elsewhere, such as at home? How can a university be made a convenient second home for students? In this research, these two questions will be answered and tackled by introducing a modified *Kansei* Engineering method. The university does not only provide an academic service, but also an emotional experience for students.

It is hoped that by introducing an improved innovative framework of *Kansei* Engineering, it could increase the level of customer satisfaction in pursuit of customer loyalty and a long-term relationship eventually.

INTRODUCTION

In today's fast changing and global competitive world, many companies are mostly investing their efforts and capitals to produce highly efficient, effective, competitive, profitable, differentiated products and services. Each product or service therefore needs to offer features or attributes or properties which make it attractive to customers. Many products that available in the competitive markets are shortly becoming mature products. It will lead the significance of number of sales.

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Compared to the first launching, the sales are not increasing as before. This influenced companies to reconsider their product and development strategies (Shimizu et al., 2004). However, some efforts of improvement such as quick model changes, technical updates or price reductions were no longer sufficient solutions (Schütte, 2005). These facts open an effort to explore more and capture the deepest voice of customer which is the *unspoken emotional needs* customers seek in product and service in generating greater sales and market share (QFD Institute, 2008). Eventually, this strategy is hoped to achieve a good long-term relationship with the customer.

To deal with emotions and evaluate affective aspects in product design and development, *Kansei* Engineering has been proposed. It is the formal methodology that has been used in

product development since 1970s. Besides products, nowadays, service sector becomes a driver of economic growth and creates more competitive advantages. Thus, it opens a great opportunity to apply *Kansei* Engineering into service industries.

In order to promote flexibility to dynamics of customer, it is important to understand and knowing for companies to purposely fulfill what the customers need and want in the future. In the long run, however, the dynamics of customer's preferences (needs and wants) is likely to occur. In other words, there will be uncertainties in the future due to the shifting of trends, competition of some manufactures or companies, changes of customer preference and other causal uncertainties within the periods of time.

This paper discusses *Kansei* Engineering methodology equipped with some tools which promote flexibility customer dynamics due to sudden changes of customer's preferences, shifting trends, lack of supporting facilities in the companies/manufactures or other sudden changes. Thus, in the long-term it is hoped to retain the potential customers and achieve customer loyalty.

MOTIVATION OF STUDY

Kansei Engineering has been only extensively applied to the designs of physical products/articles (Nagamachi and Imada, 1995; Nagamachi, 1995; Ishihara et al., 1995; Horiguchi and Suetomi, 1995; Lottum et al.; Hsu et al., 1999; Nagamachi, 2002; Schütte, 2004; Schütte, 2005; Schütte and Eklund, 2005) not of services. Thus, there is a need to propose and apply a systematic *Kansei* Engineering methodology into service design in meeting customer emotional needs to achieve high level of customer satisfaction.

RESEARCH OBJECTIVE

This research aims to propose a framework of *Kansei* Engineering applied into services. Some supporting tools and an illustration example which enhance the framework will also be discussed. By adopting and applying this framework it is hoped that the customer emotional satisfaction and loyalty in services will be fulfilled.

LITERATURE REVIEW

Definition of *kansei*

In Japanese, the concept of sensing a phenomenon or an artifact and building an individual emotional response is called *kansei*. In the context of product development, the *kansei* can be regarded as 'the impression someone gets from a certain artifact, environment or situation using all her or his senses of vision, hearing, feeling, smell and taste, as well as her or his cognition' (Schütte et al., 2008).

Kansei and Voice of Customer (VOC)

Voice of Customer (VOC) is a customer input which also called as a customer need; it is a voice in the customer's own words, of the benefit to be fulfilled by the product or service (Griffin & Hauser, 1993). Since kansei may represent what customer wants emotionally, it is referred as one kind of VOC.

Kansei Engineering

Kansei Engineering is defined as an ergonomic technology of customer-oriented product development. It does not only focus on the manufacturer's intention of the product, but rather on the customer's feelings/kansei and needs (Nagamachi & Imada, 1995). It is the first and foremost a product development methodology which translates customer's impressions, feelings and demands on existing products or concepts to design solutions and concrete design parameters.

Kano Model and *Kansei*

Kano Model basically categorizes customer needs into three different types: Must-be (M), One-dimensional (O), and Attractive (A). The must-be (M) or basic attribute is associated with those needs that are taken for granted by customers. For example, by providing sufficient toilet papers in restroom of hotel does not raise the level of customer satisfaction while late availability of toilet papers brings complaints from customers. The one-dimensional (O) or performance attribute shows the linearity relationship between customer satisfaction and performance of the attribute, the better the performance, the higher the level of customer satisfaction. For instance, in the reception service of hotel, a faster check-in process results in higher customer satisfaction.

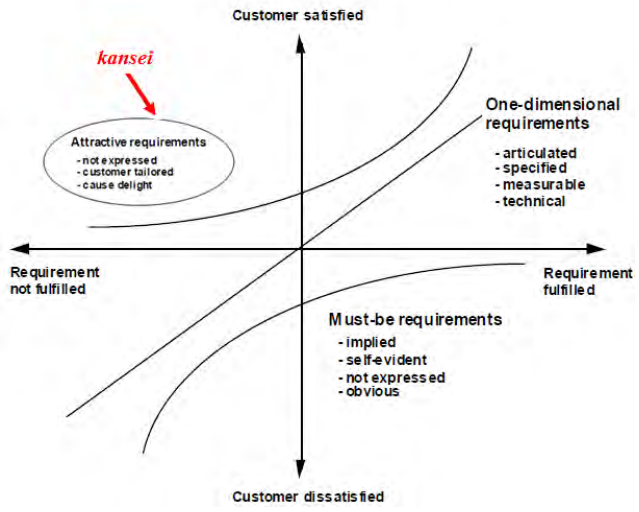

Figure 1 Incorporating kansei into Kano Model, modified from Berger et al (1993)

While, the attractive attribute (A) which is known as the delighters, a little fulfillment of performance of attribute brings a significant increase of customer satisfaction. Very often what belong to the attractive attribute is not specified and spoken by customer verbally. It may refer to *kansei* which is unspoken need of customer. A free of charge of delivery service of restaurant could be an example of attractive attribute.

Emotions in services

Many questions have arisen exploring what components

either cognitive or affective will contribute to the customer satisfaction. Customers will experience positive emotions if their expectations are met; otherwise if their expectations are not met. Emotion is influenced by two main factors (Barlow and Maul, 2000), those are, expectation and perceived performance.

Customer satisfaction and loyalty in services

Customer loyalty as a customer action oriented is regarded as the likelihood of a customer returning, making business referrals, providing strong word-of-mouth, as well as providing references and publicity (Bowen and Shoemaker, 1998). It is a function of customer satisfaction on service encountered.

Bayesian Network to model emotional needs for diagnostic and prediction approach

Bayesian Networks (BN) gives a simplified and structured way to solve problems that involve uncertainty and complexity with incomplete information (Cowell, 1999; Pearl, 1988). Bayesian Networks (BN) is directed acyclic graphs which represent uncertainties (variables) and conditional independencies. Bayes' theorem can be used as a rule to update the degree of belief when new information is presented. In human emotion area, BN are quite attractive for modeling emotion and personality. They can predict the likelihood of an affective state given a particular human emotion (Ball, 2000).

Markov Chain for long run behavior trend

Markov process could be applied to analyze customer retention and customer loyalty or in general this is useful to study the evolution of systems over repeated trials (Anderson et al., 2003; Render and Stair, 2000; Taha, 1997; Winston, 1994). A Markov chain is a special case of Markov process models which discusses either the short run or long run behavior of certain stochastic systems (Taha, 1997). A Markov Chain will be introduced as a model of customer's performances or preferences in the future (steady state condition) such that a better strategy could be made based upon the most updated customers' surveys. By incorporating last and current questionnaires surveys, initial and transition probabilities could be derived.

Quality Function Deployment (QFD)

Kansei Engineering and Quality Function Deployment (QFD) are parts of improved tools which have such methodology of translating voice of customer into product specifications. *Kansei* Engineering is the only tool especially designed for quantifying emotional customer needs and develops them into products (Schütte, 2005). The integration of these two tools are hoped to explore and capture emotional needs and translate into product properties/characteristics or service attributes.

FRAMEWORK DEVELOPMENT

Kansei Engineering methodology for services

First of all, we select a service area which is very interesting and highly expected by customer. Afterwards, it is followed by evaluating the current service quality and measuring the current customer satisfaction score. In order to improve and achieve excellent services, we will focus on the service qualities which have low satisfaction score and maintain the high level score ones.

After scoring the satisfaction level, we will do span the semantic space: collecting and selecting *kansei* words. After collecting *kansei* words, reasonable data reduction must be carried out considering sufficient number of *kansei* words and availability of the evaluation time of the questionnaire. Such selecting and structuring *kansei* words can be done manually (i.e. affinity diagram, interview) and statistically (i.e. Factor Analysis, Cluster Analysis). Then, we do span the service attributes: collecting service attributes, identifying and classifying service attributes, and selecting service attributes.

For identifying and classifying service attributes, Kano model is applied. As mentioned previously, Kano model basically categories service attributes into three different types, namely, Must-be (M), One-dimensional (O), and Attractive (A).

Afterwards, the next step is to link and evaluate semantic and service attributes space. In this step, the selected *kansei* words and service attributes are met and linked together. Some methods that might be used are Category Identification/*Kansei* Engineering Type I (Nagamachi, 1997a, 2001), Linear regression (Ishihara, 2001), General Linear Model (GLM) (Arnold and Burkhard, 2001), Quantification Theory type 1 (Komazawa and Hayashi, 1976), Neural Networks (Ishihara et al., 1996), Genetic Algorithm (Nishino et al. 1999), Fuzzy Set Theory (Shimizu and Jindo, 1995), Rough Set Theory (Nishino et al., 2001), and Neural Networks (Ishihara et al., 1996).

The relationship between *kansei* words and service attributes is represented by mathematical model with a function:

Kansei response = f (service attributes)

In dealing with dynamics of customer emotional needs (voice of customer), Bayesian Network (BN) and Markov Chain Model are approached. It will predict and diagnose the customer preferences in the future due to several changes in trends, sudden disruptions of components in the system.

Lastly, in integration of *Kansei* Engineering methodology and Quality Function Deployment (QFD), data from *Kansei* Engineering methodology can be used in order to identify customer's emotional needs and determine their importance, facilitating the setting of target values for technical response and perform benchmarking between different service attributes and brands and specify the relationships in the relationship matrix (Schütte et al., 2004; Schütte, 2005).

A proposed framework of *Kansei* Engineering methodology in dealing with customer's emotional needs in services is represented in Figure 2.

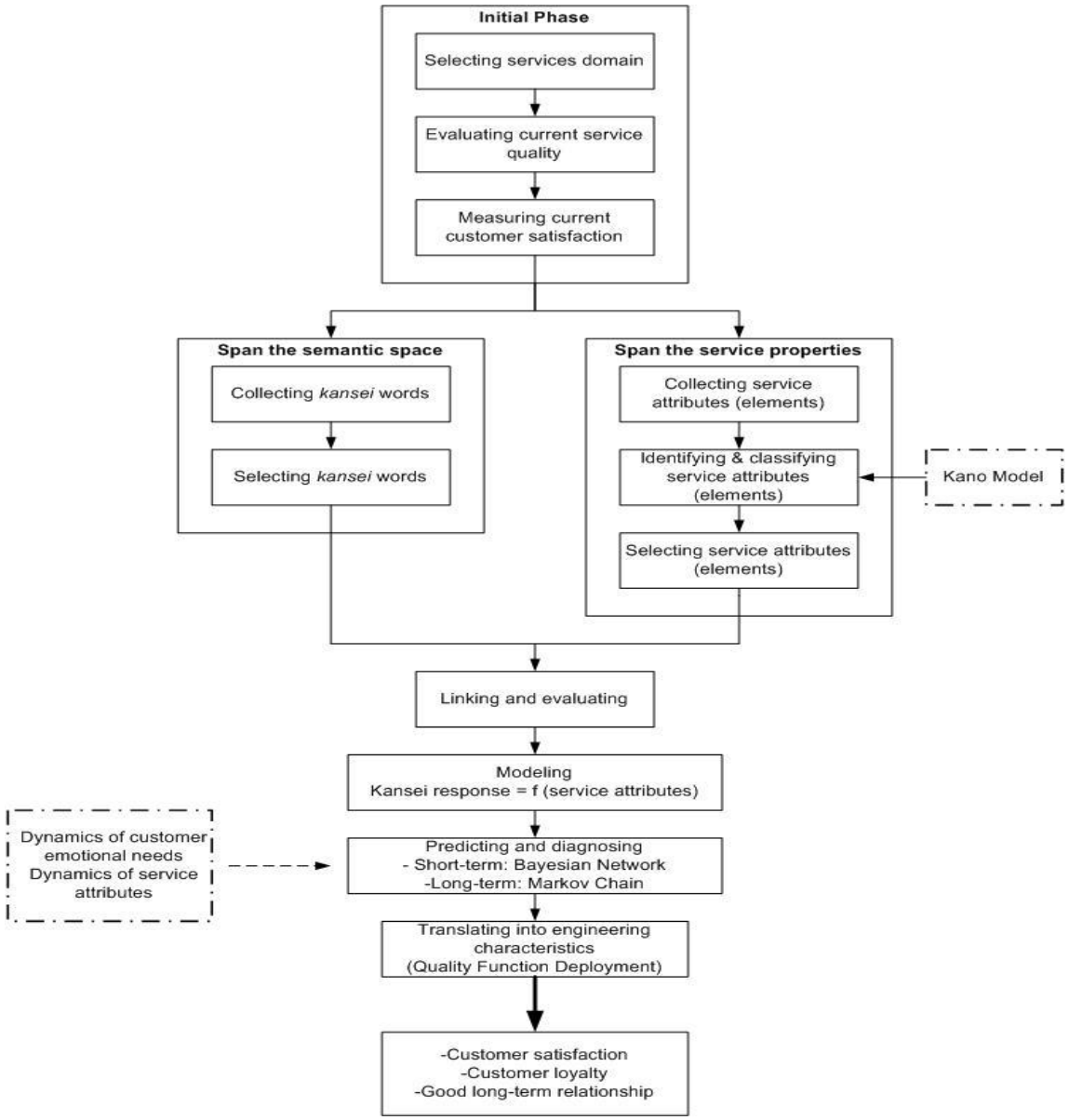

Figure 2 Proposed Framework of *Kansei* Engineering in services

ILLUSTRATION EXAMPLE
Kansei Engineering for university services

An illustrative example in the field of university services is adopted to demonstrate the applicability of the proposed *Kansei* Engineering framework. Based on the preliminary observation in several campuses, majority of the students spend most of their time in campus. Why do students spend so much time at the university when they can better spend their time elsewhere, such as at home? How can a university be made a convenient second home for students? This study tries to investigate some factors that may influence the comfort of students staying and doing some activities in campus using an approach of *Kansei* Engineering methodology.

By using SERVQUAL model we define the service attributes (elements) provided by university. The following are the service attributes categorized by the five service dimensions shown in Table 1.

Table 1 Service attributes of university demanded by students

Service Dimension				
Tangible	**Reliability**	**Responsiveness**	**Assurance**	**Empathy**
• Lighting in the class, library, and laboratory is bright • The design of class is modern-looking • Lecturers and staffs are properly and neatly dressed	• The class is started and ended at the right time based on the scheduled given • The class is accurately taught by the right professor • Quickly correct any errors in class or student	• Prompt student services • Staffs are helpful and friendly to respond student requests • Lecturers are easy and comfortable to approach	• Staffs are courteous • Lecturers have relevant and guaranteed knowledge to conduct lecturing and handle all students' questions	• Staffs give courage and attention to students patiently • Lecturers listen to student's difficulties and requests, and give supports with sympathy

Supposed some relevant collected *kansei* words (emotional needs) are **modern, beautiful, easy, friendly, pleased, fast, and relaxed.** This is done by interviewing students, distributing questionnaires, and selecting *kansei* words by using affinity diagram. Afterwards, the relevant service attributes are also successfully categorized as follows:

Table 2 Kano category of service attributes in university

Service attributes	Satisfaction score	Kano Category
Modern-looking design of class	-0.92	A
Beautiful and green park	2.4	A
Up-to-date curriculum based on market demands	-1.2	O
Easiness of class materials	-1.35	I
Prompt student services	-1.92	A
Friendly and helpful staffs	-1.2	O
Courteous staffs	0.42	I
Patient staffs in encouraging to students	0.96	O

By considering those highlighted service attributes (low satisfaction score with A and O categories) and available *kansei* words, multiple regression models are built. Supposed only a significant model (with α=5%) is obtained, i.e. Friendly = 3.5 + 0.01 (modern-look class) + 0.003 (prompt student services) + 0.25 (friendly and helpful staffs). It means that the three service attributes i.e. modern-look class, prompt student services, and friendly helpful staffs have a significant contribution to the *kansei* 'friendly' response.

In dealing with dynamics of customer emotional needs in the future or sudden changes/disruptions in certain service attributes, this framework is equipped with Bayesian Network and Markov Chain with probability point of view. We evaluate the sensitivity of likelihood of 'friendly' by adjusting the prior probability of 'modern-look class' and 'prompt student services'. As a result, the updated posterior probability of 'friendly' will come out. In other words, it is highly possible to make adjustment on some service attributes to achieve a certain *kansei* word that is needed by majority of customers.

A Markov Chain is utilized to predict *kansei* response and service attributes response in the future (steady-state). From a significant model of *'Friendly'* = f (modern-look class, prompt student services, friendly and helpful staffs), we need to calculate the response of independent variables (service attributes) by considering its level of importance and respective probabilities. The predicted level of importance of service attributes are shown in table 3.

Table 3 Comparison between current and future weight of service attributes

Service attributes	Current Level of Importance	Future Expected Level of Importance
Modern-looking design of class	4.6	3.22
Prompt student services	4.8	4.01
Friendly and helpful staffs*	4	3.55

Note: * = there is no significant different (assumed)

Lastly, we may incorporate service attributes that have no significant difference between current level of importance and future expected weight into House of Quality (HOQ). It means that the service attributes are still interesting in the future. The improvement on those service attributes will bring competitive advantages in the future. In this case, the demanded quality is friendly and helpful staffs that bring a highly influence on *kansei* 'Friendly'. Afterwards, the technical responses related to service attributes must be determined. Since this illustrative study is taken from university services, technical responses might be determined by standards of higher education.

DISCUSSION AND CONCLUSION

The objective of this paper is to propose a framework of *Kansei* Engineering in services. This paper tries to position and highlight a different application of *Kansei* Engineering methodology since *Kansei* Engineering has been applied extensively in product design, but not in services. Many attentions have been widely used in investigating customer emotional satisfaction in services. However, there is not a formal methodology that can account for customer emotional needs.

In order to give a better understanding of the proposed concept of *Kansei* Engineering approach in service design, this paper provides an illustrative example. A simple literature survey was conducted at a university field. An investigation of emotional needs of service attributes provided by university is conducted. This study is done by initially measuring current customer's level of satisfaction of services provided. It gives a valuable result of weak service attributes that may still attractive to the customers as specified by Kano categorization.

By using Multiple Linear Regression, *kansei* words (emotional needs) of student and service attributes are met, linked, and modeled mathematically. In adjusting the flexibility of provided services due to some changes of emotional needs, this framework is equipped by robust tool using Bayesian Network.

In addition to flexibility and achieve customer satisfaction in the future that influence the customer loyalty, this framework also incorporates Markov Chain model. It may predict the importance of service attributes in the future and predict the *kansei* word. It brings valuable inputs for service provider to put efforts on improvement of several attributes which are still attractive to the customer in the future (steady-state).

Lastly, those service attributes are incorporated into QFD as inputs of customer needs. QFD will provide service guidance for improving those weak and attractive attributes determined by the use of previous tools and analyses. Hence, in the end *kansei* of customers will be fulfilled and satisfied since there is a close-relationship between service qualities and *kansei* (emotional needs).

For further research and recommendation, a real case study should be conducted to showcase the effectiveness of proposed *Kansei* Engineering methodology and its contributions.

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