International Journal of Technology (2017) 6: 1070-1081
ISSN 2086-9614

HOW KANSEI ENGINEERING, KANO AND QFD CAN IMPROVE LOGISTICS SERVICES

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(Received: January 2017 / Revised: June 2017 / Accepted: October 2017)

ABSTRACT

In the period of 2004 to 2014 there was a significant growth of employment in the logistics sector in Indonesia. This reflects a rapid rise in the need for logistics activities to support outsourcing. Because there is strong competition in the sector, logistics services should be able to deliver both cognitive and affective customer satisfaction. Studies in logistic services have been mainly focused on service gaps, an aspect related to cognitive satisfaction in customers. Many studies have been conducted to evaluate logistics service quality using SERVQUAL and the Kano model. However, these are insufficient in addressing all aspects of logistics provision. Hence, a deep understanding of customer affective need (known in Japanese as Kansei) is required, to provide competitive advantage by modeling more comprehensive customer experiences based on perceived logistics services. This paper proposes a combined model of Kansei Engineering, Kano, and quality function deployment (QFD), which it is hoped will generate more innovative ideas for improvements related to customer emotional satisfaction and customer delight. A case study in supporting logistics services has been chosen to validate the proposed model, and a survey through face-to-face questionnaires involving 157 customers was carried out. The model was then validated, and through the House of Quality (HoQ) concept, some innovative improvement ideas are proposed. They include the use of apps for order confirmation and cancellation, the integration of Google Maps into the ordering system, pre-order booking, and a bilingual feature in the transaction menu. Thus, from a practical implication point of view, it is hoped that this study will provide guidelines to the managers of logistics services companies in capturing, measuring and analyzing customer emotional needs (Kansei), with respect to the service attributes which are highly significant to Kansei aspects.

Keywords: Kano; Kansei Engineering; Logistics; QFD; Services

1. INTRODUCTION

Customer loyalty will be indirectly affected by perceived service quality because of the impact such quality has on the satisfaction that in turn creates loyal customers. Service quality can be considered as a composite of multiple service attributes categorized as tangible or intangible/subjective (Stefano et al., 2015). The assessment of service quality can be performed by investigating the gap between perceived quality and customer expectation, through a research tool known as SERVQUAL (Parasuraman et al., 1988). SERVQUAL has been used extensively since the 1990s, particularly in the service domain. The common dimensions of service captured by SERVQUAL are tangibles, reliability, responsiveness, assurance and empathy.

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Permalink/DOI: https://doi.org/10.14716/ijtech.v8i6.689

One of the emerging service sectors is logistics, especially logistics. According to Chen et al. (2015), this type of service can add great value to customers and companies. There are three principal aspects to logistics services for customers: package pick-up, tracking, and delivery services, and these services may play a critical part in leveraging the effectiveness and efficiency of the physical distribution and online transactions of goods, and even of services (Hsu et al., 2011).

Service experiences start and end with human beings, with the meeting of customer needs at the beginning of the process being completed by customer satisfaction and loyalty at the end. Research exploring human involvement in service encounters is less common that other types of research (Drury, 2003). Both the 'servicescape' and interactions between customers and employees will build service satisfaction. In other words, it is said that processes, activities and interactions are more important in service experiences than are things (Lovelock, 1991; Vargo & Lusch, 2004). In terms of human-based interactions, service experiences will produce both cognitive and affective satisfaction (Wong, 2004; Hartono & Tan, 2015).

In obtaining a competitive advantage with respect to customer behavior, those delivering services should put more effort into integrating human factors into service design (Abras et al., 2004). The scope of human factors known as ergonomics covers physical and psychological human behaviors, environments, products, and services (Chen et al., 2015). Inherently, the concept of ergonomics has been significantly extended from its original approach related to physical products into service design. Hence, the service provider needs to understand what customers expect and how they perceive the services they receive (Cook et al., 2002).

Products and services are deemed to be successful when they can produce happiness in customers or users (Norman, 2004). Moreover, it is hoped that emotional satisfaction can go beyond just the usability and functionality of products (Helander & Khalid, 2006; Hartono & Raharjo, 2015). In dealing with, capturing and modeling customer emotional needs into service design and development, it is proposed that the concepts of Kansei Engineering (KE) can be employed (Nagamachi, 1995; Schütte, 2005; Hartono & Tan, 2011). Since the 1970s, Kansei has been the dominant ergonomic-based product design development, aiming to put emotions into its core concept, and later to quantify them into design specifications (Nagamachi, 1995).

According to Chen et al. (2015), KE has been applied to the design of physical products such as architectural interiors and exteriors, consumer goods, mobile phones, and even sports shoes. Recent research on KE has demonstrated its applicability for self-monitoring blood glucose applications (Dewi et al., 2017) and, in the Indonesian context, designing 4×2-wheel-drive passenger car exteriors (Yogasara & Valentino, 2017). In general, designers use Kansei terms to represent emotional needs which have been translated into product elements. However, the use of KE in services is deemed to be limited, but its application into services may cover delivery and installation of internet services (Nishino et al., 1999), hotel services (Hartono & Tan, 2011), restaurant services (Hartono, 2016a), and logistics services (Chen et al., 2015). One of the advantages of KE is its ability to show the interactive relationship between design characteristics and emotional responses, thus establishing a quantitative framework.

KE has been applied to logistics services as one of the emerging service types, as shown in research by Chen et al. (2015). Recent research into KE in logistics services has been carried out by exploring the quantitative relationship between the feelings (based on Kansei terms) and design elements in home delivery services. This research has shown that when the most important design elements are connected to critical feelings, improvements can emerge. However, in terms of efficiency, the study by Chen et al. (2015) can be strengthened and extended by incorporating potential quality tools, such as the Kano model and QFD. According to Hartono (2012), the use of the Kano model and QFD in Kansei methodology research may

provide a formal methodology which accounts for customer emotional needs in service design. Hence, this study of KE integrated with the Kano model and QFD in logistics services is proposed. Kano will help with the screening process to identify which service attributes are categorized as one-dimensional (O) and attractive (A), aspects which are critical to Kansei, while QFD will finalize the weighted, prioritized service attributes to be improved using the House of Quality (HoQ) (Hartono & Tan, 2011).

Thus, the objective of this study is to develop a conceptual framework applied to logistics services combining KE, Kano and QFD concepts, and to conduct an empirical study of IT-based logistics services to test the applicability of the proposed model. The details of the advantages of this integrative framework compared to the individual methods are summarized in Table 1.

Table 1 Comparison between the individual methods and the proposed integrative framework

Individual method	Proposed integrative framework
KE is used as a bridge between Kansei and service experience; it is a methodology to translate customer emotional feelings into service characteristics. However, it **lacks** information about which service attributes are important and most urgently need to be addressed. The **Kano model** sorts service performance into three main categories: attractive (A), one-dimensional (O), and basic/must-be (M) qualities. However, it **lacks** information about which service attributes are sensitive to particular Kansei. **QFD** translates customer needs into product or service elements/characteristics. However, it **lacks** information on customer needs (for instance, customer emotional needs/Kansei) and a weighting scale formulation.	To overcome the defined deficiencies, an **integrative framework** combining KE, Kano and QFD has been proposed. This framework **links** sensitive or urgent customer emotional needs (known as Kansei) with service attributes experience, and **prioritizes** which service attributes are to be improved, taking into account their impact on Kansei.

With regard to the details of the proposed approach shown in Table 1, the expected contribution of this current study, as contrasted to the previous research on Kansei, is that it will complete the broader application of KE in the different setting of logistics services. The use of QFD accompanied by a Pareto diagram is expected to explore and consider more practical solutions based on current best practice improvements.

2. LITERATURE REVIEW

2.1. KE in Services

Referring to Nagamachi (1995) and Nagamachi and Lokman (2011), research into KE ranges from physical products to customer service (known as Kansei quality management). Essentially, the core benefit gained is the same in whichever sector is reviewed, that is, the focus on starting and ending any process with customer emotional needs. More specifically, research into KE in services has been introduced and applied to hotels (Hartono & Tan, 2011; Hartono & Raharjo, 2015), restaurants (Hartono, 2016a), and even to interior design (Llinares & Page, 2011). By embracing current issues of sustainability, KE has been extended to tackle today's organizational problems. The most recent research on KE, in which a more efficient approach has been addressed, is an extended model of KE, Kano and the *Teoriya Resheniya Izobretatelskikh Zadach* (TRIZ) intended to solve some potential contradictions in solutions (Hartono, 2016a). KE, then, has been extended to cover sustainability issues relating to environmental, economic, and social elements. In term of the research gap identified, a short

summary of KE research on services published between 2011 and 2017 is provided in the matrix in Table 2.

Table 2 Recent research on KE applied in services

Author(s)	Concerns, tools, and methods						
	General KE	SERVQUAL	Kano	TRIZ	Culture	Sustainability	Logistics
Llinares & Page, 2011	√		√				
Hartono & Tan, 2011	√	√	√				
Hartono, 2012	√	√	√				
Rasamoelina et al., 2013	√						
Hartono et al., 2013	√	√	√		√	√	
Hartono, 2014	√	√	√				
Hartono & Raharjo, 2015	√	√	√		√		
Chen et al., 2015	√						√
Hartono, 2016a	√	√	√	√	√		
Hartono, 2016b	√	√	√	√		√	
Current research	√	√	√				√

From Table 1 it can be seen that this current research is positioned where KE may contribute to the field of logistics services (in this case, third party logistics, or 3PL) using general KE methodology integrated with SERVQUAL and the Kano model. The choice of the logistics field is hoped to generate a practical contribution to today's trends in services.

2.2. The Kano Model in Services

According to Hartono and Tan (2011), the Kano model is deemed to strengthen KE methodology by providing a guideline of how customers rate their satisfaction with perceived services, either as one-dimensional/linear satisfaction or as attractive/delighted satisfaction (Kano et al., 1984). Such aspects are related to Kansei (Hartono & Tan, 2011). One-dimensional satisfaction provides a linear relationship between product characteristics fulfillment and satisfaction level, whereas attractive/delighted satisfaction will relate more to latent or unspoken needs. Once this type of need is fulfilled, it can generate unpredicted levels of satisfaction. If they are not met only normal satisfaction will be felt. More specifically, such aspects go beyond usability and satisfaction and it is predicted that delighted customers will have an emotional bonding with a particular service provider.

2.3. The SERVQUAL Model and Logistics Services

In this study, the service quality for logistics services is modeled and measured by SERVQUAL (see Parasuraman et al. (1988) for details), which consists of five dimensions (tangibles, reliability, responsiveness, empathy, and assurance). SERVQUAL scales will serve as the measurement instrument of perceived and expected services. Overall, logistics service quality covers comprehensive activities ranging from order receipt to delivery to the customer.

In looking at logistics services, one of the most interesting aspects for research is home delivery services, as has been carried out by Chen et al. (2015). Another interesting type, which is becoming a global trend, is that of the logistics service provider or 3PL. Third party logistics is deemed to occupy a critical position in the supply chain for international and domestic trading. From the customers' point of view, Franceschini and Rafele (2000) state that logistics services can be measured in terms of lead-time, regularity, reliability, flexibility, preciseness, harmfulness and productivity. This current research looks 3PL which can be scaled and customized to customer needs such as the level of demand, and delivery service requirements. It may cover products/goods, personal services, and several other types of service. In other words, 3PL may go beyond logistics to include value-added activities.

3. FRAMEWORK DEVELOPMENT AND RESEARCH METHODOLOGY

3.1. Framework Development

Based on the research background and KE research in services, a research framework of KE incorporating Kano and QFD is developed (as shown in Figure 1). The framework starts with the problems faced by a particular logistics services company, and then spans the Kansei terms (as the response variables) and perceived service attribute performance (functioning as the predictor variables). Concurrently, a Kano categorization process is conducted to filter the one-dimensional and attractive performance indicators (O and A categories) which are sensitive to Kansei. By generating a linear model the development continued with the calculation of satisfaction scores (see Tan & Pawitra, 2001), and prioritized improvement for particular service attribute(s) is defined. This process is then completed with investigation into how to generate design specification(s) through the application of the QFD HoQ process.

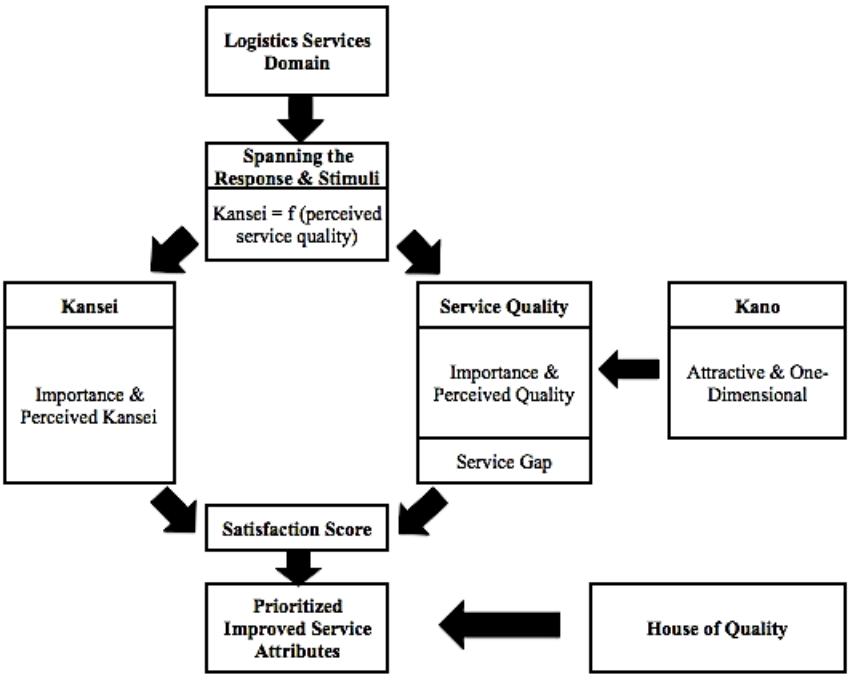

Figure 1 The framework of KE, Kano and QFD for logistics services

3.2. Research Methodology

By adopting the methodology proposed by Hartono (2016a; 2016b), this study utilizes a survey approach through a face-to-face questionnaire, convenience sampling plan, and involving a specific target of respondents for particular logistics services. Those who had experienced logistics services from XYZ company at least twice within a year were selected as potential subjects. Items in the questionnaire were devised based on the literature review, interviews with actual users, and personal observation.

4. CASE STUDY OF IT-BASED APPLICATION LOGISTICS SERVICES

A case study of IT-based application-supporting logistics services in Surabaya known as XYZ was carried out. XYZ is also known as a hyperlocal transport service that uses motorcycles. The study involved 157 respondents who had those experienced the services of XYZ over the period August–October 2016. Of the respondents 54% were female and 46% male, with a majority (55%) aged from 16 to 25 years, followed by 26–35 years (27%), 36–45 years (14%), and

above 45 years (4%). Most of the respondents were college students (39%), followed by professionals (31%), entrepreneurs (17%), with the remainder being homemakers.

In terms of the discrepancy between the perceived and expected logistics services, the service gap was calculated for each of the logistics service attributes (as shown in Table 3). Then, in order to confirm that the gap was significant, a t-test for comparing two sample means was carried out. The results of the t-test are also provided in Table 3. The results show that, in all service attributes, H_0 was rejected. This means that, for all logistics service attributes, the perceived service received was poorer than the expected service. The customers felt that what they had received did not match with what they expected.

Table 3 The statistical test for logistics service gap

No	Logistics service attributes	Gap*	t_{value}	p_{value}	< / >	α	Remark
	Tangibles (T)						
1	Vehicle type	-0.56	-7.733	0.000	<	0.05	H_0 rejected
2	Cleanliness of vehicle	-0.86	-11.852	0.000	<		H_0 rejected
3	Driver performance	-0.65	-8.664	0.000	<		H_0 rejected
4	Completeness of driver's attributes	-0.76	-9.390	0.000	<		H_0 rejected
5	Driver rating score	-0.37	-4.984	0.000	<		H_0 rejected
6	Web-based application interface	-0.39	-4.804	0.000	<		H_0 rejected
7	Cleanliness of helmet for customer	-1.27	-15.092	0.000	<		H_0 rejected
8	Provision of mask	-1.25	-14.352	0.000	<		H_0 rejected
9	Food receipt	-0.66	-8.399	0.000	<		H_0 rejected
10	Appearance of foods ordered	-0.90	-10.524	0.000	<		H_0 rejected
	Empathy (E)						
11	Provision of apology about any mistakes	-0.71	-7.853	0.000	<	0.05	H_0 rejected
12	Confirmation of any unavailability of orders	-0.74	-9.432	0.000	<		H_0 rejected
13	Confirmation of any cancellations	-0.97	-12.590	0.000	<		H_0 rejected
	Responsiveness (R)						
14	Friendliness of driver	-0.66	-8.758	0.000	<	0.05	H_0 rejected
15	Politeness of driver	-0.82	-11.067	0.000	<		H_0 rejected
16	Promptness of delivery	-1.01	-11.221	0.000	<		H_0 rejected
17	Confirmation of any orders made	-0.47	-5.543	0.000	<		H_0 rejected
18	Knowledge of driver of interesting places	-0.99	-12.256	0.000	<		H_0 rejected
	Reliability (Re)						
19	Accuracy of payment	-0.78	-9.349	0.000	<	0.05	H_0 rejected
20	Accuracy of driver identity	-0.79	-9.831	0.000	<		H_0 rejected
21	Accuracy of promotions	-0.55	-7.361	0.000	<		H_0 rejected
22	Accuracy of orders	-0.81	-10.925	0.000	<		H_0 rejected
23	Safety	-0.87	-13.978	0.000	<		H_0 rejected
	Assurance (A)						
24	Driver traceability	-0.81	-10.000	0.000	<	0.05	H_0 rejected
25	Warranty for orders	-0.67	-7.578	0.000	<		H_0 rejected
26	Privacy for customer	-0.76	-9.630	0.000	<		H_0 rejected

**the difference between perceived and expected service*

The perceived logistics services influenced particular Kansei (i.e. aspects of emotional satisfaction). In this study, the following ten Kansei were identified, formalized and measured: helped (mean = 4.09), trusted (mean = 3.93), secured (mean = 3.91), comfortable (mean = 3.85), innovative (mean = 3.83), friendly (mean = 3.79), precise (mean = 3.70), professional (mean = 3.57), prompt (mean = 3.44) and cheap (mean = 3.32). The distribution of perceived Kansei scores is shown in Figure 2. It shows that Kansei "helped" has the highest perceived score, meaning that, in general, customers felt "helped" when they received logistics services from company XYZ.

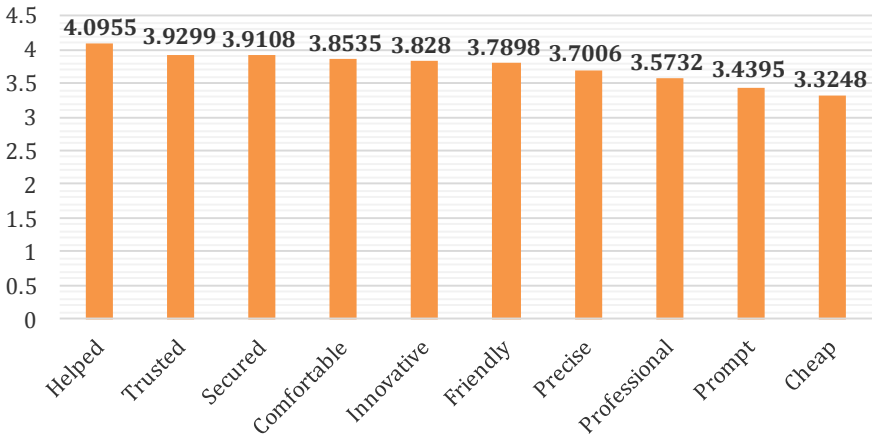

Figure 2 Distribution of perceived Kansei in logistics services

Then, through the Kano categorization process with respect to attractive (A) and one-dimensional (O) categories, aspects of the logistics service the Kansei attributes relate to were identified. They were then connected to significant Kansei through a linear model test, to calculate satisfaction scores relating to them. In line with Hartono and Tan (2011), the importance weighting was determined by incorporating the value of the satisfaction score, the Kano weight (see Tan & Pawitra, 2001), and the Kansei score. The higher the importance weight, the more important the service attribute is. The results are shown in Table 4.

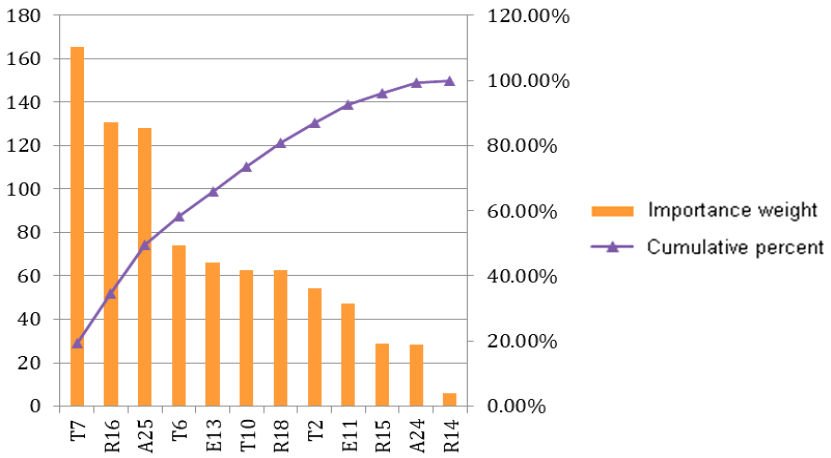

Figure 3 The Pareto chart of logistics service attributes based on importance weight

From the Pareto chart shown in Figure 3 it can be seen that there were seven logistics service attributes deemed to be critical: T7 (cleanliness of helmet for customer), R16 (promptness of delivery), A25 (warranty for orders), T6 (web-based application interface), E13 (confirmation for any cancellations), T10 (appearance of foods ordered) and R18 (knowledge of driver of any interesting places). Using the HoQ method, some related design specifications (known as metrics) were formalized, as shown in Figure 4. It can be seen that the most critical improvement idea was the provision of a modular system for helmets (inside and outside parts) for the customer.

Table 4 The importance weight of logistics service attributes

No	Code	Logistics service attributes	|Satisfaction score|*	Kano weight		Kansei score		Importance weight**
1	T2	Cleanliness of vehicle	3.47	A	4	Secured	3.91	54.27
2	T6	Web-based application interface	1.58	A	4	Friendly Innovative Helped	3.79 3.83 4.09	74.00
3	T7	Cleanliness of helmet for customer	5.73	O	2	Professional Innovative Cheap Precise	3.57 3.83 3.32 3.70	165.25
4	T10	Appearance of foods ordered	3.84	A	4	Helped	4.09	62.82
5	E11	Provision of apology for any mistakes	3.06	A	4	Comfortable	3.85	47.12
6	E13	Confirmation for any cancellations	4.16	O	2	Helped Comfortable	4.09 3.85	66.07
7	R14	Friendliness of driver	2.95	O	2	-		5.90
8	R15	Politeness of driver	3.69	O	2	Trusted	3.93	29.00
9	R16	Promptness of delivery	4.52	A	4	Friendly Prompt	3.79 3.44	130.71
10	R18	Knowledge of driver of interesting places	4.24	A	4	Precise	3.70	62.75
11	A24	Driver traceability	3.44	O	2	Helped	4.09	28.14
12	A25	Warranty for orders	2.74	A	4	Trusted Secured Comfortable	3.93 3.91 3.85	128.12

*\|*satisfaction score*\| = (perceived – expected) x importance level of service*
***importance weight = \|satisfaction score\| x Kano weight x Kansei score*

			The modular system for helmet (inside & outside part)	The app used by driver to order directly to vendor	The app for anonymous rating and comment	The thematic design of apps (i.e., Christmas, New Year)	The use of apps for order confirmation and cancellation	The use of multifunction bag	The integration of Google Maps to the ordering system
WHAT(s)	Attribute	Importance weight	**HOW(s)**						
	T7	165.25	9						
	R16	130.71		9			3		
	A25	128.12			9		3		
	T6	74.00				9			3
	E13	66.07			3		9		
	T10	62.82						9	
	R18	62.75							9
Total weight			1487.25	1176.39	1351.29	666	1371.12	565.38	786.75
Percentage			**20.09%**	15.89%	18.25%	8.99%	18.52%	7.64%	10.63%

Figure 4 Simple form of HoQ for IT-based logistics services improvement

5. DISCUSSION

This study was carried out as an extension of previous research on KE, Kano and QFD applied in services (see Hartono et al., 2013). By looking at logistics services, this study hoped to contribute to the efficiency of logistics performance. The field of logistics services is becoming a potential niche for businesses to explore. There was a huge market growth in logistics in Indonesia in the years 2004 to 2014, and it is still becoming larger due to the growth of infrastructure and economic development. Moreover, with respect to the customer's point of view, 3PL was chosen since these kinds of services can add a great deal of value to customers and companies (Chen et al., 2015).

This study has been conducted to support the potential development of emotional-based service quality tools, and the potential needs of 3PL services. It proposes a framework of KE, Kano and QFD applied to a popular IT-based supporting logistics service in Surabaya which provides logistical services for foods, documents and passengers.

From the research findings, it has been shown that the attribute "cleanliness of helmet for customer" was most important, with a significant correlation with the Kansei terms "professional, innovative, cheap, and precise". Given limited time, effort, budget or other

resources, the company should focus more effort on the cleanliness of helmets and supporting facilities in order to gain more customer emotional satisfaction. However, the Kansei term "helped" was the highest-rated emotion experienced by the customers. This was influenced by the performance of the attributes "web-based application interface", "appearance of food ordered", "confirmation for any cancellations", and "driver traceability". In other words, in general, the customers felt helped once they were served by the XYZ company.

It is also suggested that a modular system for the helmet (inside and outside parts) be considered. This was deemed to be the most important improvement, followed by the provision of application software to give comments and ratings anonymously, and also the use of application software for confirmation and cancellation.

6. CONCLUSION

This study promotes the importance of the role of human factors, especially Kansei, in influencing the efficiency and effectiveness of logistics service design and development. The integrated model of KE, Kano and QFD devised provides understanding of what should be considered and executed by the service manager or provider in improving the services offered, while focusing on prioritized solutions, given limited resources. In this study, the improvement of the helmet system, and the provision of application software for submitting comments and ratings and carrying out confirmations/cancellations were rated as high priorities.

This study was limited by a relative small sample size, and a specific IT-based logistics services. Since the proposed model is intended as a general model for the improvement of logistics services, more empirical studies are required. Moreover, the exploration of another part of the logistics services sector is needed; not only 3PL which focus on the end customer, but also on more upstream entities.

7. ACKNOWLEDGEMENT

This study on model development and its application to logistics services was fully supported by a research grant under the scheme of applied product with a contract number of 22/SP-Lit/LPPM-01/Dikti/FT/V/2017, endorsed by the Directorate of Higher Education, the Ministry of Research, Technology, and Higher Education, Republic of Indonesia. Also, it was partially supported by the Department of Industrial Engineering, University of Surabaya, Indonesia.

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