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TRANSLATING COMPANY INTERNAL DATA INTO CUSTOMER NEEDS: A TEXT MINING ANALYSIS APPROACH

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ABSTRACT

Efficient product design process is crucial for enterprises willing to introduce new products or develop their existing products pursuing a short time to market. However, successful product design depends on the ability to effectively manage customer needs throughout the entire product development process. This study developed a voice of customer (VOC) program to help enterprises to identify customer needs. Accordingly, a text mining approach is proposed, which translates internal company data into customer needs automatically. Finally, an illustrative example is shown to clarify how this program can be applied by product designers in QFD.

Keywords: internal data, VOC, text mining, QFD.

1. INTRODUCTION

Fulfilling customer needs is recognized as one of the most important key performance indicators of success. It is one of companies' strategies to reduce customer dissatisfaction and complaints. Companies need to pay attention to customer needs and have to organize around the customer in order to be a successful firm. They are forced to change their activities from a companies' point of view towards a customer's point of view [1, 2]. While a good quality of product has been considered a competitive advantage, many researchers have now pointed out that a product quality aiming to satisfy expectations can no longer win the hearts of customers. How to fulfil customer needs is more critical now [3, 4, 5, 6].

The key idea of capturing the voice of the customer is to be able to provide vital information for the product development process and understand how the product development process works so that the best approach for capturing the voice of the customer can be accomplished [2, 7, 8]. Cooper and Kleinscmidt [9] explained that building the voice of customer (VOC), as a customer-focused and market-oriented new product effort, was the strong driver of on-time and fast paced product development projects. Parasuraman *et al*. [10] mentioned that VOC can be collected from customer's recognition and customer surveys. Since it highly affects the analysis phase, they emphasized the importance of the method of collecting VOC. Customer feedback is not only vital for design engineers, but also for marketing experts to make targeted interventions to pricing policies [3].

Quality function deployment (QFD) is a cross-functional planning methodology commonly used to ensure that customer requirements, often referred to as VOC or WHATs, are deployed through product planning, part development, process planning and production planning [11, 12]. It is a total-quality-management process in which VOC is organized throughout the engineering and manufacturing stages of the product development [5]. The House of Quality (HOQ) is one of the matrices of the QFD. The HOQ is often utilized to understand customer requirements and translate those requirements into the voice of the engineer [13]. The VOC is the input for the product design and development. The company should convince that the product to be developed is in accordance with the customer needs. All product design features have to be the response to the customer needs. Thus, it can be inferred that the customer need is very important for the design resulting in a product that will deliver customer satisfaction [6].

Increasing competition in global markets and the rapid technology development have imposed a great deal of pressure on product designers [5, 14]. Requirement understanding plays an important role in product design. Traditionally, QFD relies on customer survey to obtain voice of the customer. Customer needs come from questionnaires which are mainly collected by customer survey [15]. It is often time-consuming and labor-intensive to obtain sufficient customer needs [16]. The acceleration of this customer needs has been responded by practitioners with increasing the frequency of new product launches. This situation results in a faster product life cycle, and in turn, the product design lead time is getting shorter [17].

Most of companies have a division that is responsible for providing the best service to all customers. This division communicates directly to the customers. Customer service data (complaints and claims) is usually well documented and reported periodically to the company. This customer service data reflects the real customer needs since the customers directly deliver their own needs. Unlike the results of customer surveys, the customer needs from the customer service data has much longer time dimension [8, 16]. Data from a survey describes only for a certain time event, while data from the customer service tell us many events from time to time [18]. The trends of the data will be very useful information to respond a certain customer need. The utilization of customer service data is mostly used to improve the customer service performance [19]. Exploration of the customer service data utilization for improving the other business processes would be very challenging and would give some opportunities for continuous quality

improvement programs in the process of product design, production processes, maintenance processes, and so on.

The efforts of this study are at least three folds. First, customer opinions are examined as customer requirements for product designers by using survey. It is one of the first attempts to integrate the result of customer survey into QFD directly. Second, company internal data in the form of free text, which are a new form of customer requirements, are exploited for product design input. Specially, it is one challenging work to analyze unstructured customer needs for requirement analysis through QFD. Finally, this research highlights a possibility to build a program to alleviate the burdens of product designers to digest customer opinions and a text mining analysis approach is proposed to translate company internal data into VOC in QFD periodically. Customer service data (data of claims and complaints) as well as the company initiatives have to processed so that it can be used as an alternative source of the voice of the customer (VOC) replacing a customer survey [8, 14]. The practical application of this approach is demonstrated empirically in a case study of a skin care center in Jakarta. After that, result and discussion is outlined and then ended with the conclusion.

2. RESEARCH METHODOLOGY

The conceptual thinking framework

A text mining analysis approach of determining customer needs is proposed. Firstly, the analytical method is used to identify the voice of the customer for particular attributes of the product purchase and service process through the implementation of a quantitative customer survey and company internal data. The survey instrument is based on the Kano model questionnaire format. Kano model [20] is applied to classify the customer needs based on how they affect customer satisfaction. It is designed to gather customer input in order to generate the voice of the customer according to Kano category (must be one dimensional, attractive) and type of internal data (complaint, claim, company initiative). After defining the attributes and producing questions to measure each of attribute, validity and reliability testing is conducted. The aim of these testing is to ensure that the questions are measuring what they are intended to: that is that they produce a reliable and valid measurement.

The classification of Kano category is based on the answers of a pair of questions for each attribute. The first question concerns the reaction of the customer if the product/service has that feature (functional form of the question), the second concerns his reaction if the product/service does not have that feature (dysfunctional form of the question).Secondly, by using text mining approach, the unstructured text of customer needs will be converted into a semi-structured dataset so that we can find patterns and even better, train program to detect patterns in new customer need texts. Figure 1 provides the conceptual thinking of this approach.

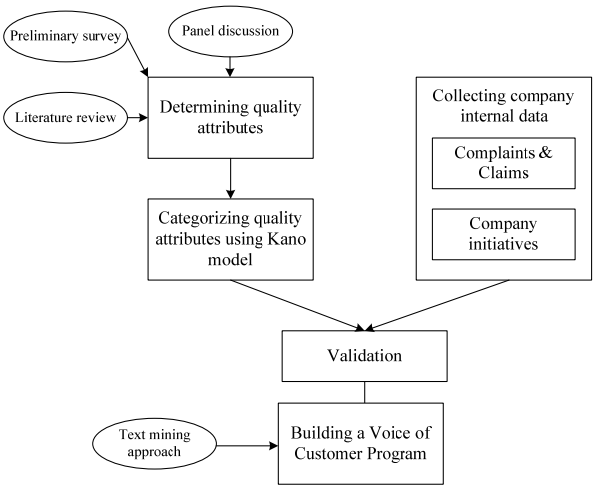

Figure-1. Conceptual thinking framework.

An empirical study

In this research, Skin Care Center in Jakarta will be used for further analysis in order to describe the implementation of the conceptual thinking. This empirical study analyzed customer expectations of quality attributes at a skin care center. Questionnaires were designed according to SERVQUAL model [10], Product and Service System (PSS) model [21], and a panel discussion. The survey instrument (questionnaires) consisted of two main sections: (1) demographic data about respondents (gender, age, occupation, and regular customer), and (2) functional-dysfunctional statements for Kano model focused on customer perceptions of product and service at skin care. The statements all use a Likert 5-point scale.

3. RESULT AND DISCUSSIONS

Profile of respondents

There was a sample of 200 skin care customers, comprising 81.5 percent female and 18.5 percent male respondents. Most of the customers were female and 21-30 years old (41.5%). Within the sample, 46 percent of the customers were private employees, 20 percent were entrepreneurs, 16 percent were students, 10 percent were civil servants, and 6 percent were other occupations, respectively. The detail information of the respondents is presented in Table-1.

Table-1. The profile of the respondents (N=200).

Characteristics	Frequency
Gender	
Male	37 (18.5%)
Female	163 (81.5%)
Age	
< 21 years old	27 (13.5%)
21-30 years old	83 (41.5%)
31-40 years old	50 (25%)
41-50 years old	33 (16.5%)
> 50 years old	7 (3.5%)
Occupation	
Students	33 (16.5%)
Civil servant	21 (10.5%)
Private employees	93 (46.5%)
Entrepreneur	40 (20%)
Others	13 (6.5%)
Regular customer	
< 1 year	67 (33.5%)
years	107 (53.5%)
5-10 years	23 (11.5%)
>10 years	3 (1.5%)

Determining critical service attributes

Firstly, a total of 30 customers were randomly asked to think of product benefit and service experiences in skin care center. At the same time, a panel discussion was conducted. The participants of discussion included skin care stakeholders such as regular customers, owner, employees, and doctors. The discussion material was derived from a combination of products and services, which is often referred to as a SERVQUAL model [10] and a Product and Service System (PSS) [21].

The purpose of preliminary survey, literature review, and a panel discussion was to determine the appropriate attributes to be listed in the final questionnaire. As a result, eleven attributes developed for this study are room temperature, doctor attitude, front-line services, call center services, skills of doctor and nurse, doctor's explanation, computerized service system, post-treatment effects, drug reaction, personalized program concept, and complaint handling.

Validation between Kano survey and internal data

Based on the preliminary survey and panel discussion, 11 critical service attributes will be utilized for further analysis. These attributes are evaluated with the evaluation steps of Kano model. After having combined the answers to fulfilment and disfulfilment questions in the Kano evaluation procedure, the categories of the attributes can be determined. According to the result, six attributes are categorized as 'must be', four attributes as 'one dimensional' and only one attributes as 'attractive'.

Internal data (complaints, claims, and company initiatives) have been collected for period January-December 2014. Complaint happens when the customer is not satisfied with anything relating to the purchased product conformity and or received services. The customers will claim the product/service when they feel that the purchased product/service is not in accordance with what was promised to them within the warranty period. Based on the data, numbers of complaints, and claims, are 61 cases, 38 cases, respectively. Company initiatives data were derived from the skin care's strategic plans in the near future.

Must be (M) attribute is attribute whose absence will result in customer dissatisfaction. These properties are similar to the nature of a complaint. Satisfaction of complaining customer, if the complaint is solved, is usually small or even considered normal. However, if the complaint is not solved the customer will be very disappointed. One dimensional (O) attribute is the properties of a customer need that customer will be satisfied when it is fulfilled and customer will be disappointed if it is not fulfilled. These properties are similar to the nature of the claims. Customers will be satisfied if the claims are fulfilled otherwise customer will not be satisfied [8, 14].

The analytical approach will be applied to know whether there is a difference between data drawn from two sources (customer survey and internal data). In order to build and structure the VOC, subjectively we analyze the data correspondence between Kano category and type of company internal data. According to analytical result, most of quality attributes (64%) correspond to the company internal data. The validation between Kano survey and internal data is presented in Table-2.

Building the voice of customer program

All valid attributes were used as the input of the program. However, other invalid attributes were also being considered because these attributes were also customer needs that had to be satisfied by the company. By utilizing all information gathered before (customer feedback, internal data type, and Kano category), a voice of customer program was designed. A text mining approach was applied to analyze the data. The fundamental step in text mining involves converting text into semi-structured data. To convert the unstructured text into semi-structured data, the standard descriptive or predictive analytic techniques were applied. The unstructured text needs to be converted into a semi-structured dataset so that we can find patterns and train models to detect patterns in new text input. Figure-2 identified the main steps in this process at a high level.

Table-2. The validation between survey and internal data.

Service attribute	Internal data type	Kano category	
Room temperature	CO	O	Not Valid
Doctor attitude	CO	O	Not Valid
Front-line service	CO	M	Valid
Call center services	CO	M	Valid
Skills of doctor and nurse	CO	M	Valid
Doctor's explanation	CO	M	Valid
Computerized service system	CL	O	Valid
Post-treatment effects	CL	M	Not Valid
Drug reactions	CL	O	Valid
Personalized program concept	CI	A	Valid
Complaint handling	CI	M	Not Valid

CO= Complaint, CL= Claim, CI= Company Initiative
M= Must-be, O= One-dimensional, A= Attractive

The program consisted of 3 main parts: (1) category master data, (2) homepage, and (3) query. The category master data will save all database used as the keywords and analyze the voice of customer (Figure-3). The homepage showed a textbox for users to type the voice of customer and its query at the top showing all the voice of customers that had been input, as shown in Figure-4. The query of the program can be exported into spread sheet Microsoft Excel. This feature was useful for the company to summarize or make a report about the voice of customer in a certain period of time.

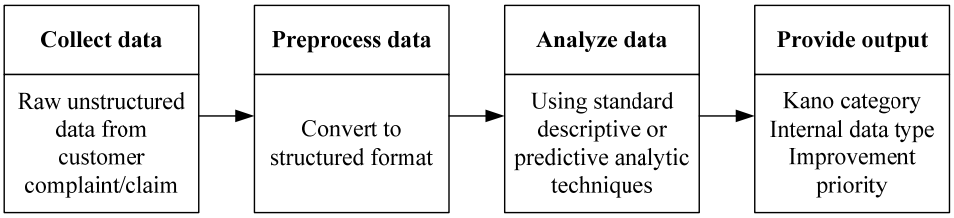

Figure-2. A high-level process for text mining.

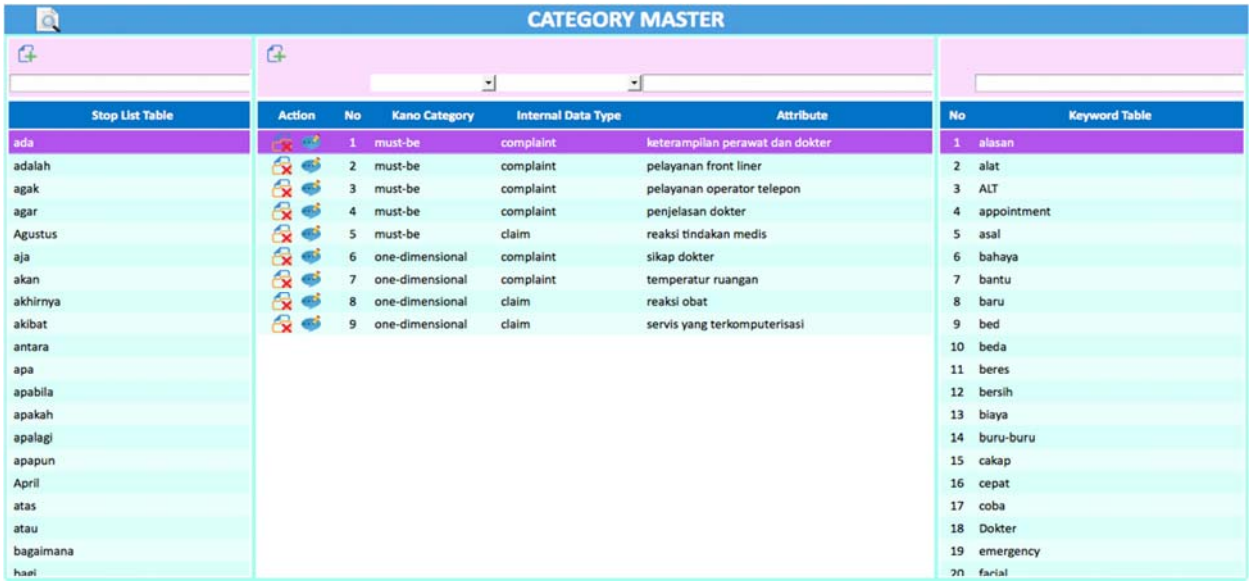

Figure-3. Category master data.

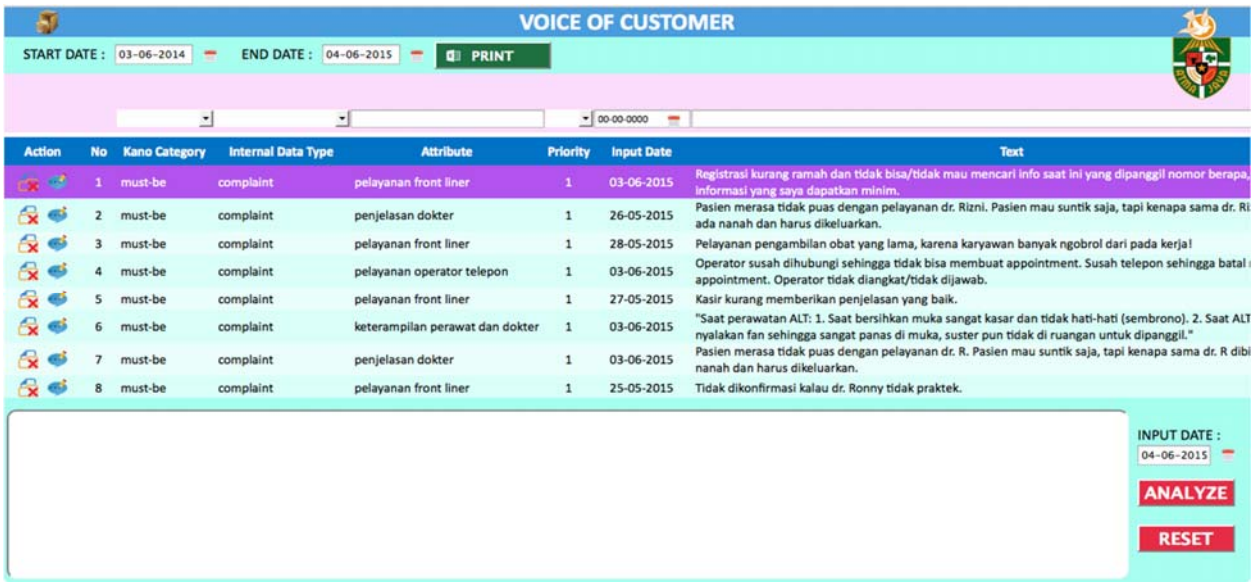

Figure-4. VOC program homepage.

4. CONCLUSIONS

In this paper, a VOC program was built for identifying the voice of the customer (VOC) using company internal data (complaints, claims, and company initiatives) at early stage of product development process. By using this program, the time needed to obtain the VOC is much shorter compared to those using a customer survey. We do not need to classify the data into Kano category since they have already separated as the complaints, claims, and company initiatives which are matched with the must be, one dimensional, and attractive attributes. The data processing may take a few minutes while customer survey may take several weeks or even months. A text mining approach was applied to classify and predict text documents (customer complaints/claims) and even voice recordings (call center services) that have been transcribed to text. However, it should be emphasized that we need a documented report of the customer service division. Otherwise, we have nothing for the data processing. This study does provide a skin care center with some information about its customer needs. It is particularly useful for the skin care center's decision maker to identify the quality attributes for improvement and/or development. For the future research, this approach can also be applied to other sectors, and demonstrates the usefulness of company internal data to generate the voice of the customer.

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REFERENCES

[1] C.K. Chen, A.J. Shie and C.H. Yu. 2012. A customer-oriented organisational diagnostic model based on data mining of customer-complaint databases. Expert Systems with Applications. 39: 786-792.

[2] R. Sukwadi, C.C. Yang and L. Fan. 2012. Capturing customer value creation based on service experience - A case study on News Café. Journal of the Chinese Institute of Industrial Engineers. 29(6): 383-399.

[3] E. Bradlow. 2010. User-generated content: The voice of the customer in the 21st century. Marketing Intelligent Systems using Soft Computing. 258: 27-29.

[4] X. Li, L. Hitt and Z. Zhang. 2011. Product reviews and competition in markets for repeat purchase products. Journal of Management Information Systems Architecture. 27(4): 9-42.

[5] C.C. Aguwa, L. Monplaisir and O. Turgut. 2012. Voice of the customer: Customer satisfaction ratio based analysis. Expert Systems with Applications. 39: 10112–10119.

[6] R. Sukwadi. 2015. Utilizing Customer Experience Management framework to create a delightful service experience. International Journal of Industrial Engineering and Management. 6(1): 29-42.

[7] K. Yang. 2007. The voice of the customer: Capture and analysis. McGraw-Hill, New York, USA.

[8] R. Sukwadi, M. Suef and E. Widawati. 2014. Capturing voice of the customer via company internal data. International Research Conference on Business, Economics and Social Sciences. Singapore Conference IRC-2014. 24-25 September 2014.

[9] R. Cooper and E. Kleinscmidt. 1994. Determinants of timeliness in product development. Journal of Product Innovation Management. 11(5): 381-396.

[10] A. Parasuraman, V. Zeithaml and L. Berry. 1988. SERVQUAL: A multiple item scale for measuring customer perceptions of service quality. Journal of Retailing. 61(1): 12-40.

[11] Y. Akao. 1990. Quality function deployment: Integrating customer requirements into product design. Productivity Press. Cambridge.

[12] E.R. Wolniak and A. Sędek. 2009. Using QFD method for the ecological designing of products and services. Quality and Quantity. 43(4): 695-701.

[13] C. Temponi, J. Yen and W.A. Tiao. 1999. A fuzzy logic-based requirement analysis. European Journal of Operational Research. 117: 340-354.

[14] M. Suef, Suparno, M.L. Singgih, R. Sukwadi and E. Widawati. 2014. Utilizing claims, complaints, and company initiatives as VOC in a product development using QFD-Kano approach. International Journal of Applied Engineering Research. 9(22): 18013-18024.

[15] X.T. Wang and W.E.I. Xiong. 2011. An integrated linguistic-based group decision-making approach for quality function deployment. Expert Systems with Applications. 38(12): 14428-14438.

[16] G. Szolnoki and D. Hoffmann. 2013. Online, face-to-face and telephone surveys - Comparing different sampling methods in wine consumer research. Wine Economic and Policy. 2(2): 57-66.

[17] P.G. Maropoulos and D. Ceglarek. 2010. Design verification and validation in product lifecycle. CIRP Annals - Manufacturing Technology. 59: 740-759.

[18] B.A. Galitsky, M.P. González and C.I. Chesñevar. 2009. A novel approach for classifying customer complaints through graphs similarities in argumentative dialogues. Decision Support System. 46(3): 717-729.

[19] S. Wu and A. Akbarov. 2012. Forecasting warranty claims for recently launched products. Reliability Engineering and System Safety. 106: 160-164.

[20] N. Kano, N. Seraku, F. Takahashi and S. Tsuji. 1984. Attractive quality and must-be quality. The Journal of the Japanese Society for Quality Control. 14(2): 39-48.

[21] C.V. Halen, C. Vezzoli and R. Wimmer. 2005. Methodology for Product Service System innovation. Uitgeverij Van Gorcum. Assen.