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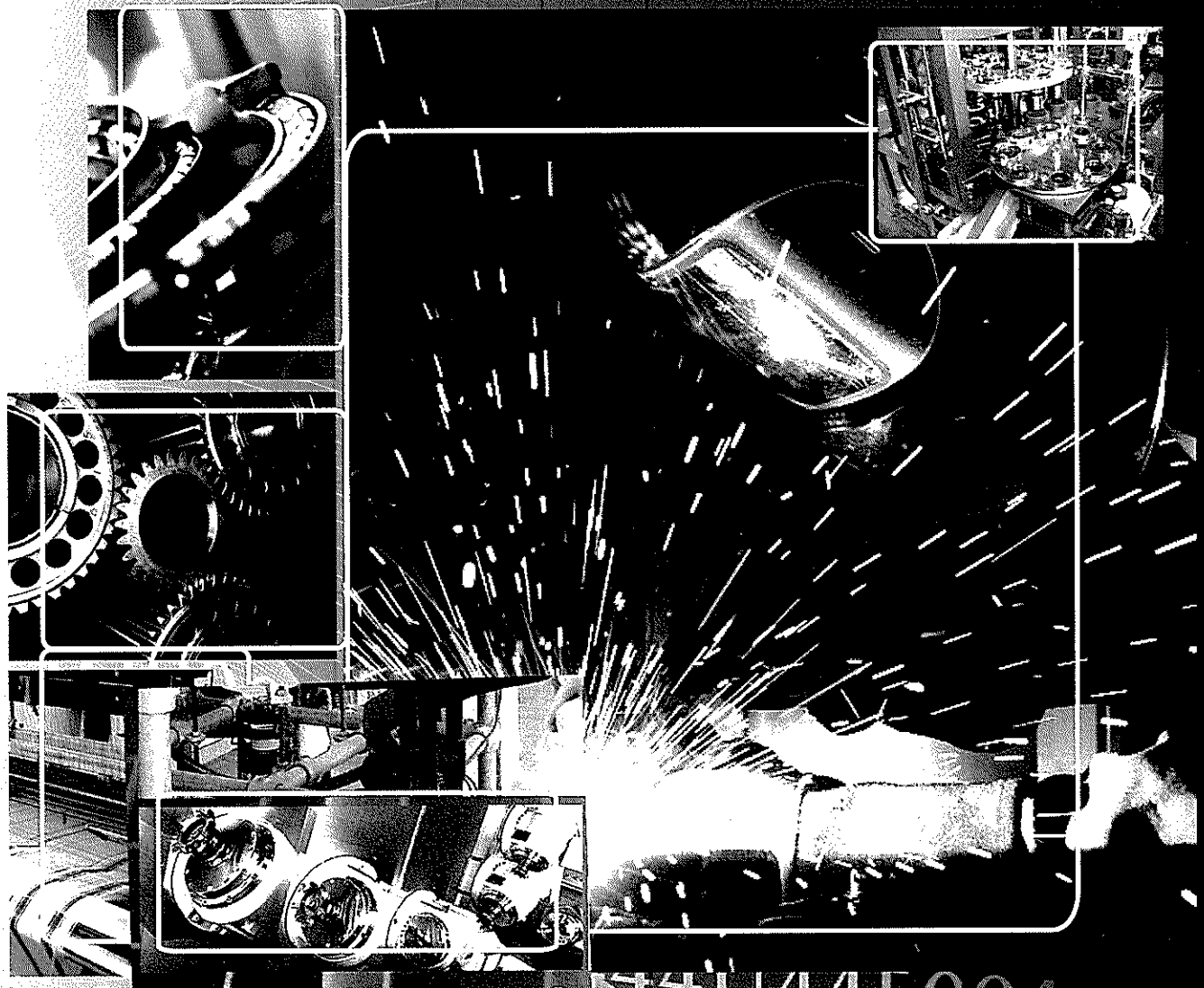

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# Application of Integrated Kano's Method and Quality Deployment Function in New Product Development Process

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*Abstract* – Staying competitive in the fast growing globalization is becoming more challenging. Every new product development is fundamental for any company but the quick launching time and meeting customer expectation is essentials. To stay competitive, one has to have a systematic way of new product development and have an effective approach to understand customer requirements better translate into new and improved product. Quality Function Deployment (QFD) method can help to gather customer demands and link to product design in a systematic way. Integrating Kano's Model result from the questionnaires into QFD framework, provide a deeper perspective of "hidden" customer needs that leads to a better product design. The objective of this study is to implements the integrated method Kano's Model and QFD on a new vegetable cutting machine blade cleaner development.

## INTRODUCTION

Marketing new product has becoming more and more challenging due to product's life cycle is becoming shorter and shorter everyday. New product is launched today and before you know it, another new product is launching somewhere else in the world the next day. Besides that, customers demand and needs have become more intense and want it to be fulfilling faster and with customized products. Customers not only demand on higher levels of quality, but they also demand in innovations in new product. Global dynamic companies are now looking for ways to reduce development time and introduce their new product more quickly. As a result, it is crucial to identify customer needs and informing the requirements to the design team is essential for any business to stay competitive in the market [1-2].

These increase pressure on designers, forced them to be more creative and many techniques have been developed in order to reduce the time to market. One of the successful design tools is the quality function deployment (QFD). There have been many implementation of QFD in various field and resulted in many improvements in product design and development process [3, 4].

The paper presented on the concept development of a new product design which involved the applications of Kano's Model which uses to identify customer requirements through questionnaires. QFD is used to analyse the best design that are in line with customers' requirement. Study on the integration of Kano's Model with QFD is conducted to identify the effectiveness and the feasibility of the integration method for this particular concept development. Construct Kano's questionnaire is the core way to study closely with customer requirements since it provides a model to what kind of question one should ask to understand their needs. QFD is one of the successful design tools to implement because it is a comprehensive quality system that links the needs of the customer with various business functions and process. The information on the product development by using the integration method leads to this study to be conducted. Fig.1 shows the usually problem when using any vegetable grater. When any vegetable is grated especially rooted vegetable, the fibres tend to stuck on the blade which causes the blade sharpness to become blunt if it used continuously. This study focused on the case of using the rotary blade in the vegetable cutting machine.

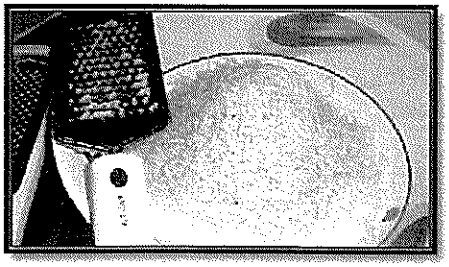


Fig. 1. The problem of stuck fibres usually on the blade in vegetable cutting machine. Above is shown by the manual grater

## LITERATURE REVIEW

There are several case studies have been conducted using approach of integrating Kano's Model into QFD. Chiou and Cheng [5] have conducted a study to identify customer's satisfaction on healthcare service industry in Taiwan. The study was focusing on how to recognize the service requirement that would exceed beyond customers expectations. By referring to Kano's Model, they came up with questionnaires which were important to identify closely the 'hidden' attributes and features. Then the results were properly translated into QFD's House of Quality. From the study, they were able to identify and prioritize the customer needs and provided practical procedures for improving and upgrading health care service quality and satisfy customer needs.

Sireli et al. [6] had made a research using the integration method for multiple product design. In their study, they were trying to create a multiple product design simultaneously using the integration methodology. They applied their proposed methodology on cockpit weather information system (CWIS) design, a part of NASA's Aviation Weather Information (AWIN) project to demonstrate its usefulness. Designing new ways of the integration was for the purpose of designing a better CWIS due to high number of weather-related aviation fatalities. By following the proposed steps, they were able to design four different levels of CWIS simultaneously. They achieved valid and very reasonable results approved by experienced pilots and made the study a success. However, they discovered a few drawbacks of integrated method 1) it has its own difficulties in capturing accurate customer needs, 2) there was no uniform and quantitative methodology in the integrated process and lastly 3) literature lacks of techniques that incorporate this two models specifically. Therefore, they suggested that this integrated methodology should be applied on other product design problem to test on the usefulness. Another study that uses integration methodology is done by Lai, Xie and Tan [7]. In this study, they proposed the integration method in order to meet customer requirements in product design. What differentiate them from other studies is that they took the approach of constructing a programming or mathematical optimization model. The study focused on gaining quantitative information instead of qualitative. This will lead to the model is able to provide an optimal design using the QFD optimization method under the cost constraint.

Despite some research have been carried out on integration of Kano's Model and QFD implementation in product development process, there is still a very limited information or study on implementation of the integrated method Kano's Model and QFD on vegetable cutting machine blade cleaner. Therefore the main purpose of this project is filling the gap of implementing the integrated method to root vegetable cutting machine blade cleaner. There is no concept development implementation of integrated Kano and QFD done for that particular machine previously. There are several dissatisfactions when questions regarding the functions of the machine were briefly asked lead this study. Therefore, this study is focusing on what are the detail requirements that have to be emphasized in designing a better solution or product.

## METHODOLOGY

Generally the methodology is divided into four main areas as follows:

- Vegetable Cutting Machine
- Kano's Model
- Quality Functional Deployment (QFD)
- Integration with QFD House of Quality.

### *Vegetable Cutting Machine*

In this study, a vegetable cutting machine is used to uncover the problem of cleaning the blade during the cutting process. The brand is TWOTHOUSAND with Model Number: TT-F21A. It is originally from China. Fig. 2 shows how the machine looks like.

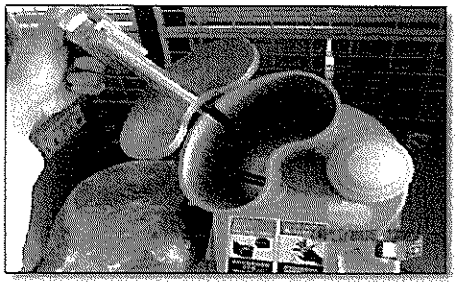


Fig. 2: Vegetable Cutting Machine

### *Kano's Model*

In general, Kano's Model consists of four steps in order for one to identify customer requirements as depicted in Fig. 3. The paper described the use of Kano's Model in the early stage of product design development by focusing on identifying market needs.

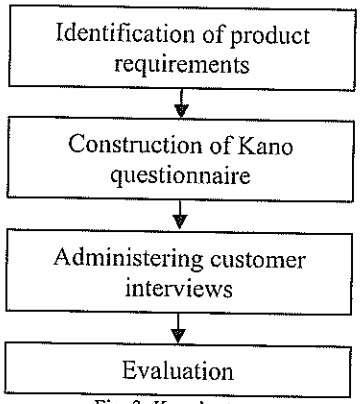


Fig. 3. Kano's steps

*Integrate With QFD*

Kano surveys results and feedbacks is analysed using Quality Function Deployment (QFD). This is where the integration of both Kano's Model and QFD happen.

## RESULT AND DISCUSSION

The results of the study are presented to illustrate the feasibility and effectiveness of the integrated methodology in determine customer's requirement that will improve the vegetable cutting blade cleaner.

*Kano's Model results*

After the survey is conducted, the frequencies of the answers are evaluated and placing the values into a result table as shown in Table 1. With the total of 84 feedbacks, the results are presented in percentage.

Customers Satisfaction coefficient is calculate from the results obtained. The results are as shown in Table 1. From the table, it is shown that the product requirements on blower and manual cleaning both falls under the category of "O" where manual cleaning get the score of 47.8% and blower receives a 39% scores. This category means when the manual cleaning and blower installed or fulfilled, customers will be satisfied. However, if this requirement is not fulfilled there will be dissatisfaction. If the requirements can be fulfilled at higher level, then the satisfaction will increase much higher. This is much more linear between satisfaction and dissatisfaction on the requirements.

Table 1: Table of result

| Product Requirement | A | O | M | I | R | Q | Total | Cat. |
|---|---|---|---|---|---|---|---|---|
| Manual cleaning | 14.5 | **47.8** | 21.7 | 10.3 | 1.2 | 4.5 | 100% | O |
| Blower | 18.4 | **39.0** | 25.9 | 10.8 | 1.2 | 3.7 | 100% | O |
| Self-cleaning System/ Auto Cleaning | **56.2** | 20.9 | 10.2 | 8.4 | 1.2 | 3.1 | 100% | A |
| Easy to clean | 12.6 | 24.6 | **37.0** | 17.9 | 2.3 | 5.6 | 100% | M |
| No Fibres stuck on blade | 14.8 | 24.5 | **38.9** | 11.4 | 3.6 | 6.8 | 100% | M |
| Attachable brush | 10.4 | 13.2 | 27.3 | **39.7** | 1.6 | 7.8 | 100% | I |

From Table 2, the auto cleaning system falls under the "A" category. It scores the highest of 56.2% or 47 people love this idea of having self-cleaning or automatic cleaning system. The next highest category is the "O" category with 20.9% and follows with category "M", "I", "Q" and "R". Category "A" shows that this product criteria or automatic system cleaning has the highest influence on customer satisfaction. Customers may not expect them, but if it is not fulfill, there is no dissatisfactions occur. Product requirements of easy to clean and having no fibres get stuck on the blade falls both falls under the category of "M" which means that these criteria suppose to be basic criteria of the product. Both scores 37.0 percent for easy to clean and having no fibres stuck on the blade is 38.9 percent. As basic criteria, if these requirements are not fulfill, there will be extreme dissatisfactions. However, if it is fulfill, it will not increase their satisfactions. The only product requirement that falls under the category of "I" is attachable brush. It scores 39.7% with a number of frequencies of 33. Attachable brush falls under this categories because it is not what customers are looking for in this product. The presence of attachable brush does not make them neither satisfied nor dissatisfied. Overall, Table 4.1 shows that customers have their own opinion on different requirements in the product. Some that will satisfy them and some will not.

The customer satisfaction (CS) coefficient states whether the level of satisfaction can be increase or not if the product requirement is meet. Different market holds different customer needs and satisfactions. The coefficient is calculated and tabulated in Table 2. The results from the Table 4.2 are simplified in the chart shown in Fig. 4. From the chart, it shows that the blue colour represents customer satisfaction and red colour represents customer dissatisfaction. CS- coefficient for manual cleaning is 0.66 for CS and -0.73 for DS (Dissatisfaction).

Table 2: Customer satisfaction calculations

| Product Requirement | A | O | M | I | R | Q | Total | Cat. |
|---|---|---|---|---|---|---|---|---|
| Manual cleaning | 14.5 | **47.8** | 21.7 | 10.3 | 1.2 | 4.5 | 100% | O |
| Blower Self-cleaning | 18.4 | **39.0** | 25.9 | 10.8 | 1.2 | 3.7 | 100% | O |
| System/ Auto Cleaning | **56.2** | 20.9 | 10.2 | 8.4 | 1.2 | 3.1 | 100% | A |
| Easy to clean | 12.6 | 24.6 | **37.0** | 17.9 | 2.3 | 5.6 | 100% | M |
| No Fibres stuck on blade | 14.8 | 24.5 | **38.9** | 11.4 | 3.6 | 6.8 | 100% | M |
| Attachable brush | 10.4 | 13.2 | 27.3 | **39.7** | 1.6 | 7.8 | 100% | I |

This means that the requirement is equal in terms of the influence. The result is similar to manual cleaning. Auto cleaning give a great influence on the satisfaction if the system is presence in the product with coefficient value of 0.8. However, it is not quite strong on the dissatisfaction if the requirement is not fulfill with coefficient value of –0.33. As for having no fibres getting stuck on the blade and easy to clean have the CS-coefficient of 0.41 and 0.44 have average influence of satisfaction and get DS- coefficient value -0.67and -0.7 accordingly. The absence of the requirement will influence greater on the satisfaction of customers. Lastly the brush have the least influence on customers satisfactions whether it presence or not with the value of 0.27 for CS and -0.45 on DS.

*Integration of Kano's Model into the House of Quality*

Constructing the house of quality is part of the tools in Quality Function Deployment. House of quality is constructed steps by steps. From the information and results obtained in Kano Questionnaires, steps one to step three of house of quality is already achieved using Kano's method. The results of the integrated is depicted in Fig. 5

Fig. 4. CS Coefficient

**System QFD - House 1 (Voice of the Customer)**

| Kano Type |
|---|
| B = M category |
| L = O Category |
| D = A Category |

| Correlation indicators | |
|---|---|
| 2 | Strong positive |
| 1 | Positive |
| 0 | No correlation |
| -1 | Negative |
| -2 | Strong negative |

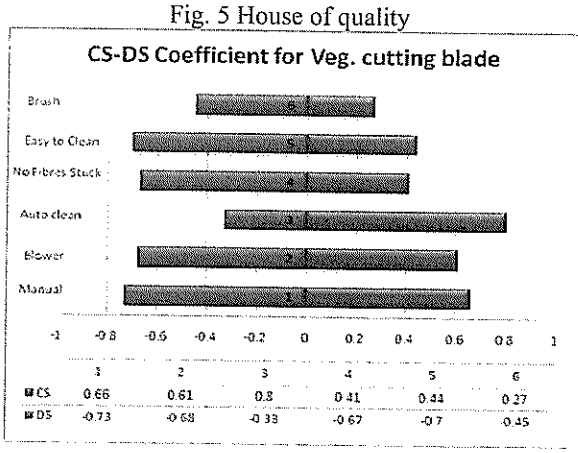
| | Weight | |
|---|---|---|
| 2 | Detachability | 2 |
| 3 | blade sharpness | 0 0 |
| 4 | strong blade material | 0 0 2 |
| 5 | retractable container for waste | 1 2 0 0 |
| 6 | easy to operate | -1 0 0 1 -1 |
| 7 | simple installation | 2 2 0 0 1 2 |
| 8 | | |
| 9 | | |

Product/Service Requirements

Customer Opinion Survey

| | Customer Needs | CS | DS | Kano Type | Weight | Detachability | blade sharpness | strong blade material | retractable container for waste | easy to operate | simple installation | Poor 1 | 2 | Acceptable 3 | 4 | Excellent 5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Manual cleaning of the blade | 0.65 | -0.73 | O | 1 | 0 | 2 | 1 | 2 | 2 | 2 | | | | | |
| 2 | Using blower to clean | 0.61 | -0.68 | O | 1 | -1 | -2 | -1 | 1 | 2 | 1 | | | | | |
| 3 | Automatic cleaning of the blade | 0.8 | -0.33 | A | 0 | 2 | 2 | 2 | 2 | 1 | 2 | | | | | |
| 4 | Easy to clean | 0.41 | -0.67 | M | -1 | 1 | 1 | 0 | 1 | 0 | 2 | | | | | |
| 5 | No fibres stuck on the blade | 0.44 | -0.7 | M | 0 | 0 | 2 | 1 | -1 | -1 | 0 | | | | | |
| 6 | | | | | | | | | | | | | | | | |
| | | | Raw score | | 2 | 2 | 5 | 3 | 5 | 4 | 7 | | | | | |
| | | | Rank | | 7 | 6 | 2 | 5 | 3 | 4 | 1 | | | | | |
| | Technical Difficulties | | | | 4 | 3 | 5 | 3 | 1 | 4 | 2 | | | | | |

Fig. 5 House of quality




## CONCLUSION

The House of Quality constructed from this study is very simple. This is due to a very niche focus which is to identify the best method that helps the customers to overcome the stuck fibres on the blade problem. The design attributes that requires in the design is also have been identify. There is not much to compare with competitors for this area of study because there have been no studies in this particular area. The main objective of implementing both Kano's Model and QFD has been achieved in this study. The first objective is achieved when feedbacks of the questionnaires were returned with important information that leads to completion of this study. From here, the customer requirements of are identified. Second objective of the study is to analyse the feedback using House of Quality is also achieved. Although it is simple, it gave a big picture of what to focus on the new design. The last objective is unable to be completed due to too much time were spent on the constructing questionnaires and getting the feedbacks from the customers. Overall view from this study is that it should be conducted in a big team. At least 4- 6 people because it will be more details and design options.

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