DESIGN OF KANSEI LAUNDRY BAG BY USING FIBER OF WATER HYACINTH (*EICHHORNIA CRASSIPES*)

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ABSTRACT

Plastic bag in laundry services is one of products that it was not readily biodegradable. This state may cause contamination of environment and also as source of malady. The paper presents a study to design a bag manufactured from fiber of water hyacinth to reduce the negative impact. Kansei Engineering method is used to translate customer feelings and emotion into the design parameters of laundry bag. Nonparametric statistical analysis was conducted to test the hypothesis. Result of this study shows that the designed bag was satisfied the customer feeling and emotion.

Keywords: *Laundry Bag, Eichhornia crassipes, Kansei engineering*

1. INTRODUCTION

Nowadays, the plastic bag is widely in use to store goods in mostly activities such as the laundry services. However this bag was not readily biodegradable such that it may cause contamination of environment and also as source of malady [a]. This fact encourages a need to develop eco-friendly bag design. One of them is use the water hyacinth as main raw material.

Water hyacinth is a water weeds that it can have a poor impact to environment [b]. Therefore, It is important to change this material into worthwhile resources because this weeds have a wear well resistant as base material of handicraft [b]. Moreover, the use of the resources can avoid people getting negative impact. Thus the better bag design should consider customer voice.

Objective of this study is to design eco-friendly bag made from water hyacinth to satisfy customer need by using Kansei Engineering method.

2. THEORETICAL BACKGROUND

Kansei Engineering is a technology that unifies feeling and emotion with engineering and product development into the design to produce an image and impression [c]. It is known as kansei. This concept consists of six types namely classifications (type1), kansei engineering system (type 2), hybrid kansei engineering (type 3), expert system kansei engineering (type 4), virtual reality kansei (type 5), collaborative kansei engineering (type 6) [c][d]. This study was focus on kasei engineering type 1.

Kansei engineering process type 1 consists of 5 steps. This type begins with the identification of the target market group to determine kansei word. Then second step is to determine the Product Concepts as given in figure 1.

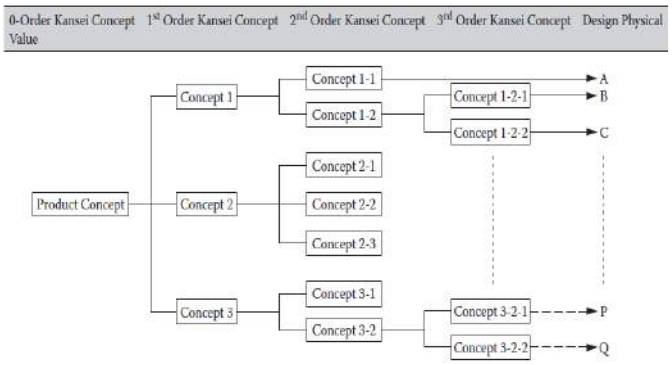

Figure 1. Conceptual map of Kansei Engineering method Type I [d]

The next step is breaking down Product Concepts. The fourth step is continuous Deployment for Physical Design Characteristics, and then the last step is the Translation Technical Specifications [d].

3. RESEARCH METHOD

3.1. Survey

This study uses a paper-based survey to identify consumer criteria of laundry bag. Questionnaires are given to more than 40 respondents. Questionnaires are used to identify consumer criteria, physical design parameters and validation. Respondents are laundry service users and aged between 16-25 years old.

3.2. Develop The Virtual and Real Prototyping

Virtual prototype development aims to validate physical design parameters laundry bag that is capable of satisfies consumer criteria. Virtual design made by SketchUp 13.0.3689. This research is done by showing the virtual design of a laundry bag to be rated by laundry service users. Measurement validation of virtual prototype based on the results of questionnaires is given to the respondent.

3.3. Statistical Analysis

Non-parametric statistical analysis was conducted to test the hypothesis. kansei word validity was analyzed by Spearman correlation while reliability kansei word analyzed by Cronbach Alpha [e]. Then, factor analysis is used to map the concept of the product. The next stage, Stuart Maxwell test of marginal homogeneity test to validate the design of laundry bags [f]. The last stage is the Wilcoxon Signed - rank test to compare between the design of eco-friendly bags made from water hyacinth and plastic bags commonly used as a laundry bag [f]

4. RESULT AND DISCUSSION

4.1. Kansei Word

Ninety seven kansei words were identified from laundry costumer. 6 kansei words were valid [g] (Table 2)

Table 2. Kansei Word

no	Kansei Word	no	Kansei Word
1	Big	4	Practical
2	Light	5	Trustworthy
3	Foldable	6	Fragrant

Kansei word “Big” in this study means of sufficient size to make a lot of content. “Light” is defined as words that describe the heavy bag that is lightweight and does not add to the burden of congenital when filled. Kansei word "Foldable" is defined as a description of the shape of the bag can be folded so that when not in use can be stored in the form of small and do not use spaces. “Practical” in this study was defined as the functioning of the bag is easy to use and does not complicate the user. “Trustworthy” meaning that laundry bag used durable and not easily damaged. In addition, because the laundry bag made from natural fibers, it is necessary to be convinced that the basic material of the bag is not harmful to the user. Kansei word “Fragrant”, used as a criterion for consumers to laundry bags, to avoid the damp smell of the bag during use, so it takes the water hyacinth fiber that has low humidity and do not emit odors if used.

4.2. Purposed Design of a Laundry Bag

Result of mapping process can see in Table 3. It consist of two alternatives design namely design A is tube design and design B is Cube design. Figure 2 and Figure 3 describe virtual prototyping of laundry bag for each alternative design.

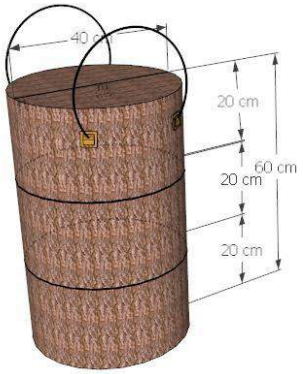

Figure 2. Design A of Laundry Bag with Fiber of Water Hyacinth

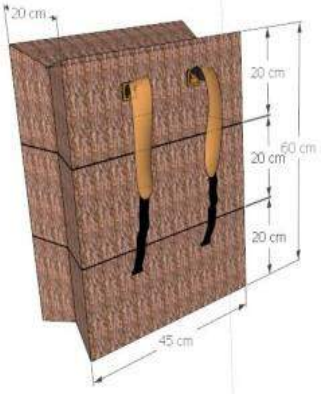

Figure 3. Design B of Laundry Bag with Fiber of Water Hyacinth

Table 3 Mapping of Product Concept

Level 1	Level 2	Level 3	Level 4	Specific Design A (Pipe)	Specific Design B (Cube)
Big	Size	Length of Bag			45 cm
		Height of Bag		60 cm	60 cm
		Width of Bag			20 cm
		Diameter of Bag		40 cm	
	Maximum Capacity			25 kg	25 kg
Light	Easily Was Appointed	Rope	Material	Rubber	Thick Nylon
			Form	Hand-Bag Rope	Backpack Rope
	Little Weighs	Weight of Bag		350 gram	300 gram
Foldable				Foldable (3 section)	Foldable (3 section)
Practical	Efficient	Form of Bag		Pipe	Cube
		Lid of Bag		Wrinkle Rope	Zipped
	Happiness to use	Pattern of Bag		Horizontal Pattern	Vertical Pattern
		Color	Bag	Brown	Brown
			Rope	Black	Black
Trustworthy	Material	Unbroken	Rope	Rubber	Thick Nylon
			Bag	Fiber of Water Hyacinth	Fiber of Water Hyacinth
		Non-toxic	Rope	Rubber	Thick Nylon
			Bag	Fiber of Water Hyacinth	Fiber of Water Hyacinth
		Not Injure	Rope	Rubber	Thick Nylon
			Bag	Fiber of Water Hyacinth	Fiber of Water Hyacinth
		Uncontaminated	Rope	Rubber	Thick Nylon
			Bag	Fiber of Water Hyacinth	Fiber of Water Hyacinth
		Unpolluted	Rope	Rubber	Thick Nylon
			Bag	Fiber of Water Hyacinth	Fiber of Water Hyacinth
Fragrant	Scent	Humidity of Bag		Low	Low

4.3 Homogeneity Test

Validate of laundry bag test by Stuart Maxwell test of Marginal homogeneity.
The hypotheses were developed as follow:
H_0: There is no a significant difference between the consumer criteria and laundry bag design
H_1: There is a significant difference between the consumer criteria and laundry bag design

Table 4. Result of Marginal Homogeneity

Kansei Word	z value	
	A	B
Big	.050	.225
Light	.793	.317
Foldable	.038	.251
Practical	.647	.072
Trustworthy	.000	.705
Fragrant	.000	.665

The table 4 shows that all the z value of design B has z >0.05 the null hypothesis can be accepted, it means there is no a significant difference between the consumer criteria and laundry bag design. Then the z value of design A, ranged from 0.000 to 0.793. 4 of 6 z value of design A (big, light, foldable, and practical) has z value >0.05, can be accepted and means there is no significant difference between consumer criteria and laundry bag design. But 2 of 6 z value of design A (trustworthy and fragrant) has z <0.05, can't be accepted and means there is a significant difference between consumer criteria and laundry bag design. The null hypothesis of design A can't be accepted cause not all of the z value >0.05, it means there is a significant difference between the consumer criteria and laundry bag design. [f]

4.4 Sign Test

Wilcoxon signed-rank test used to compare the selected design of laundry bag with fiber of water hyacinth and the common laundry bag with plastic material.

Table 5. Result of Wilcoxon Signed-Rank Test

Kansei Word	Asymp.Sig. (2-Tailed)
Big	.000
Light	.000
Foldable	.000
Practical	.000
Trustworthy	.000
Fragrant	.000

The table shows that there are significant differences between the two laundry bags (Sig. <0.05) [f]. Results showed that the respondents chose a laundry bag with water hyacinth fiber than common laundry bag with plastic material. This is indicated by the mean value of both, as follows:

Table 6. Mean of Laundry Bag with Fiber Hyacinth and Laundry Bag with Plastic Material

Kansei Word	WH	P
Big	**3.4348**	1.2319
Light	**3.4493**	1.4783
Foldable	**4.0145**	1.3623
Practical	**3.7101**	1.3188
Trustworthy	**3.4928**	1.3768
Fragrant	**3.4928**	1.2319

5. CONCLUSIONS

Based on the result of this research, concluded as follows:

1. Consumer feelings of design of laundry bag with fiber of water hyacinth *(eichhornia crassipes)* are big, light, foldable, practical, trustworthy and fragrant.
2. The best design is cube design (design B). Its dimensions are 45 cm of length, 60 cm of height and 20 cm of width by using colored brown with a vertical pattern. Backpack rope of this bag made by a black thick - nylon and a zipper as the lid of this design.
3. The proposed design of laundry bag is valid to meet the consumer feelings and significant different with other design at 5% of significant levels.

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