International Journal of Manufacturing & Industrial Engineering – IJMIE
Volume 1: Issue 2 *[ISSN: 2374 -1589]*
Publication Date : 25 June 2014

The Integration Framework of Kansei Engineering (KE) and Kano Method (KM) for Product Development

[Fevi Syaifoelida, S.H Yahaya, Haeryip Sihombing and M.Y Yuhazri]

***Abstract*— This study highlights and proposed the integration framework between Kansei Engineering (KE) and Kano Method (KM) in the product development. Kansei Engineering (KE) used is related to emotional needs of consumers of a product, while Kano Method (KM) is the articulation of the quality attributes of product. Through the survey conducted using the questionnaires developed of 6 Kansei Words (*i.e.* Miserable-Comfortable (MC), Slippery-Firm (SF), Irritating-Convenience (IC), Boring-Attractive (BA), Simple- Stylish (SS), and Ugly-Beautiful (UB)), the preference scale (between Dislike to Strongly Like), and 9 quality attributes based Functional vs. Dysfunctional questions, we use the design of pen product as a case study to justify the integration framework proposed. The survey is distributed to 220 students in higher education public institutions in Melaka, Malaysia. In this study, the result showed that any correlation existed between the emotional design (KE) and quality attributes (KM). However, the most of the correlation existed are on the functional elements of quality attributes.**

***Keywords*—Kansei Engineering (KE), Kano Method (KM), Emotional Design product, Semantic Differential (SD)**

I. Introduction

Nowadays, the customer purchases a product based on more subjective terms such as manufacturer image, brand image, reputation, design, and impression, although the products seem to be equal. Therefore, this condition make the companies in their product development related to the criteria of the design products are becoming more complex since they do not only have to meet the criteria of the customer satisfaction based on functionality of product, but also aesthetic of product based on emotional design. This is as argued by many scholars that supported the argument about the importance of the design criterion after the functionality and usability of product have been met (1). In this perspective, because of the level of product value itself that plays an important thing to be explored according to the requirement and satisfaction of the customer. First, Jordan (2) claimed that the functional and emotional considerations should collaborate to ensure the excellent product design happens to the optimal success in product development.

Fevi Syaifoelida, S.H Yahaya, Haeryip Sihombing and M.Y Yuhazri

Faculty of Manufacturing Engineering, Universiti Teknikal Malaysia Melaka, UTeM, Durian Tunggal, 76100 Melaka
MALAYSIA

Based on this reason, what actually the initial 'spark' for the demand in product design is a customer's own emotions. Here, due to the emotions can change a person's behavior which is a response to environmental conditions (3), but how to unlock those customer emotions to be something that could be in the right interpretation?

Second, there are various interpretations related to a human thought process involving or incorporating emotions, feelings and creativity (4). Here, Kano brings a fresh quantity of customers' expectation facts to the last feature set decision process and it also has the potential to fill out unspoken or the latent human needs (3). However, how they are having sensitivity, sensibility, feeling and emotion to the products related to aesthetic sense on the customer feelings? (5)(6)(7).

Third, there are no the integration of KE and KM existed in product development, although Lanzotti and Tarantino (8) have suggested this idea in their paper. Furthermore, Hartono and Chuan (3) that was inspired by Schutte (9) proposed the idea to integrate Kano Method and Kansei Engineering is also only focusing their work on how such integration in the development of a service.

Based on the reason above, this study therefore proposed the integration of the quality attributes (as a construction of consumers' feeling and perception of how much the level of importance of a design to the user) since, the method of KM takes into account what product to the consumer (10), and KE to grasp the customers' affective needs in accurately and subsequently to the design products that match to their needs since it is, in reality, the subjective impressions are difficult to translate into verbal descriptions and emotional states tend to be imprecise and ambiguous. (11).

II. Theoretical Approaches

A. *Kansei Engineering (KE) for product*

Nagamachi & Imada (12) claimed that the KE has a strong ability to deal with a current trend, besides to accommodate towards to customer emotional needs (Kansei). Kansei product is a product resulted from both qualitative and quantitative approaches in KE implementation. A successful Kansei product could be developed by the amalgamation of design requirements produced by implementing it and the experience and skill of product designers. Some noted example of Kansei products are Mazda Miata (13), Wacoal Good-up Bra (14), and Boeing 7E7 Interior Design (15). There are numerous

SEEK DIGITAL LIBRARY

other products of KE such as automobiles, home appliances, daily product use, kitchen cabinet design, virtual community design, airplane interior design, and the list keep mounting (16)(17)(18). In the implementation, KE has been used at different point of the product development cycle where sensible flexibility exists in making decisions concerning any design aspects of the product. Not only limited towards the product development, KE is also usable for the service product (9).

B. *Kano Method (KM)*

Kano Model was described about the customer satisfaction and determined to which requirements of a product or service bring more than proportional satisfaction to customers. Also, it determined which requirements didn't bring satisfaction when present, but brings dissatisfaction when they were not met. There are three distinct categories which affect to the customers in a different way identified through the product characteristic in Kano Model, *i.e.* Must-be (M), One-dimensional (O), and Attractive (A). Must-be (M) attribute is also known as dissatisfies. If these requirements are not fulfilled, the customer will be extremely dissatisfied. While the O, is also known as satisfiers. With regard to these requirements, customer satisfaction is proportional to the level of fulfillment. The higher level of fulfillment, the higher the customer's satisfaction and vice versa. Here, the A is also known as delighters.

These requirements are the product criteria which have the greatest influence on how satisfied a customer will be with a given product. Attractive requirements are neither explicitly expressed nor expected by the customer. The additional three attributes are Indifferent (I), Questionable (Q) and Reverse (R) (19). By formulating the questions, the expectation of what customer need is a prime importance as their expectation is a description of the problem to be solved from the customer's viewpoint and what they actually want. Figure 1 is an example of a pair of questionnaire used in order to gaining what a prior attribute among the six categories of Kano method.

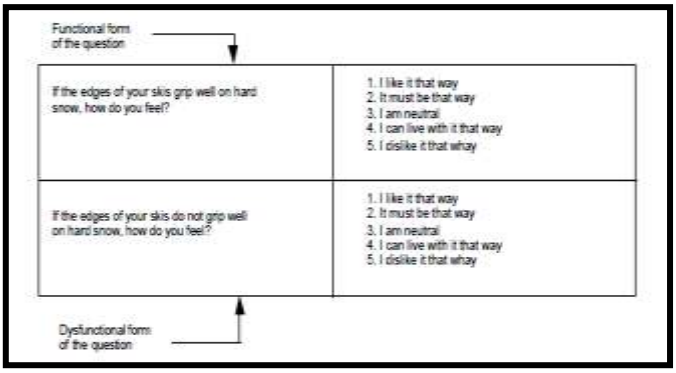

Figure 1: An example of functional and dysfunctional question in the Kano questionnaire (20)

III. Methodology

In this study, the proposed integration framework based on the hypotheses below in order to support the analysis conducted to the product development.

H_o: There are no existing correlation between the emotional design quality and functional product quality ($p<0.05$)

H_1: There are any existing correlation appears between the emotional design quality and functional product quality ($p<0.05$).

A. *Selection of product domain*

As a requirement of selection in product domain, a product (pen) is selected as a main part of a survey conducted among students in three public higher education institutions. A total of 220 students are involved and covering gender of male, female and a variety of races. The pen is chosen because it is an important medium in the form of a lesson in class and also acts as one of products that are often used in student daily life.

B. *Description of the framework*

As depicted in Figure 2, there are three major parts of the proposed integrative framework. The first part consists of Semantic Differential (SD) Emotional Word Development (KE involved), the second part is the Functional Product Development (KM involved), while the third part is the Product Study Development. These three parts play as an important key to capture the elements of KE and KM performed in the product development.

- Part 1: SD Emotional Word Development (KE involved)

In identifying what the needs of customers through their emotions, a process must be designed so that every word may be disclosed. In this section, there are two phases being concerned. Phase 1 is a 'Customer Emotional Word Exploration'. It is a process of how to collect the Kansei Word (KW) which the combination comes between the external collection (*i.e.* magazine) and the words articulated by users to the product design based on existing products. Finally, a database of new words is built and formed into a group of words (same meaning) and the major word chosen is selected as a word used for questionnaire developed. Phase 2 is 'Customer Emotional Word and Construction'. It is a process that involves the translation of the word in antonyms (opposite) and synonyms (real meaning), before every single Kansei word can be formed and expressed in the scale of Semantic Differential (20).

- Part 2: Functional Product Development (KM involved)

In this section, the development of the words in Part 1 (Phase 1 & 2) will be used to form the sentences or statements of Kano (Functional& Dysfunctional). The formation of functional requires a combination of positive words (synonyms), meaning and function of the product itself while

SEEK DIGITAL LIBRARY

the formation of dysfunctional requires a combination of negative word (antonyms), meaning and function of the product itself.

- Part 3: Product Study Development

In order to gain what the exact requirement in the process of design, the first step is the product study development to the elements required of the existing products in current market until the pre-result of an element existed (main requirement of design). Before entering into the next phase (combination Part 1&2), the development design of the product is continued as the final result and takes into consideration as the "final characteristic of product". The result is developed based on analysis carried out towards the collected data of KE, KM and product as illustrated in Figure 3 and Figure 4.

Figure 3. Pen Design Development

Miserable	1 2 3 4 5 6 7	Comfortable
Slippery	1 2 3 4 5 6 7	Firm
Irritating	1 2 3 4 5 6 7	Convenience
Boring	1 2 3 4 5 6 7	Attractive
Simple	1 2 3 4 5 6 7	Stylish
Ugly	1 2 3 4 5 6 7	Beautiful
How much do you like this design?		
Strongly Dislike	1 2 3 4 5 6 7	Strongly Like

Figure 4.Kansei Words in Semantic Differential Scale

IV. Results & Discussion

A. *SD Kansei Words (KW) and Kano Statements*

The collecting of Kansei Words based on survey in Phase-1 (Comfortable, Slippery, Convenience, Attractive, Stylish, and Beautiful) and Phase-2 (Miserable, Slippery, Irritating, Boring, Simple and Ugly) are pairing towards the SD scale in weighted of seven. While the preference of design is constructed into the Likert type with seven scales as shown in Figure 4.

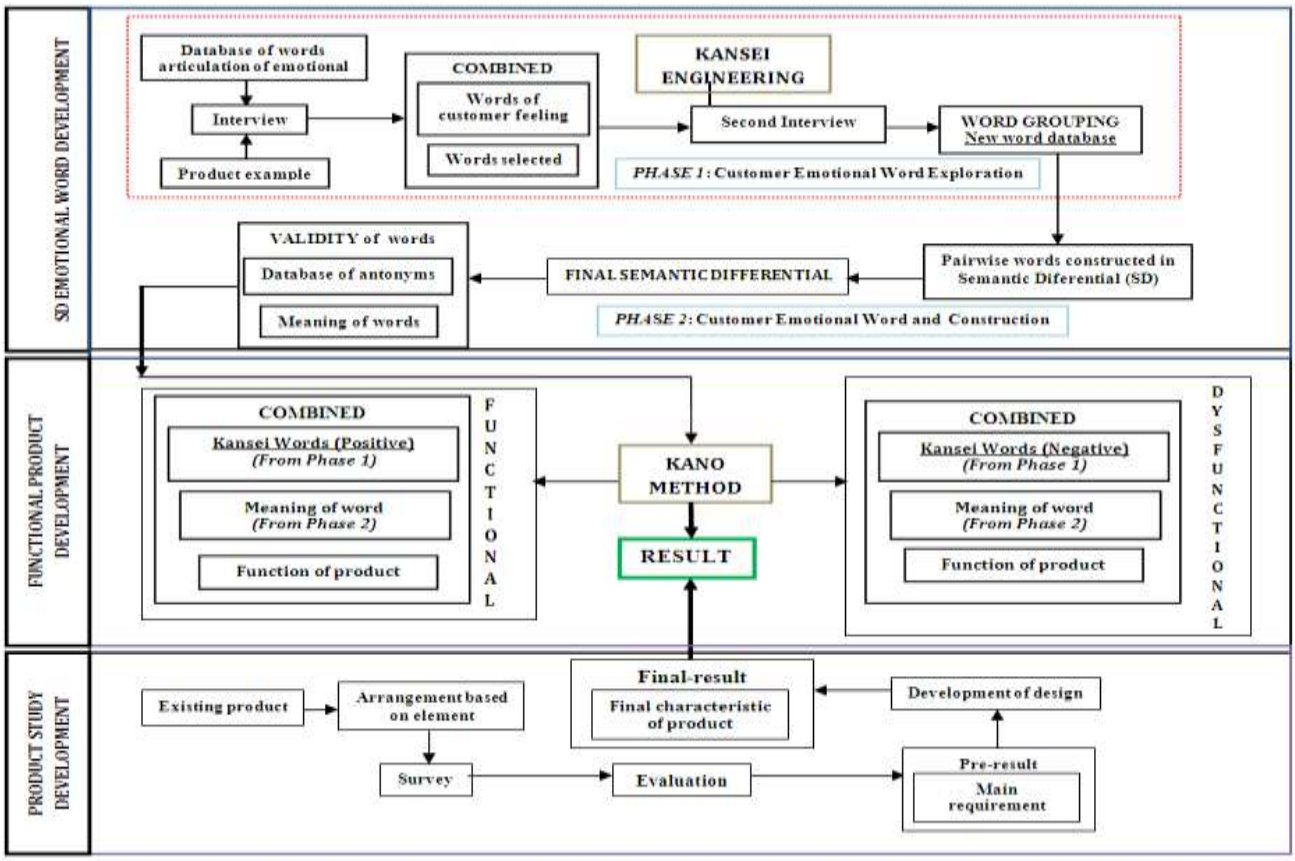

Figure 2.The integration framework of KE and KM in product development

SEEK DIGITAL LIBRARY

As a combination of the results towards the functional product development in part 2 (Fig.2), the Kano statement is come out in Functional and Dysfunctional domain, which are as follows:

- In Functional element of Kano Method, the statement is gained as 'A pen with a click makes me feel comfortable *(KW)* as it is provides physical relief *(meaning)* when writing (function)'
- While in Dysfunctional element, the statement is 'A pen with a click makes me feel miserable *(KW)* as it is giving uncomfortable *(meaning)* when writing.'

Both of statements above are indirectly give the combination between the perceived attributes/qualities and the emotional/Kansei response.

B. *The preference design and the priority of Kansei words*

The powerful method using Analytical Hierarchy Process (AHP) as a decision making showed the most preference design is the design no .4 (Figure 5) towards the Kansei Words of 'Firm', where the score is 89 out of 220 of the respondents. The respondent agreed that the 'Firm' is most factors that need to be first considered in designing of a pen product. This is means that the element of 'grip' of a pen makes a pen product more valuable in the market and as a main priority considered by customer while purchasing made.

Figure 5: Preference design of pen and main requirement.

C. *The Integration of KE and KM*

Figure 6 shows that the KM represented in the Functional (F) code (F1, F2, F3, F4, F5, F6, F7, F8 and F9) and the Dysfunctional (DF) code (DF1, DF2, DF3, DF4, DF5, DF6, DF7, DF8, and DF9) against the Kansei Words code of Miserable-Comfortable (MC), Slippery-Firm (SF), Irritating-Convenience (IC), Boring-Attractive (BA), Simple- Stylish: (SS), and Ugly-Beautiful (UB). The results showed that the more correlation is existed in Functional compared to Dysfunctional elements.

Figure 6 shows the SF (Slippery-Firm) has the highest number strong correlation to the Functional elements of Kano attributes, while F1 has most numbers of strong correlations to the Kansei words. While to the Dysfunctional elements, the strong correlation is only on SS and UB. The strong correlation among Kano method represented in Functional and Dysfunctional element to the Kansei words occurred on UB, (0.156 and 0.169, $p<0.05$). This is means that the twist design of pen is having strong correlation with the emotional design represented with Kansei words of Ugly – Beautiful (UB).

	MC	SF	IC	BA	SS	UB
F1	,185(**)	,201(**)	,250(**)	,202(**)	,235(**)	,238(**)
F2	,184(**)	,156(*)	,181(**)		,142(*)	,183(**)
F3	,152(*)					,156(*)
F4	,226(**)	,188(**)	,219(**)		,166(*)	,184(**)
F5						
F6					-,188(**)	
F7						
F8		,178(**)				
F9		,208(**)				

	MC	SF	IC	BA	SS	UB
DF1						
DF2						
DF3						,169(*)
DF4						
DF5						
DF6						
DF7					,134(*)	
DF8						
DF9						

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed)

Figure 6.The Interrelationship of KE and KM in DF & F

v. Conclusion

This study found that there are relationship existed between the KE and KM. An integration framework of the Kano Method and Kansei Engineering is tested through three empirical studies towards the product used in our daily life. The result shows us that the perceived attributes or qualities is impacted or influenced against the emotional design or Kansei response. Based on this study with using the pen design product, we conclude as follows:

- The strong correlation between Kano Method and Kansei Engineering are mostly on Functional elements of quality attributes.
- The attributes of 'A pen with a click makes me feel comfortable as it is providing physical relief when writing' should be given as a main priority in the pen product development because the relationship is existed towards all of the emotional design.
- The Kansei words of ugly-beautiful having correlation with the mechanism (twist) of pen design. However, the value of this strong correlation is low.

This study gives the useful spectrum to the others in order to gain more powerful product development in the future, and still on the customer satisfaction and requirement track. Further research should focus or more effort given towards on applying this integrated framework in order to evaluate, to access this relationship of customer emotional needs or

SEEK DIGITAL LIBRARY

requirement and product attributes in the other product development domain.

Acknowledgment

This research supported by Fundamental Research Grant Skim FRGS/2012/FKP/TK01/03/1/F00133 through Universiti Teknikal Malaysia Melaka (UTeM).

References

[1] D.J. Koehler. And N. Harvey, "Walking with the Scarecrow: The Information-processing Approach to Decision Research," In J. W. Payne & J. R. Bettman (Ed.), Blackwell Handbook of Judgment & Decision-making ,pp. 110-132, Blackwell Publishing, 2004.

[2] P. Jordan, Designing Pleasureable Product. New York, Taylor & Francais,2000.

[3] M. Hartono. and T.K. Chuan, "A Proposed Integrative Framework Of Kansei Engineering And Kano Model Applied To Services," The 2nd International Research Symposium in Service Management,Yogyakarta, 26 – 30 July 2011, pp.484-492.

[4] S. Lee, H. Hee. and Stappers, Pleasure with Products: Design Based on Kansei, Chapter 16 of Pleasure with Products: Beyond the Usability, Taylor and Francis, 2002.

[5] M. Nagamachi, Kansei Engineering and Its Method, Management System, vol.2, no.2,pp. 97-105,1992.

[6] S. Ishihara, K. Ishihara. and M. Nagamachi, "Analysis of Individual Differences in Kansei Evaluation Data Based on Cluster Analysis," Proceeding Of The Kansei Engineering International, pp. 49-58,1993.

[7] A. Harada, "On the Definition of Kansei," Prooceeding of the Modeling the Evaluation Structure of Kansei Conference. vol.2 pp.22, 3 November 1998.

[8] A. Lanzotti. and P. Tarantino, "Kansei engineering approach for total quality design and continuous innovation," Total Quality Management Journal, vol. 20, pp.324-337, 2008.

[9] S. Schütte, J. Eklund, J. R. C. Axelsson. and M. Nagamachi, "Concepts, methods, and tools in Kansei engineering," Theoretical Issues in Ergonomics Science, 5, 214-232, 2004.

[10] E. Sauerwein, F. Bailom, K. Matzler. and H. Hans, "The Kano Model: How to Delight Your Customers," Proceeding of the International Working Seminar on Production Economics, Innsbruck/Igls/Austria, vol.I, pp. 313 -327, 19-23 February 1996.

[11] M.G. Helander, and H.M Khalid "Affective and Pleasurable Design". In G. Salvendy (Ed.), Handbook of human factors and ergonomics,3rd ed.. New York: Wiley Interscience, 2005.

[12] M. Nagamachi. and A. S. Imada, "Kansei Engineering: An Ergonomic Technology For Product Development," International Journal of Industrial Ergonomics, 15, vol.1,1991.

[13] M. Nagamachi, Kansei Engineering- A New Consumer-Oriented Technology for Product Development. In W. Karwowski and W. S. Madras (Eds.), The Occupational Ergonomics Handbook, CRC Press, pp.1835-1848,1999.

[14] M. Nagamachi, The Story of Kansei Engineering, Tokyo: Japanese Standards Association, Vol.6,2003.

[15] J. Guerin, "Kansei Engineering for Commercial Airplane Interior Architecture," Proceeding of the 16th Symposium on Quality FunctionDeployment, pp. 19-26, 10 July 2004.

[16] Y. Takama, M. Kawabe, K. Hirota, "Kansei Keywaord Extraction from Japanese Film Scenario Using Sensitivity Information," Proceeding of the IFSA World Congress and 20th NAFIPS International Conference. July 25-28,2001.

[17] T. Childs, A. Pennington, J. Rait, T. Robbins, K. Jones, C. Workman, S. Warren, and J. Colwill, Affective Design (Kansei Engineering) in Japan. University Of Leeds: Leeds, 2003.

[18] F. Syaifoelida, H. Sihombing, S.H. Yahaya, M. Y. Yuhazri. and K. Izzet, "The Design Preferences Decision Using the Analytical Hierarchy Process towards Kansei Engineering Approach: Spectacles Design," International Journal of Application or Innovation in Engineering & Management, vol.2, no.2, pp.2319 – 4847, 2013.

[19] K.H. Kano, H.H Hinterhuber, F. Bailon. and E. Sauerwein, "How to delight your customers," Journal of Product and Brand Management, vol.5, pp.6-17,1984.

[20] C. E. Osgood, G. J. Suci. and P. Tannenbaum, The Measurement of Meaning. Urbana USA: University of Illinois Press, 1957.

About Author (s):

Fevi Syaifoelida (@FNAS) received her diploma and degree in Manufacturing Engineering from Universiti Teknikal Malaysia Melaka (UTeM) in 2009 and 2012. Currently, she is a postgraduate student in the Faculty of Manufacturing Engineering of UTeM and assigned under the Manufacturing Management Department. Her research interest is in Product and Service Development, Quality & Reliability, Lean Manufacturing, and Strategic Management

Saifudin Hafiz Yahaya received his degree and MSc. degree in Applied Mathematics from Universiti Sains Malaysia (USM). Currently, he is as an academic staff in the Faculty of Manufacturing Engineering of UTeM and assigned under the Manufacturing Design Department. His research interest is in Computer Aided Geometric Design, CAD/CAE, Sustainable Design, Mathematical and Computer Modeling, Ecological and Environmental Modeling.

Haeryip Sihombing (@HHIP) received his degree in Electronic Engineering from ST.INTEN in 1994 and MSc. degree in Industrial Engineering from UPH (Indonesia) in 2000. He experienced working with AT&T, Sinoca, MicroPack, and Chubb Lips. Since 2006, he has been giving a service in the Department of Manufacturing Management at UTeM as a visiting lecturer in the Faculty of Manufacturing Engineering. His research interest is in Operation Management, Product Development, Quality & Reliability, and Strategic Management

Mohd Yuhazri Yaakob received BSc and MSc. degree in Mechanical Engineering from Kolej Tun Hussein Onn in 2005 and Universiti Teknikal Malaysia Melaka (UTeM) in 2008. Currently, he is as an academic staff in the Faculty of Manufacturing Engineering of UTeM and assigned under the Engineering Materials Department. His major research interest is in Structural Composites research. He is also actively involved in the innovation and composites based product development.

SEEK DIGITAL LIBRARY