The customer-oriented bag matrix to support the design leather bags

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Abstract
This study aims to propose a new design method to help designers design new bags meeting customers' perception. The method is structured by a matrix that maps semantic values of customers' perception to product visual form and technical features (design attributes) of products to be manufactured. It leans on quality function deployment (QFD) concept to evaluate the relationship matrix between semantic adjectives and design attributes. The semantic values will be used to guide for designing new products. The method is in 2 steps. The first aims to create the customer-oriented bag matrix. The second aims to support how to use the customer-oriented matrix to design a leather bag.

Keywords:
product design, design method, customer-oriented

1 INTRODUCTION

The idea of successful marketing has involved an effort to see products from the customer's or user's point of view [1]. Designers need to deal carefully with possible interaction problem between customers and product interfaces. Reducing gap between customers and products is an important in product design.
Nowadays the leather goods industry in Thailand is facing a severe competition in the global markets. Owing to quality and image, products from Thailand are often unsatisfied. The quality of product does not meet customer requirements. The image of product is not recognized from customers. Product did not express to identity. Efficient design and manufacture of products preferred by customers at competitive costs within shorter lead time over those offered by competitors is crucial to their survival [2]. In order to compete with foreign competitors, it is necessary to adopt a design strategy coping with higher quality, reduced production cost and above all closer matching to consumer values.
Quality function deployment (QFD) is an important product development method. It is most commonly used in the early phase of the design process. Engineers, technical development personals and quality experts have tended to use QFD to translate customer needs into product design characteristics. Marketers are more likely to use QFD to help design new product feature sets [3].
In this study, we create a new design method to help designers design new bags meeting customers' perception. This approach leans on QFD concept to evaluate the relationship between semantic adjectives and design attributes. The proposed method is in 2 steps. The first aims to create the customer-oriented bag matrix. The second aims to support how to use the customer-oriented matrix to design a leather bag. The customer-oriented matrix will be used to guide for designing new products.
This paper is organized as follows: Section 2 presents the literature review. Section 3 describes the proposed method and results. The results are discussed in Section 4. Conclusion is drawn in Section 5.

2 LITERATURE REVIEW

The literature review was achieved in the fields of quality function deployment and product design.

2.1 Quality Function Deployment

QFD, as a customer-driven tool, is generally used in the early phase of new or improved products/services design process [4]. QFD originated in the late 1960s and early 1970s in Japan from the work of Akao [5]. QFD is a systematic method for translating the voice of customers into a final product through various product planning, engineering and manufacturing stages in order to achieve higher customer satisfaction [6]. QFD has been used by many companies because of the following three basic reasons: to save design and development time, to focus on the satisfaction of customer and to improve communication at all levels of the organization [7].
QFD is typically viewed as a four-stage process to design products that optimally meet customer needs. The first phase is to collect customer needs for the product (or customer requirements, customer attributes) called WHATs and then to transform these needs into technical measures (or technical requirements, product design specifications, engineering characteristics, performance measures, substitute quality characteristics) called HOWs. The second phase transforms the prioritized technical measures in the first phase into part characteristics, called Part Deployment. Key part characteristics are transformed in the third phase, called Process Planning, into process parameters or operations that are finally transformed in the fourth phase called Production Planning into production requirements or operations [8].

2.2 Product Design

The visual appearance of products is a critical determinant of consumer response and product success. Judgments are often made on the elegance, functionality and social significance of products based largely on visual information that relate to the perceived attributes of products and frequently centre on the satisfaction of consumer wants and desires, rather than their needs [9]. Kansei Engineering (KE) was founded at Hiroshima University about 30 years ago. It aimed at the implementation of the customer's feeling and demands into product function and design. Kansei engineering, as a kind of human ergonomic technology, can be defined as a methodology for translating human psychological

processes such as feeling and emotion related to products into appropriate product design elements such as size, shape, and color [10]. Currently more and more models enabling stylistic innovation are proposed, which are based on the definition of design rules and their translation into product parameters [11]. Chang et al. [12] proposed five expression modes commonly used by consumers when attempting to convey their desires for product form. McDonagh et al. [13] presented product personality profiling for evaluation mood boards and visual product evaluation.

Many researcher studied product design in the field of fashion product. Bouchard et al. [14] investigated the emotional of European people in the field of shoe design. Cappetta et al. [11] proposed an evolutionary model of stylistic innovation that is the change in the aesthetic and symbolic elements of products and services.

In the next section, we propose the method to help designers design new bags meeting customers' perception and present some results.

3 METHOD

This section describes an experiment led in sector of bags design. This method leans on QFD concept. This approach is structured by a matrix that maps semantic values of customers' perception to product visual form and design attributes of products to be manufactured. The method is focused on the customer-oriented matrix to help designers design new bags meeting customers' perception.

This approach is in 2 steps. The first aims to create the customer-oriented bag matrix. The second aims to support how to use the customer-oriented matrix to design a leather bag. Then, the proposed method is tested by a selected bag company in Thailand. Results from customer-oriented bag matrix have been used to guide for designing new products. This approach followed the following steps:

3.1 Create the customer-oriented bag matrix

The first step leans on QFD concept to evaluate the relationship between semantic adjectives and design attributes. The structure of customer-oriented matrix is composed of 3 parts: semantic adjectives, design attributes and relationship between semantic adjectives and design attributes as shown in Figure 1.

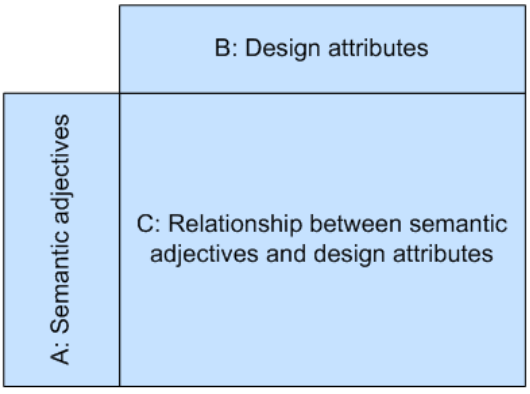

Figure 1: The structure of customer-oriented matrix.

Semantic Adjectives

This part focused on the semantic adjectives that related to activity, lifestyle and taste of target customers. The semantic adjectives were collected from magazines and websites of luxury brand, which were chosen by fashion experts and chief designer. A list of 10 words was proposed. The following list of semantic adjectives was established: feminine, elegance, functional, compact, chic, simple, urban, comfortable, luxurious and classic.

Design Attributes

This part aims to classify the design attributes. They were analyzed by designers, engineers and pattern makers. It can be classified in 4 groups: shape attributes, material attributes, accessory and detail attributes, and manufacturing attributes.

- Shape attributes – It can be classified in 4 sub-groups: type of shape, size, structure and complexity. The list of shape attributes is shown in Figure 2.
- Material attributes – It can be classified in 4 sub-groups: Type of material, surface finishing, color and flexibility. The list of material attributes is shown in Figure 3.
- Accessory and detail attributes – It can be classified in 2 sub-groups: accessories and details. The list of accessory and detail attributes is shown in Figure 4.
- Manufacturing attributes – It can be classified in 2 sub-groups: stitching line and binding. The list of manufacturing attributes is shown in Figure 5.

Type of shape	Barrel
	Bucket
	Double handles
	Drawstring
	Facile
	Flap
	Frame
	Hobo
	Luggage
	Satchel
	Shoulder bag
	Structure
	Tote
	Trapezoid
	Wireframe
Size	Small
	Medium
	Large
Structure	Rigid
	medium
	sofft
Complexity	simple
	medium
	complex

Figure 2: The list of shape attributes.

Type of Material	Leather	Cow leather	full grain
			top grain
			suede
		python leather	
		fish leather	
		crocodile leather	
		ostrich leather	
	not leather	Cotton	
		Silk	
Surface finishing	Normal leather		
	Patent leather		
	Printed leather		
	Emboss leather		
Color	metallic color		
	classic color		
Flexibility	soft		
	medium		
	strong		

Figure 3: The list of material attributes.

Accessories	Lock system	buckle
		knob
		lock
		zip
		zip puller
		pad lock
		magnet
		press button
		clasp
		snap
	Connecting	strap holder
		chain
		ring
		snap hook
	Decorate	stud
		rivet
		corner

Detail	Handle	Double handles	no tab
			with tab
			with buckle tab
		Top handle	no tab
			with tab
			with buckle tab
		Shoulder handle	no tab
			with tab
			with buckle tab
	crest		
	fringe		
	patchwork		
	trim part		

Figure 4: The list of accessory and detail attributes.

Stiching line	Flat machine	single line	
		double lines	
	Stiching machine	single line	
		double lines	

Binding	Saddle stiching	
	Flat binding	
	combined cement and stiching binding	
	pasted assembly	
	Assembly turned over without edging	
	English binding assembly	
	Turned edge binding with welt, cord or edging	
	Turned edge binding	
	Seam angle	
	German assembly	

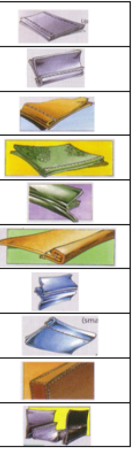

Figure 5: The list of manufacturing attributes.

Relationship between semantic adjectives and design attributes

This part aims to evaluate the relationship values between semantic adjective and design attributes. It has 4 steps as shown in Figure 6.

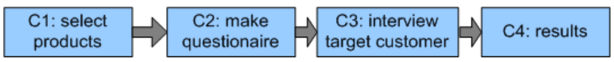

Figure 6: Methodology for evaluate the relationship values between semantic adjective and design attributes.

- Select products – The development design team selected sample products for interview target customers. The sample products classified from group of target customer. The criteria are age, career, life style and salary of this brand as shown in Table 1. This study focused on Thai women perception that are between 25-35 years old and selected 5 bags to test this method.

Age	Career	Salary	Lifestyle
Woman 18-25	Student	High	Adventure
Woman 25-35	Officer	Medium-High	Trendy
Woman 35-50	Excutive	Medium	Simple

Table 1: The example of criteria used to classify group of customers.

- Make questionnaire – The questionnaire focused on customers' perception to product visual form as shown in Table 2. It included 2 parts: semantic values and design attributes. The semantic values have 10 semantic objectives for selecting. The scale values have a 5 degree Likert scale. A Likert scale is a psychometric scale commonly used in questionnaires, and is the most widely used scale in survey research. The design attributes are composed of 4 sub-attributes: shape attributes, material attributes, detail attributes and manufacturing attributes. In each sub-attributes have attribute not over 5 attributes that expressed to identity of product. The design attributes of each bag are not same every bag that depended on identity of bag.

	1	2	3	4	5	
not chic	x					chic

Figure 7: The example of 5 Likert scale.

Semantic values						Design attributes																			
	scale values					Shape attributes					Material attributes					Detail Attributes					Manufacturing Attributes				
semantic objectives	1	2	3	4	5	Medium size	Tote	Soft structure			texture (main)	Classic color (main)	texture (trim)	Contrast color (trim)		Handle	Ring	Pockets			Stiching line	Binding	Handle Manufacturing		
feminine				x			x	x																	
elegance		x															x								
functional			x				x																		
compact		x				x																			
chic			x					x																	
simple			x													x						x			
urban			x											x											
comfortable		x				x																			
luxurious		x															x								
classic	x															x									

Brand:	....
Season:	....
Year:	....

Table 2: The example of questionnaire.

- Interview target customer – This step is worked on paper by directly interview with target customers. The number of target customer has 50 persons. The target customer selected semantic objectives that expressed from bag. After that, selected design attributes that showed relation between semantic objectives and design attributes. In each semantic adjective can selected design attributes not over 2 attributes.
- Results – The results as shown in Table 3 illustrate semantic values which presented relationship between semantic adjectives and design attributes. The values as shown in Table 3 were selected from the maximum value of each attribute. Then, Table 4 summarizes the average semantic values of each bag which were calculated from the maximum value of each bag.

Semantic values						Design attributes																Manufacturing attributes					
semantic objectives	Values					Shape attributes						Material attribute			Detail Attributes						...	Binding Mnu			Stiching Mnu		
	1	2	3	4	5	S1			S2			M1			H1			T1	P1	F1		BM1			ST1		
						S1-1	S1-2	S1-3	S2-1	S2-2	S2-3	M1-1	M1-2	M1-3	H1-1	H1-2	H1-3	T1-1	P1-1	F1-1		BM1-1	BM1-2	BM1-3	ST1-1	ST1-2	ST1-3
feminine						3.45	3.24	3.67	4.02	3.78	3.24	3.26	3.87	3.29	3.37	3.87	3.45	3.78	3.26	3.67		3.26	4.08	3.25	3.64	3.41	3.8
elegance						1.21	1.67	2.87	2.12	1.89	1.56	1.64	1.45	2.34	1.96	1.85	1.36	1.36	1.56	2.09		1.45	2.34	1.96	1.89	1.56	1.64
functional						2.45	2.23	2.31	2.56	2.12	2.65	0	0	0	0	0	0	3.45	3.03	3.01		2.13	2.78	2.56	2.53	2.09	2.08
compact						3.98	2.08	2.08	2.97	2.16	4.05	0	0	0	0	0	0	2.76	2.63	3.02		2.67	3.06	2.43	2.44	2.31	2.15
chic						3.87	3.56	1.23	1.95	1.23	2.13	2.78	2.67	1.98	2.89	0	3.04	2.78	0	3.23		2.34	2.05	2.12	1.89	1.56	1.67
simple						3.06	3.13	3.01	3.87	4.08	3.54	3.25	3.33	3.78	3.54	3.25	3.33	3.78	3.23	3.87		3.78	3.41	3.21	3.29	3.56	3.42
urban						4.01	3.28	1.87	1.56	1.76	2.67	1.78	2.35	2.56	2.56	0	2.97	3.03	0	3.45		2.56	2.41	1.87	2.67	2.07	2.06
comfortable						3.78	4.1	3.79	3.23	3.12	3.43	3.63	3.87	3.23	3.12	3.33	3.67	3.54	3.67	3.23		3.12	3.31	3.78	3.67	3.56	3.21
luxurious						1.22	1.34	1.76	1.56	1.19	1.34	2.11	1.89	1.56	1.45	1.32	1.32	1.56	2.07	1.87		2.01	1.34	2.11	1.89	2.02	2.01
classic						1.87	1.93	2.23	1.98	1.67	2.04	2.13	2.22	2.31	1.98	1.93	1.79	1.83	1.82	1.69		2.13	2.45	2.34	2.13	2.34	2.06

Table 3: The results of the relationship between semantic adjectives and design attributes.

semantic objectives	 No.1	 No.2	 No.3	 No.4	 No.5	Average semantic values
feminine	3.45	3.87	4.08	3.67	3.87	3.79
elegance	1.21	2.34	2.87	2.12	2.09	2.13
functional	2.45	1.78	2.31	3.45	3.03	2.60
compact	3.98	4.05	2.08	2.63	2.43	3.03
chic	1.96	2.89	3.87	3.56	1.23	2.70
simple	3.78	3.29	3.01	3.78	4.08	3.59
urban	1.56	2.67	4.01	3.28	1.87	2.68
comfortable	3.78	3.79	4.1	3.87	3.67	3.84
luxurious	1.22	2.11	2.07	1.56	1.19	1.63
classic	2.34	2.45	2.23	1.98	1.67	2.13

Table 4: The summary results of average semantic values of each bag.

3.2 How to use the customer-oriented matrix to design a leather bag

This step aims to find the suitable solution in bag design process. We proposed 2 principles for analysis data: similarity principle and combination principle.

Similarity Principle

This principle is used to design a new product from modifying some design attributes of existing products as shown in Figure 8. Regarding to the customer-oriented matrix, the design attributes which have maximum values will be used to guide for designing new product from existing ones. The design attributes which have minimum values will be removed to be replaced by another one. The discussion of these results will be detailed in section 4.

Figure 8: The concept of similarity principle.

Combination Principle

This principle is used to design a new product from combine the design attributes with maximum values as shown in Figure 9. Figure 10 shows an example of combination principle.

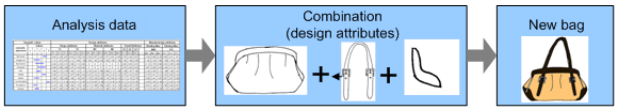

Figure 9: The concept of combination principle.

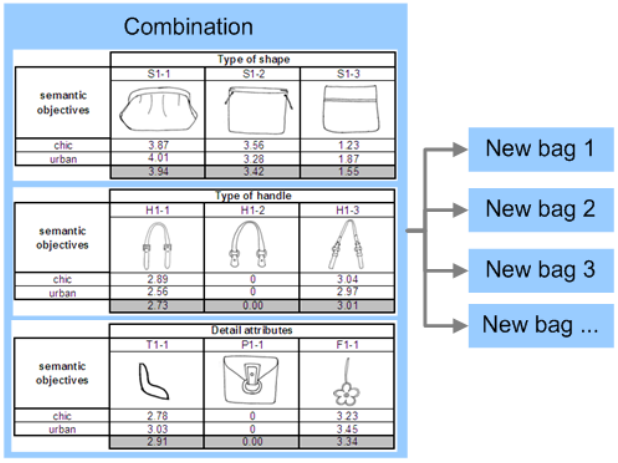

Figure 10: An example of combination principle.

4 DISCUSSION

In this section, the results in section 3 are discussed. This study focused on target customers that are between 25-35 years old. They are officers. The salary level is medium-high. Lifestyle is trendy. The results of customer-oriented matrix show the customers' perception to product visual form. The average semantic values (see Table 4) express comfortable, feminine and simple. This is not meet designer intention. As shown in Table 1, designers intend to design trendy bags. Normally, chic and urban are semantic values that related with trendy. Thus, designer needs to add chic and urban values to bag in order to meet customer's perception. In this case, the customer-oriented matrix applied with design principles (similarity principle and combination principle) will be used to guide for designing new products.

Similarity Principle

Table 4 illustrates results of average semantic values of each bag. The bag No.3 and No.4 have chic and urban value more than other bags. Then, we will use either bag to designing a new bag. The semantic values of bag No.4 show in Table 5. Frame shape and soft structure were selected to guide for designing new bag according to chic and urban value. Other attributes are removed and replaced by new attributes which can be able to add chic and urban value. The new attributes can be able to bring from other bags or create a new one. The new bag from similarity principle shows in Figure 11. We removed pockets, changed handles and changed color. Owing to pockets didn't expressed chic and urban value.

		semantic objectives	Design attributes													Highest Value
			Shape attributes			Material attributes				Detail Attributes			Mfg Attributes			
			Medium size	Tote	Soft structure	Texture (main)	Classic color (main)	Texture (trim)	Contrast color (trim)	Handle	Ring	Pockets	Stitching line	Binding	Handle Manufacturing	
		feminine		3.67			3.26			2.54					3.25	3.67
		elegance								2.07	2.12					2.12
		functional	3.16	2.31						2.11		3.45				3.45
		compact	2.63													2.63
		chic		3.56	3.87											3.56
		simple								3.78	3.01				2.76	3.78
		urban		3.28	3.07											3.28
Brand:	...	comfortable	3.87							2.45						3.87
Season:	...	luxurious				1.45					1.56		1.23			1.56
Year:	...	classic		1.78			1.98									1.98

Table 5: The semantic values of bag No.3.

Figure 11: The new bag from similarity principle.

Combination Principle

From Table 3, the design attributes with maximum value were selected to design a new bag. The example focused on design attributes that express chic and urban value. From Figure 10, the new bag from combination principle shows in Figure 12 and 13. The new bag as shown in Figure 12 combined (S1-2), (H1-3), (T1-1) and (F1-1). The new bag as shown in Figure 13 combined (S1-1), (H1-1) and (T1-1).

Figure 12: The new bag from combination principle.

Figure 13: The new bag from combination principle.

5 CONCLUSION

This study proposed a new design method to help designers design new bags meeting customers' perception. The method is structured by a matrix that maps semantic values of customers' perception to product visual form and design attributes of products to be manufactured. The customer-oriented matrix leans on QFD concept to evaluate the relationship between semantic adjectives and design attributes. Results from customer-oriented matrix have been applied with design principles to guide for designing new products. This approach will lead further study in order to integrate with decision supporting system to assist designers determine the values in design process.

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