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Designing Cannes Eco-Product Using Quality Function Deployment

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ABSTRACT

This research aims to determine what factors are needed to design Cannes shoes, a brand of eco-friendly footwear products, and to examine the theory behind the implementation of Quality Function Deployment (QFD) related to eco-products. Samples were collected by distributing questionnaires with non-probability sampling to 100 respondents to define what customers want in eco-shoes. The data were then analysed by QFD. An in-depth interview with the product owner was carried out to determine technical specifications and also to determine benchmarking with two competitors. The results showed that customers want comfortable shoes manufactured using eco-friendly materials. The technical response to Cannes environmentally-friendly shoes is that they are made from genuine leather, they use natural dyes and they have a foot bed, eco-friendly soles and shoe construction that are comfortable for wear. The variables tested showed a good relationship with one another. Comparison with its competitors showed that Cannes is considered far superior in quality by consumers. The technical evaluation considered the use of these elements: Horween leather, natural dyes, arc-technology foot bed, eco-friendly sole 100 % reuse and recycle and Norwegian welt construction.

Keywords: Environmentally-friendly design, house of quality, quality function deployment

INTRODUCTION

Quality Function Deployment (QFD) was developed in the Mitsubishi Kobe Shipyard, Japan, in 1972. It was pioneered by Yoji Akao in Japan in 1966. Akao's finding published in an article in 1972 under the title 'Hinshitu Teinkai System' came to be known as Quality Deployment. This function

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was later adopted by Toyota Ford Motor Company and Xerox and then brought to the United States at the end of 1986. Since then, QFD has been implemented by many Japanese companies as well as those in the United States and Europe. Big companies such as Procter & Gamble, General Motors, Digital Equipment Corporation, Hewlett-Packard and AT&T now use this concept to improve communication, develop products and process their measuring systems (Desiawan, 2010). Small Medium Enterprises (SME) have been able to increase their economic growth to reach 6.3% by using this concept. They have been able to increase their GDP to 56% (Mulia, 2013). SMEs in 2011 contributed to 55,206,444 units of the 'Usaha Menengah" (UM) business consisting of 54,559,969 units of the business. They also contributed to 602.195 Millions "Usaha Kecil" (UK) business units, and a 'Menengah Besar' (MB) of 44.280 Millions business units. The number of SMEs in the year 2012 increased to 56,534,592 units of the UM business consisting of 55,856,176 units of the business, amounting to 629.418 UK business units and for MW, it was 48.997 business units. The development of SMEs in the period 2011-2012 was 2.41% or 1,328,147 units of the SME business. For 'Usaha Besar' (UB) in 2011, the amount was 4,952 units, while the UB business in 2012 amounted to 4.968. UB and development amounted to only 0.32% or 16 business units. Based on Table 1, it can be concluded that SMEs experienced greater growth than UBs.

SMEs that are showing growth are those dealing in shoes (Kemennegkop, 2012). The shoe industry began to grow after Presidential Instruction No. 2 was issued in 2009 by the government for domestic product usage of goods and services. The Presidential Instruction had a positive impact on shoe sales, which increased by 20% (Rubiyantoro, 2009) as it was seen by the CEOs of Chevalier (http://chevalierstore.com/) and Cannes (http://cannesstore.com/) shoe stores as a huge opportunity for their shoe business. Since the important criterion was quality, Chevalier used materials of international standard while Cannes used environmentally-friendly materials.

This study focussed on the factors that have made Cannes shoes popular among consumers. The researchers set out to discover: the technical response necessary to produce Cannes eco-friendly shoes; the relationship between each item related to technical response; the importance of technical response; the competitors based on an assessment of the needs of consumers; and the technical evaluation of competitors of Cannes. A new perspective derived from the literature showed that the concept of a house of quality can also be used in the manufacture of eco-products. There is a lack of research on eco-product development using Quality Function Deployment (QFD). With QFD, eco-products of good quality can be made. QFD has also made a social contribution to Indonesian SMEs, enabling them to develop quality products at affordable prices without having to engage professional designers.

LITERATURE REVIEW

Mahaptra and Mohanty designed office furniture using Quality Function Deployment (QFD), showing that QFD could be used as an integrated approach to design office furniture. QFD can also be used to improve the quality of products as it helps in identifying important design characteristics (Mahaptra & Mohanty, 2013).

Bereketli, Genevois and Ulukan attempted a green-product design for mobile phones using Eco-QFD, integrating social responsibility with the original QFD model. For such a venture, the raw materials or substances used can be less toxic and more environmentally-friendly. The needs of consumers and the government's call for adherence to recycling and environmental awareness in industry should be taken into the account by the manufacture of eco-products (Bereketli et al., 2009).

Ersam and Supriyanto used Integration Servqual and QFD in 'Gedung Olahraga' (GOR) Kertajaya to improve the quality of a service gymnasium. In their research, they used Cartesian diagrams charted around six elements of perception (clean toilets, optimum temperature, proper schedule, sufficient lockers, hygiene and services). They were able to collect four responses to do with technical details (Ersam & Supriyanto, 2012).

Pusporini, Abhary and Luong, in 2013, stated that environmentally-friendly products are becoming an important consideration for the manufacturing industry, and that this growing focus would force the industry to increase their awareness of the need to protect the environment by producing products that would meet customer and environmental requirements. Such products would be accepted based not only on quality but also on their ability to meet the environmental requirements. They concluded that QFD is effective in designing and developing products with the aim of creating customer satisfaction and that this has been successfully implemented in many industries (Pusporini et al., 2013).

Cardoso, Filho and Miguel, in their research on the application of QFD for the development of an organic product, found that the element of preventing harmful socio-environmental damage is essential for developing an organic product because this dimension comprises one third of the relative weight of the planned quality (Cardoso et al., 2014).

Li and Guo (2013) stated using the concept of the house of quality could not be guaranteed. Manufacturers would need to find the key factors to make their product a success. Alemam and Li (2014) researched eco-design using an integration of QFD and functional analysis, and concluded that QFD had solid grounds for design and planning and that using an eco-design would indeed reduce environmental impact. The key technique of the proposed method is to integrate the functional descriptions of a product in the framework of QFD for eco-design. However, certain features of the method have not been implemented or studied, such as benchmarking and tradeoff analysis. The proposed method does,

however, provide a solid framework for including more features for the eco-design method (Alemam & Li, 2014).

METHODOLOGY

Questionnaires intended to discover what customers want were distributed to 100 respondents based on convenience sampling. The house of quality shown in Figure 1 was used the assessment tool.

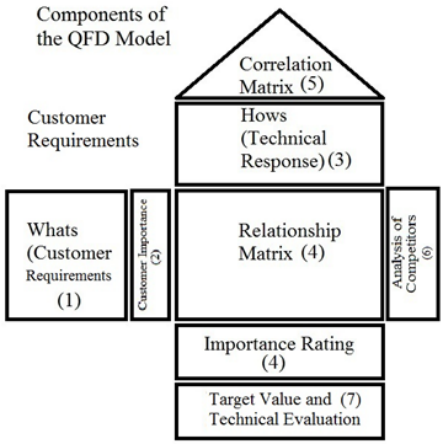

Figure 1: House of quality (Heizer & Render, 2009).

Customer Requirements

Customer requirements are important attributes for an eco-product. According to Heizer and Render (2009), the six guidelines below can help operations managers to design an ethical and environmentally-friendly workflow:

a. Make products that can be recycled.
b. Use raw materials that can be recycled.
c. Use components that are not dangerous.
d. Use components that are light.
e. Use more economical sources of energy.
f. Use raw material that are less harmful to the environment.

Customer Importance

First, the questionnaires were distributed among the respondents. Then the attributes under customer requirements were arranged based on the Likert scale used. Data from the questionnaires were calculated using descriptive analysis and weighted for priority.

Technical Response

Collecting data on technical response was done through an in-depth interview with the maker of Cannes products.

Relationship Matrix and Importance Ratings

The relationship matrix was calculated as follows:

$Kt_i = \sum BT_i \times H_i$

Where:

Kt_i = absolute value technical needed by every attribute

BT_i = relative importance of customers who have a relationship with the attributes

H_i = desire a relationship between customers and the attributes

Correlation Matrix

The data for this were collected from an interview with the CEO of the company that produced Cannes products.

Competitor Analysis

Analysis of competitors of Cannes was done through observation of the competitors. Product competitors were compared against the attributes under customer requirements. The data were collected through benchmarking against two competitors.

Target Value and Technical Evaluation

Target value was assessed from observation of the attributes of technical response and through an interview with the management of the company supplying eco-products. Technical evaluation of each company's product (Cannes, Amble and Portee) was also done.

RESULTS AND DISCUSSION

Respondents in this study were all consumers or users of shoes, numbering 100 respondents. The characteristics of the respondents taken into account for this study were gender, age, importance of environmentally-friendly products to the respondents and purchase of environmentally-friendly footwear products. About 43 or 43% of the respondents were male while 57 or 57% were female. Four (4%) were in the age category of 17-19, 90 (90%) were in the age category of 20-22 years and six (6%) were in the age category of 23-25. None were above 25 years of age. Women in the age category of 20-22 years formed the largest group of the population. All the respondents (100%) considered environmentally-friendly products as being important. Respondents who had previously bought environmentally-friendly products numbered 50 (50%); this was of course the same number of respondents who had not previously bought environmentally-friendly products. This showed that among the respondents, there was an equal distribution of those who bought environmentally-friendly products and those who did not.

The number of respondents responding to the statement item on environmentally-friendly design was very high. The response to the item on recycled shoes was 79.80%. The lowest response was to recyclable product attributes. The less harmful rating was the most important attribute, with a quality score of 922. The attribute of less material was seen to be the least important, recording a quality score of 855.

The correlation matrix on QFD evaluated the relationship between technical response items. The value of the association was subjective based on qualitative data obtained from interviews with management and field observations, indicating that genuine leather had a relationship to all the indicators such as natural dyes with a weight of 5, foot bed with a weight of 1, eco-friendly soles with a weight of 3 and construction shoes with a weight of 5. Natural dyes had no relationship except for original quality with a weight of 5. Foot bed had a moderate relationship with a weight of 3 to eco-friendly soles while eco-friendly soles had a high correlation with a weight of 5 with construction shoes.

Figure 2 shows that customer requirements contained six attributes i.e. product recyclable, recycled materials, less harmful, lighter components, less energy and less material. These six attributes

Figure 2: House of quality for eco-shoes.

obtained from six opinions were tested for validation through questionnaires to 30 respondents from Bandung city.

The relationship matrix provided customer importance ratings and scores for the technical response. The results were based on kilogramme. The relationship matrix was multiplied with the customer importance ratings. The result was added to the relationship matrix. The attribute of native leather received a response of 71, native dye, 35, foot bed 43, eco-friendly sole (material used), 77 and construction shoes, 73. The relationship matrix was correlated with the importance ratings.

The competitive competitor assessment was done through benchmarking and observation. Cannes' competitors were Amble and Portee. The results gave a 'poor' rating to Amble's efforts to recycle products. This is because Amble used skin synthesis that was not environmentally friendly. Recycled materials received a rating of 'fair' because some of the components were easy to recycle. The attribute 'less harmful' received a rating of 'fair' because arc technology was used, which safeguards shoes. Lighter up components as an attribute got a rating of 'fair; because the thickness of the skin used to make the shoes was only 5mm. Less energy, another attribute, received a rating of 'fair' because the shoes used the skin type, corrected grain breads, which was easier for customers to clean. The attribute, less material, received a 'fair' rating because the product did not use too many use additional accessories. Portee received a rating of 'fair' for recyclable products because it used original. Its skin-recycled materials received a rating of 'fair' because some of the components were easy to recycle. Its attribute, less harmful' received a rating of 'poor' because only wooden sleepers were used. Its lighter up components received a rating of 'fair' because the thickness of the skin used was only only 5mm. Less energy, another attribute, received a rating of 'fair' because the shoes used the skin type, corrected grain breads, which was easier for customers to clean. The attribute, less material, received a 'fair' rating because the product did not use too many use additional accessories. Based on the interview with the owner of Cannes, Amble and Portee shoes were the closest competitors to Cannes. Observation of

footwear products of the three competitors showed that Cannes was superior, with higher ratings for six customer requirement attributes compared to Amble and Portee. Cannes scored in the categories recyclable products and less harmful while Amble received 1 and 5 for these attributes. Portee received the same rating as Amble.

Five attributes made a reference to the target by description attributes for the target, value. To gauge value, interviews with shoe experts were conducted. Five attributes were noted: use of Horween leather; use of natural colouring agents made from plants and animals; use of arc-technology foot beds to avoid feeling tired; and the use of environmentally-friendly soles that can be recycled. Environmentally-friendly soles are made of microtech materials that degrade automatically and do not pollute the environment because they do not contain heavy metals such as phthalates (chemicals that are difficult for micro-organisms to reduce). The technique used to make environmentally-friendly shoes is the technique of using Norwegian welt, where the soles are sewn rather than glued to make them durable and waterproof. Cannes products used Horween leather, arc-technology foot beds, environmentally-friendly soles, natural colouring agents and Norwegian Welt, while Amble had only one positive attribute, the use of arc-technology foot beds and Portee's only positive attribute was the use of Horween Leather.

Technical evaluation of performance among the competitors provided results for target value. The data collected showed that Cannes used three attributes, namely, Horween leather, arc-technology foot beds and environmentally-friendly soles while Amble only used arc-technology foot beds and Portee used Horween leather.

CONCLUSION AND RECOMMENDATION

Cannes footwear products use original leather, natural colouring agents, arc-technology foot beds, environmentally-friendly soles and construction shoes. Of high interest among the respondents was the use of environmentally-friendly soles, construction shoes, original leather, original foot beds and natural colouring agents. Cannes was ranked as being superior to its nearest competitors, Amble and Portee. Technical evaluation considered the use of Horween leather, natural colouring agents, arc-technology foot beds, eco-friendly soles and Norwegian Welt construction.

Some of the conclusions obtained from this study are:

1. Consumers want comfortable shoes that do not hurt their feet while also being environmentally-friendly.

2. Technical response to satisfy consumers who demand eco-friendly shoes is to use genuine leather materials, natural dyes, foot beds, environmentally-friendly soles and construction shoes.

3. The relationship between each attribute evaluated in the technical response is as follows:
   a. Genuine leather materials have a high relationship with natural dyes
   b. Genuine leather materials has a low correlation with foot beds
   c. Genuine leather materials with sole eco-friendly relationships being the most important
   d. Construction material genuine leather shoes have a relationship with quality
   e. Foot beds with environmentally-friendly have a relationship with quality
   f. Foot beds have a high relationship with construction shoes
   g. Environmentally-friendly soles have a high relationship with construction shoes

4. The level of interest ranging from the highest to lowest is as follows:
   a. Environmentally-friendly soles with a score of 77
   b. Construction shoes with a score of 73
   c. Genuine leather material with a score of 71
   d. Foot beds with a score of 43
   e. Natural dyes with a score of 35

5. Assessment of the competitors based on customer needs showed that Cannes was considered superior to Amble and Portee both in terms of customer requirements and target value as Amble and Portee did not meet the needs of consumers and was far from the desired target value.

6. Technical evaluation of the characteristics showed the following as attributes that consumers want in shoes:
   a. Cannes and Portee used Horween leather from the United States, rated the best in the world.
   b. Cannes, Amble and Portee do not use natural dyes from plants and animals that do not contain chemicals and are more environmentally-friendly.
   c. Cannes and Amble use arc-technology cushioning foot beds for comfort and to prevent foot tiredness.
   d. Cannes used environmentally-friendly sole technology from Italy that allows 100% recyclability.
   e. Cannes, Amble and Portee use Norwegian welt sewing. Norwegian Welt sewing is a technique that sews the upper part of soles, the insole and the outsole and it does not use glue/adhesive chemicals as making it more powerful and environmentally friendly.

Cannes should develop comfortable shoes that are less harmful, as desired by consumers. Cannes should use natural colouring agents from plants and animals to be more environmentally-friendly. Cannes should immediately implement construction shoes that use Norwegian welt sewing technique because this technique allows for shoes to be more durable, waterproof and environmentally-friendly. Cannes must do more to innovate to create greater distinction between its products and those of its nearest competitors, Amble and Portee.

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