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Journal of Engineering Design and Technology 1 LOGIC Journal of Engineering Design and Technology Vol.22 No.1 March 2022; p. x - x Implementing Kansei Engineering and Quality Function Deployment Method in Designing Shoes : Case Study at Rejowinangun Original Leather 1,2) Department of Industrial Engineering. Ahmad Dahlan University, BanguntapanBantul, DIY 55191 Correponding email 1) : hapsoro.jatmiko@ie.uad.ac.id Hapsoro Agung Jatmiko1), Danov Setiyo Nugroho2)

Abstrak. Small Medium Enterprise (SME) played an important role in the economic growth in Indonesia, as Yogyakarta one of it's promising province with relied so much on tourism and art and creative business, SME has become one of the main source of income for Yogyakarta. Rejowinangun Original Leather is one of SME in Yogyakarta that creates and produces its own hand made shoes. Not only producing themselves, this SME also buy several shoes product from another province, which ironically sells better than their own. One of the main concern of the failure in sale is the poor design of the self-made shoes. If the SME cared about their own design, it could be their selling point in order to survive and even played as an one of the big player in shoes industry. This research implementing both Kansei and Quality Function Deployment (QFD) on the design of the shoes, thus collecting what the customer needs and creating the best design for the SME. The outcome of this research is the newly designed shoes based on what the customer needs, the proposed design basically make the product looks more aesthetics compared to the last one.

Keywords : Shoes, Kansei Engineering, Quality Function Deployment, Brand Image

1. INTRODUCTION

Shoes, has become one of the main point of fashion [1] , at the moment wearing a shoes has becoming more of an fashion icon and fashion item, rather than a regular foot protector. It has also transformed into a new communication item where the wearers would like to confer the message into the public or as a statement or stance [2]. Choosing to buy a new product or a new fashion item, in this case a pair of shoes, needs several considerations from the customers, ranging from price and even small details such as color, design and so on [3],

sometimes a good product is the one that could capture what the customers actually needed. Another consideration in buying a shoes, is how fit and comfortable in the wearer's feet and also giving a satisfaction upon buying it. [3] [4]. As shoes has evolved and grown into several types and design, so does the complication of creating and designing a good and satisfying shoes. Several problems such as monotonous design and the high cost of the material [5], the needs to implementing new technologies in order to create a better footwear [6], and even lacks of strategies that consist of the usage of data and technologies in both market analysis and information technology [7] has become a great barrier 2 in this industry, moreover in a SME. As it mentioned in the previous sentences, monotonous design, 1 is one of the problems in shoes business, design could defined as the aesthetic part of the shoes, that could i mpact user's satisfaction using or buying the product [8], another research stated that design, somehow also giving and impact and intervene on both customer's satisfaction and loyalty towards the product [9].On 2 the other hand, shoemaker sometime still using the old-fashioned method in creating and designing shoes like the old time, although the usage of technologies have slowly been implied in the process [10] and it could hinder the growth of the business especially in shoe making. Customers are the vital point for SMEs, as they are the "bloodline" that help SME to grow and survive. Building a good communication, is one of the key points for SME to grow and survive [11]. On a side note, as SME 2 does not have a huge capital to help them grow, customer's satisfaction is needed in order to help the survive against bigger player [12]. Having a quality product, is one of the way to ensure customer's satisfaction both directly or indirectly [13], several others variable should also be considered by company in order to improve p-ISSN : 1412-114X e-ISSN : 2580-5649
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Journal of Engineering Design and Technology 2 customer's satisfaction such as : Serviceability, Durability, Aesthetics and Perceived Quality [12], furthermore, the image of the brand also plays an important role in this [12] [14]. Fashions, leads to the needs of an

aesthetic feels or even a vibe, to fully grasps what the customers wants. Kansei Engineering (KE), is one of the tools in product design and development that relies on that. KE basically a consumer's oriented method that was developed in Japan, that can be utilized in product development [15]. KE comes from the terms Kansei, a Japanese word that can be used to express impression towards several things such situation, surrounding or anything else [16]. As shoes is a fashion product, Kansei could be used to capture what actually the customer's need. It is also possible, to implement Kansei in several other item, not fashion related, such as in : food packaging [17] [18] [19] [20], electric motorcycle [21], kitchen appliance [22], or even an intangible product and services [23] [24] [25]. Another tools, that mostly used in product design and development, is the Quality Function and Deployment (QFD). QFD, is a method that could make every step in product design and development become transparent by finding and understanding what the customer's need [26], thus one of the step in this method is creating the House of Quality (HoQ) which represent the customer's needs and the specification of the product. Implementing QFD will most likely having several impact such as : a) Finding and could prioritizing both spoken and unspoken customer needs. b) Translating theirs needs into technical characteristics via HoQ. c) Building and delivering a quality product (or services) by focusing on customer's satisfaction. [27]. Based on the research background, this paper will mostly covering on the redesigning process of the shoes in Rejowinangun Originial Leather SME, as the mentioned SME are mostly having its product's design quite outdated compared to the other shoes-making SME. Rejowinangun Original Leather mostly relies on another distributor to supplies their catalog, as the consequences of it's poorly design shoes. Both Kansei and QFD method are implemented in this research in order to create a more aesthetic shoes that could help to boost the sales of Rejowinangun Original Leather, as it is now most of their best selling products are the one that the SME does not create by itself. KE, has the approach in aesthetic sides, some products, such as fashion, should be having an aesthetic approach in order to help to enhance the current design, whereas QFD will mostly be used to establish the specifications of the wanted

product, thus author could decide what color, size, shape or any design related things that could help boosting the sales of the shoes in Rejowinangun Leather. 2. METHODS This research is can be dividied into two (2) big steps. The first part of this research is conducted using Kansei Engineering, while the latter, is done in QFD Method. The KE method, is used to find the customer's needs, hidden in their feelings, words or action that being represented in Kansei Words. The Kansei words, in this research, are found in online forum in several platform or application that mostly talking and commenting about shoes. The Kansei words that been collected than being used to create the questionnaires that will be spreaded into the customers. QFD is then used on the next step. Using the customers need that been found by the KE method, authors could build up a HoQ model that could fit and answer's all of the needs that been found in the previous step. This step will provide several parameters result that could be used to create a final design. This final design, will be returned back to the respondent of the research i n order to be validated by them. The validation given by the respondents will be in a form of comments on the final design whether it is finally relevant to their needs or not. The validation process, will be conducted through a questionnaire along with the newly designed shoes. The questionnaire used in this validation process basically a simple question . The validated design most likely become the final design of the shoes that could be used by Original Leather Rejowinangun SME to boost their sale. 3. RESULTS AND DISCUSSION 3.I. Kansei Words Mining KE solely relies on the impression and feels that customers felt when seeing, hearing or even wearing the products. The first step in this research is done by collecting the Kansei Words that will be used in KE method. Kansei words were mined from 30 students 15 of Universitas Ahmad Dahlan (UAD) Industrial Engineering's students that become the main respondents in this research. The words were solicited using Google Form because it is unable to collect the words using regular method such as interview due to Covid-19. The results of the solicitation process of the Kansei words, is shown in Table 1 below

 Tabel 1 Potential Mined Kansei Words Number Mined Text (in Indonesian) 1 Indahnya 2 Keren Hitam Polos 3 Motif Camo Realtree Bagus 4 Warna Putih Bagus 5 Keren Banget 6 Keren Pisan Euy 7 Warna Tan Bagus 8 Soft Sekali Warnanya Tan 9 Ganteng 10 Manis 11 Cakep Banget 12 Ganteng Banget 13 Halus Dan Rapih 14 Materialnya Benar-Benar Bagus 15 Sol Dan Kulitnya Tebal 16 Good Price Good Quality 17 Model Lama Bagus 18 Desain Rapi Dan Terlihat Casual 19 Bagus Ya Warnanya Pastel 20 Warnanya Manis Karena Pastel 21 Warna Kulit Mengkilap 22 Kelihatan Formal 23 Desainnya Simple Bagus 24 Jangan Pakai Logo Yang Itu, Jadi Keliatan Kurang Unik Mined text that have been collected mostly can be grouped into several groups, it is because several mined text somehow have similarity. Using the grouped mined text, we could extract the final Kansei Words that being shown in Table 2 Table 2 Kansei Words Number Kansei Words (in Indonesian) 1 Indah 2 Berwarna Hitam 3 Bermotif Camo 4 Berwarna Putih 5 Elegan 6 Berwarna Tan 7 Desain Menarik 8 Bertekstur Halus 9 Material Berkualitas 10 Kulit Tebal 11 Sol Rapih 12 Harga Bagus 13 Old School 14 Desain Menarik 15 Kasual 16 Berwarna Pastel 17 Mengkilap 18 Formal 19 Simple 20 Tidak Unik Using the 20 Kansei Words, we could proceed to create the Semantic Differential Questionnaire/ Kansei Questionnaire that will be used to find the customers need. The Semantic Differential Questionnaire is shown in Table 3 below.

 Table 3 Kansei Semantic Differential Kansei (in Indonesian) 1 2 3 4 5 6 7 Kansei (in Indonesian) Tidak Indah Indah Berwarna Putih Berwarna Hitam Polos Bermotif Camo Tidak Elegan Elegan Berwarna Pastel Berwarna Tan Mewah Kasual Bertekstur Kasar Bertekstur Halus Kulit tipis Kulit Tebal Sol Tidak Rapih Sol Rapih Harga Murah Harga Bagus Membosankan Desain Menarik Model Modern Model Klasik Pucat Mengkilap Umum Unik Desain In-Formal Desain Formal Kompleks Simple The Kansei Questionnaire shown above, will be spread into 30 respondents, whom are the students

Engineering of UAD, the result is shown below. Table 4 Kansei Questionnaire Recap Kansei Words K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K15 K16 Respondent 1 3 3 3 3 2 2 2 1 3 2 3 1 3 3 3 3 2 6 7 1 7 6 7 7 2 6 5 6 7 6 2 4 6 3 3 3 2 2 2 4 4 4 4 3 3 3 4 4 3 3 4 4 3 2 3 2 3 2 4 4 2 3 2 3 3 3 3 5 2 1 3 3 1 1 1 3 4 3 2 3 3 1 3 2 6 6 6 3 5 6 5 6 6 3 3 5 6 5 6 2 6 7 6 6 5 5 6 3 3 5 7 6 5 7 6 3 4 5 8 3 3 5 6 5 6 5 7 6 6 3 5 5 7 6 6 9 2 3 1 3 3 3 3 3 6 1 3 3 3 3 1 3 10 2 2 1 2 2 2 1 2 3 2 2 2 1 2 1 2 11 1 3 1 1 3 3 3 3 3 2 3 1 3 2 2 3 12 2 2 1 2 2 2 3 3 3 3 3 4 3 3 3 13 2 3 3 2 1 3 1 3 1 1 3 3 1 2 2 3 14 1 7 4 1 4 7 7 4 7 1 4 6 5 3 2 7 15 3 3 3 3 2 3 3 3 3 2 3 3 3 2 3 3 16 3 1 1 3 3 2 3 3 3 1 3 3 1 1 1 3 17 3 6 6 7 5 7 6 2 6 1 4 4 2 5 2 6 18 2 3 1 2 3 3 3 1 3 1 3 3 1 1 1 3 19 5 7 1 7 5 7 7 4 7 4 4 7 4 7 1 7 20 4 4 1 4 4 4 4 4 4 3 4 4 4 2 2 4 21 2 1 2 2 3 2 3 1 3 2 2 2 2 1 2 1

3.2 Quality Function Deployment (Creating the HoQ) Following on the results gathered by Kansei Engineering method, QFD will 1 be used in order to find the designated design of the shoes. Using QFD method, basically will force the developer to find the matching technical responses to the collected needs and will also be used as a connecting bridge between qualitative value (in customers needs) and quantitative value in technical responses. The technical responses are also 2 used by the developer in the next process in order to create the final design. Table 5 Technical Response Using the technical responses shown in Table 4, the next step that should be done while using the QFD method is creating the House of Quality (HoQ). HoQ is the manifestation between customers needs that being found while spreading the questionnaire in the previous section while technical responses are the quantitative 2 aspects of the product that will be produced by the developer. The HoQ 3 of this research is shown in Figure 1 below Figure 1 House of Quality Kansei Words K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K15 K16 22 5 6 2 6 4 6 6 6 6 4 6 4 4 5 4 6 23 4 4 1 4 3 4 4 2 4 1 3 1 4 3 4 4 24 5 5 1 1 5 5 5 5 5 2 2 7 5 5 6 25 2 3 2 3 3 2 3 3 3 3 2 3 3 2 3 3 Code Technical Responses 1 Safe and secure toe tip 2 Having a good material strength and quality 3 Color and motive combination 4

Comfortable counter shoes design 5 Unique design 6 Informal Casual shoes design 7 Perforation vents design 8 Comfortable shoelace design 9 Comfortable outsole design 10 Strong midsole 11 Elastic collar shoes type 12 Safe yet slick shoe tongue design

 3.3 Quality Function Deployment The next step in QFD method, is generating the concept of-soon to be-the final product. The concept generation in this research is based on the current product of Rejowinangun Original Leather, and being used as a reference to improve their current product. Figure 2 Referenced Product It is shown in the Figure 2, that the referenced shoes or the original product of the SME, is a formal shoes with leather as its main material and it has a gum rubber out-sole. Based on the current product, authors are generating two concept that related with the customer's need and it is shown in Figure 3 and 4 below Figure 3 Alternate Concept Figure 4 Alternate Concept The first concept is the closest design with the current product, this design is the improved design of the previous product that based on several customer's needs, on the other hand, concept 2 is another improved design from the current product too. The second improved design, is based on the customer's need that wanting an in-formal shoes, even though this research focusing more on the formal shoes. It is possible that customer saw the current product of Original Leather is not appealing to their sense, thus it is an insight for the authors as it is become one of the generated concepts in this research. Benchmarking, in product design and development, is an essential step as it is giving an insight for the developer to compare their own generated concept with the existing product in the market. In this research, authors do a benchmark with several existing product which are closely resembles the current product/referenced product and also the second concept. These two benchmarked shoes, will be used as comparison in the concept screening and scoring process. Both benchmarked shoes is shown in Figure 5 and 6 below. Figure 5 Benchmarked Product 1

Journal of Engineering Design and Technology 7 Figure 6 Benchmarked Product 2 Both benchmarked shoes come from the existing product. The first shoes is from Nappa Milano Edmond Derby, and it is closely resembles with current product as it is made from leather, gum rubber outsole and a formal shoes. Second one, is from Exodos57 model Gennaios Green, and it will be used as a comparison for the second concept as the latter come up from the in-formal shoes needs. 3.3 Quality Function Deployment (Concept Screening and Scoring) Both screening and scoring process, is a way to eliminate unwanted concept and to ensure that the proposed design should go further in the product development or not. The concept that being screened and scored is the first alternative (Figure 3), because of the current product is the formal type shoes, while second alternative is the in formal type and it will create another different need. Table 6 Concept Screening Screening Concept Current Product Alt I Benchmark 1 Benchmark 2 Safe and secure toe tip 0 + + + Having a good material both strength and quality 0 + + 0 Color and motive combination 0 + − − Comfortable counter shoes design 0 + + 0 Unique design 0 + − + Informal casual shoes design 0 − − + Perforation vents Design 0 + + − Comfortable Shoelace design 0 + + + Comfortable outsole design 0 + + 0 Strong midsole 0 0 − 0 Elastic collar shoes type 0 − 0 0 Safe yet slick shoe tongue design 0 + + + Pluses 10 8 5 Sames 1 1 5 Minuses 1 4 2 NET 9 4 3 Rank 1 2 3 Continue? Yes Yes No From Table 6, we could inferred that both Alt 1 (the generated concept) and benchmark 1 is going through the scoring process, the reference product is not getting any ranking but it will go to the next step, it is because the referenced product will become the main comparison for both the alternative and the benchmark. The second benchmark is out of the screening process, because of its irrelevant type and looks compared to the other two.

 Table 7 Concept Scoring Concepts Reference Alt1 Benchmark 1 Selection Criteria Weight Rating Weighted Score Rating Weighted Score Rating Weighted Score Safe and Secure Toe Tip 54 3 162 4 216 4 216

Having a Good Material Both Strength and Quality 60 3 180 4 240 4 240 Color and Motive Combination 142 3 426 5 710 2 284 Comfortable Counter Shoe 18 3 54 4 72 2 36 Unique Design 129 3 387 5 645 3 387 Informal Casual Shoes Design 69 3 207 5 345 3 207 Perforation Vents Design 98 3 294 5 490 4 392 Comfortable Shoelace Design 93 3 279 4 372 3 279 Comfortable Outsole Design 18 3 54 4 72 3 54 Strong Midsole 27 3 81 3 81 3 81 Elastic Collar Shoes Type 24 3 72 2 48 2 48 Safe Yet Slick Shoe Tongue 51 3 153 4 204 4 204 Total Score 36 2349 49 3495 37 2428 Rank 3 1 2 Continue? NO YES NO 3.4 Final Design and Validation Process Based on both screening and scoring process, it could be concluded that Alternative 1 or the generated concept will be the winning concept for the redesigning process, the following steps would be creating the final design and validated the proposed design back to the respondent Figure 7 Proposed Final Design Figure 7 is the proposed final design although it is still need to be validated, the next step is validating Figure 7, by returning back the proposed design to the respondents. Validation is the process which will become an input for the researcher to grasp “unseen” needs by the customers. Validation also acted as a t ool to improve further the current design and also possible for researcher to add or even remove several features of the current proposed design. Figure 8 Validation Process

 The validation process, shown in Figure 8, provides an information that the current design is good enough for the respondent, although 10% of the respondents still demanded an improvement on the proposed design, mainly talking about a distinctive feature on the back part of the shoes, thus, authors provide an improved design based on the suggestion that is shown in Figure 9 and 10 below. Figure 9 Final Design of the Shoes Figure 10 Change of Design On the previous step, authors could generate 2 designs based on the customer’s need, although authors only focusing on redesigning on the current product as an improvement. The second design, as it is also part of the customer’s need, would be better to help the SMEs grow better in the future. Having another type of shoes, most likely help the SME to

gain another segment of market, namely the youngsters. The proposed design, is also undergo the same steps as the previous design, which will also having a validated process by the respondent. Both the proposed design and the validated design by the respondent (Final Design) are shown in both Figure 11, 12 and 13 below Figure 11 Proposed Design Figure 11 is the proposed design, that expected could help the sales for Original Leather, this proposed design is then validated to the same respondent for the first design Figure 12 Final Design of the Informal Shoes

 Figure 13 Change of Design The same responses obtained for the second alternative. Respondents feels the lack of identity for the proposed design, thus authors provide the SME logo and put it in the back heel of the shoes. Based on the result, the usage of Kansei Engineering could be applied in fashion item, because of its relations with aesthetic things. It is strongly believed that fashion relates a lot with aesthetic and several other parameters such as price, quality and so on. QFD, is also a staple tool in Product Design, as it helps researcher in determining what should or should not be implied and incorporated on the product, therefore the integration of both theories should be able to be used in most of fashion products. 4. CONCLUSION Creating a brand image, in someway, will boost customer satisfaction. Customer, for an SME, somehow plays an important role in their continuity, and one of the way to raise customer satisfaction, is by creating a good product both design and function. Original Leather, is one of an SME in Yogyakarta that somehow lack a proper design in their product and ended up having trouble with their sales. Using KE and QFD as the tools has made an impact in changing the looks of their design, the referred shoes have a significant changes as it shown in Figure 9 and 10 after undergoing several steps and validation with the respondents. Authors also provide another design that hopefully could gain and grasp another segment, which is the youngsters. Undergoing the same ste ps, the newly proposed design are shown in both Figure 12 and 13. This newly made concept is expected to gain another new segment of market that could help

boosting the sales level. The applied method in this research significantly help the SME in making a better yet aesthetic product.

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