Application of Kansei Engineering Techniques for the Design and Development of Wallet from Donax Canniformis

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Abstract: This research aims to design and develop a wallet product from Donax canniformis basketry by applying Kansei engineering techniques. This research began with a survey to select words that express customers' feelings or Kansei towards the product. The next step was to explore customers' emotions, feelings and needs regarding the product characteristics and representative images to inform the design process. The data was collected using a Likert scale questionnaire. The main components of the third questionnaire included sections for expressing the extent of feelings, the scope of product features, and representative product images. The data obtained from the survey was then analyzed using quantitative analysis methods. The research findings indicated that the words expressing the desired feelings for designing a wallet product from Donax canniformis included "compact," "outstanding," "convenient to use," "modern," and "eye-catching." Additionally, the requirements and features for designing a wallet from Donax canniformis included product size, texture, closure material, stitching material for the edges, and overall shape, aligning closely with customers' emotions, feelings, and needs.

1. Introduction

Folk art is an art form closely related to human life that has been passed down and developed over time, reflecting the lifestyles of various communities throughout history [1]. Satun Province is recognized as an agricultural and fishing society known for its crop and horticultural cultivation. Additionally, it serves as a repository of local wisdom and is a hub for handicraft production aimed at achieving self-sufficiency. Klum products exemplify this local wisdom, as the province has abundant Klum trees, encouraging the community to create marketable products [2]. However, these products have not fully satisfied customer demand; their traditional designs often complicate consumer purchasing decisions. Although the production group is skilled in craftsmanship, they face limitations in product design that do not align with contemporary customer preferences. Klum products are handmade handicrafts, creating additional design challenges [3]. The Kansei Engineering technique is increasingly used in the product design industry to establish a connection

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between the characteristics of various product categories and consumer sentiments. Its applications span multiple areas, including food product design—evident in the development of parboiled rice products [4]—packaging design, such as ketchup bottles [5] and perfume powder packaging [6]; children's product design—including cloth bags [7] and toys [8]—as well as souvenir design, like ceramics [9], and rattan lamps [10]. The literature demonstrates that Kansei Engineering is a feasible approach for developing diverse product designs. This methodology can also be applied to the design of unique products such as Klum-woven wallets, integrating natural materials to enhance alignment with market demands. Consequently, this investigation uses the Kansei Engineering method to focus on the design and development of Klum-woven purses. This study represents a significant advancement in the field of Klum-woven wallet design by establishing a connection between consumer emotions and the attributes of unique, handcrafted products made from natural materials. It also illustrates meeting market demands while prioritizing sustainability and preserving local knowledge. The aim is to create Klum-woven products that are functional and appealing to today's consumers.

Therefore, this research aims to study and explore customers' needs, emotions, and feelings towards these products, which will inform the design and development of woven wallets made from Klum. Applying Kansei Engineering techniques to product design holds great potential, as these handmade items face limited market competition. Moreover, there is a growing trend of consumer preference for woven products that help preserve local wisdom and traditional crafts.

2. Materials and Methods

The Kansei Engineering technique is a product design method that aims to connect consumers' emotions with product characteristics. This approach holds significant potential for enhancing development and competition in markets with limited competition, particularly for handmade products such as woven fabrics and traditional handicrafts. The method utilizes the principles of Kansei Engineering to define the intended scope and associated emotions. This process involves collecting product images and developing a Likert-type questionnaire to gather consumer feedback. Quantification Theory Type 1 (QT1) is a widely recognized field method employed for data analysis. For instance, Wu and Chen [11] applied QT1 to examine the factors influencing people's opinions on food photos. Xue et al. [12] utilized it to explore a qualitative decision model for product image design, identifying the most critical design elements. The results obtained from these analyses will aid in creating prototypes of products that meet consumers' emotional needs and assess their satisfaction levels. This aligns with the current trend of enhancing the market value of sustainable products while preserving local knowledge. Consequently, the following sections will detail the subsequent phases of Kansei Engineering.

2.1 Defining the Scope

The product studied is the Klum-woven wallet, as its design lacks variety and does not fully reach the target consumers. The producers aim to develop the product to meet customer needs better. The target group includes working-age consumers in Satun and Songkhla provinces and general users, both women and men.

2.2 Defining the Emotional Scope

The process of selecting emotional descriptors or Kansei words linked to product attributes involves three steps:

1) Collection of Emotional Descriptors Gather emotional descriptors or Kansei words related to Klum-woven wallets, totaling 47 words from various sources such as the internet and books.

2) Selection of Emotional Descriptors Review the collected descriptors to select those significant or impactful for design perspectives. This selection is based on an IOC value greater than 0.5, ensuring accuracy and acceptance.

3) Interpretation Filter the selected emotional descriptors with an IOC value greater than 0.5 through consultations with product design experts to choose the descriptors that best convey the product's essence.

2.3 Defining Product Attributes

The process of determining product attributes to define the scope of the product involves three steps:

1) Collection of Product Attributes Identifies important product attributes that affect consumer perception and emotions. Collect these attributes from sources such as the internet and relevant research.

2) Selection of Product Attributes: Use the collected attributes to create a second questionnaire, employing a Likert-type scale for scoring. Select attributes based on the arithmetic mean to determine their relevance.

3) Determination of Product Attributes Review the results from the previous step with product design experts to select the most important attributes for the Klum-woven wallet.

2.4 Collecting Product Images

Collect representative images of various Klum woven wallets with different product attributes. These images come from the Internet and Klum web groups. Using an affinity diagram, representative images are grouped according to the defined product attributes, which are then used in the third questionnaire.

2.5 Creating a Questionnaire for Product Evaluation

Develop the third questionnaire with three components: Kansei words reflecting emotional scope, product attributes, and representative images. Collect data from 246 target consumers.

2.6 Analysis

Evaluate the third questionnaire using statistical principles and summarize the results, which are analyzed using Quantification Theory Type 1 (QT1) or multiple linear regression. The process involved converting qualitative attributes into dummy variables and constructing a multiple regression model, as shown in Equation 1. This means that once the multiple regression model is found, the multiple linear regression will be used to get the R-squared (MCC^2), the prediction contribution coefficient (PCC), and the category score (CS).

$$Y = \beta_0 + \sum_{i=1}^{k} \sum_{j=1}^{n_i} \beta_{ij} x_{ij}$$

(1)

Where Y is the response variable (the Kansei word), β_0 is the intercept, k is the number of product attribute groups, n_i is the number of categories in the i-th attribute group, and β_{ij} represents the coefficients for the dummy variables x_{ij}, x_{ij} are dummy variables (1 if the category applies, 0 otherwise). Consequently, the following criteria for decision-making should be used after obtaining the MCC^2, PCC, and CS values.

1) Data Collection and Trend Analysis: Collect scores from the third questionnaire for each Kansei word associated with the representative product images. Calculate the average scores to understand how each emotional descriptor relates to the product images.

2) Multiple Regression Analysis: Analyze the collected data using multiple linear regression to determine the R-squared (MCC^2) value, which typically ranges from 0.00 to 1.00. For this research, a MCC^2 value greater than 0.7 is considered acceptable [13].

3) Partial Correlation Coefficient (PCC) Analysis: Analyze the correlation between the Kansei words and the primary product attributes to identify those with significant relationships. A significance level of 0.7 will be applied for this analysis.

4) Category Score (CS) is the coefficient β_{ij} that is calculated by approximating the least squares method in Equation 1. Each β_{ij} represents the impact of each category of dummy variables on the response value Y. Analysis Determine the relationship between Kansei words and sub-attributes of the product to identify those with strong correlations, using a significance level of 0.7. This provides a basis for designing products that align with customer emotions and needs.

2.7 Product Design

Provide the design team with the summarized data from the previous steps to guide the design and development of the Klum-woven wallet.

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2.8 Satisfaction Evaluation

Create the fourth questionnaire to evaluate customer satisfaction with the newly developed Klum wallet. Determine the sample size (246 people) and rate the satisfaction level for each emotional descriptor.

3. Results and Discussion

Results of Applying Kansei Engineering Techniques for Designing and Developing Klum-Woven Wallets.

3.1 Results of Defining Emotional Descriptors

From the data collected through the third questionnaire, 47 emotional descriptors were identified for the Klum-woven wallet. Analysis of the responses from Questionnaire 1 indicated that most respondents were female (72.4%) and aged 22-28 years (36.9%).

Although there were 47 Kansei words with Item Objective Congruence (IOC) values greater than 0.5, many descriptors complicated the effective communication of the product's attributes. Three design experts reviewed and selected the most suitable descriptors to address this. Consequently, the final selection consisted of 10 Kansei words, as presented in Table 1.

Table 1. Results of Defining Emotional Descriptors: 10 Words.

Results of Defining the Scope of Emotional Expressions			
Emotional Expressions That Passed the Criteria:	**IOC>0.5**	**Emotional Expressions That Passed the Criteria:**	**IOC>0.5**
Modern	0.84	Convenient	0.90
Novel	0.87	Distinctive	0.89
Valuable	0.90	Refined	0.89
Compact	0.91	Durable	0.95
Natural Color	0.93	Eye-catching	0.91

3.2 Results of Defining Product Attributes

Based on the collection of product attributes and data gathered from Questionnaire 2, attributes were selected according to their average scores. The selection criterion required choosing attributes with scores exceeding the average of 4.43. Following consultations with three design experts, it was concluded that these attributes were sufficient for inclusion in the third questionnaire. The final selection comprised six main product attributes and 13 sub-attributes for the Klum-woven wallet.

Table 2. Results of Product Attributes with Scores Above Average.

Number	Main Product Attributes	Sub-attributes of the Product	Mean
1	Product Shape	**Shape**: Square, Curved	4.71
2	Product Size	**Size**: Small, Medium, Large	4.52
3	Edge Material	**Material**: Genuine Leather, Fabric	4.44
4	Closure Material	**Closure**: Zipper, Twist Lock	4.49
5	Texture	**Surface Texture**: Glossy, Matte	4.38
6	Weave Pattern	**Weaving Pattern**: Lay-Song, Khad	4.49

3.3 Results of Defining Representative Product Images

The collection of representative images revealed that the Klum-woven wallet exhibits a variety of attributes, resulting in a total of 24 identified images. An affinity diagram was utilized to categorize these images based on their represented attributes. The images that best exemplify the selected sub-attributes of the product are displayed in Figure 1.

Product Shape	
Square	Curved
Image 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 24	Image 1, 2, 3

Product Size		
Small	Medium	Large
Image 1, 4, 6, 7, 9, 11, 19, 20, 22, 23, 24	Image 2, 3, 10, 11, 15, 18, 21	Image 5, 8, 12, 13, 14, 16, 17

Color Tone	
Natural Color	Dark Color
Image 1, 2, 6, 7, 8, 10, 11, 14, 19, 22	Image 3, 4, 5, 9, 12, 13, 15, 16, 17, 18, 20, 21, 23, 24

Closure Material	
Zipper	Twist Lock
Image 1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24	Image 10, 11, 14

Edge Material	
Fabric	Genuine Leather
Image 3, 4, 5, 6, 9, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23	Image 2, 7, 10, 11, 12

Material for Strap	
Genuine Leather	Woven Rope
Image 8, 9, 13, 19, 22	Image 15, 16

Texture	
Glossy	Matte
Images 3, 4, 5, 6, 8, 10, 11, 12, 13, 18, 24	Image 1, 2, 7, 9, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24

Weave Pattern	
Lay-Song	Khad
Image 1, 2, 4, 6, 8, 10, 11, 12, 13, 14, 19, 21, 22	Image 3, 5, 7, 9, 15, 16, 17, 18, 20, 23, 24

Figure 1. Results of Grouping by Wallet Product Attributes.

Based on the grouping and comparison of representative product images, it can be concluded that a total of 5 images best represent the sub-attributes of the product, as illustrated in Figure 2. Each image corresponds to specific sub-attributes as follows:

Image 1: Represents the sub-attribute of a small product size.

Image 2: Represents the sub-attributes of small size and genuine leather edge material.

Image 3: Represents the sub-attribute of a rectangular product shape.

Image 4: Represents the sub-attribute of a zip closure.

Image 5: Does not cover any sub-attributes, as the PCC value does not align with the CS value

3.4 Results of Quantification Theory Type 1 Analysis

Data from Questionnaire 3 were analyzed using Quantification Theory Type 1, specifically through multiple linear regression analysis. The Multiple Correlation Coefficient (MCC^2) was calculated for 10 emotional descriptors to 5 representative product images. It was determined that the average scores for the emotional descriptors that exceeded MCC^2 values of 0.7 included 5 descriptors, which satisfied the criteria for further analysis using Minitab 16 software. Furthermore, the Principal Component Coefficient (PCC) and Category Score (CS) were calculated to identify attributes with positive analysis values at a significance level of 0.05 (P-Value < 0.05). All conditions for the product attributes were met, as they consistently influenced emotions in the same direction, leading to clearer conclusions. The results of the analysis are summarized in Table 3.
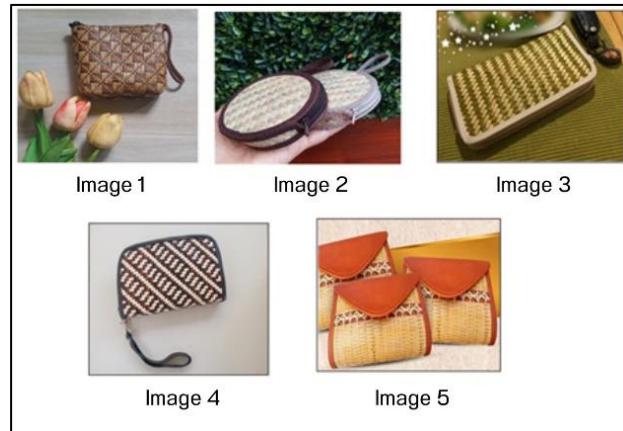
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Figure 2. Representative Product Images with Attributes Covering Sub-Attributes.

Table 3. Results of the Analysis of Emotional Expressions

Pic.	PCC	P-Value	Feelings	Main-attributes	Sub-Attributes	CS	P-Value	MCC²
2	0.857	0.000	Compact	Size	Small Size	0.273	0.000	0.78
1	0.170	0.000	Distinctive	Surface Texture	Matte Surface	0.382	0.200	0.70
4	0.266	0.000	Ease of use	Closure Material	Zipper	0.101	0.031	0.77
2	0.151	0.000	Modern	Edge Material	Genuine Leather	0.642	0.000	0.72
3	0.985	0.000	Eye-Catching	Shape	Rectangular Shape	0.503	0.000	0.75

Table 3 presents the analysis results regarding selecting attributes for the Klum-woven wallet. This summary provides design specifications to guide the design team in creating a product that meets consumer needs. The design specifications are as follows:

1) Product Size: The design should be compact, as this attribute conveys a sense of neatness. For reference regarding the size attribute, see Representative Product Image 2.

2) Surface Texture: The design should feature a matte texture to impart a sense of distinctiveness. For guidance on the surface texture, refer to Representative Product Image 1.

3) Closure Material: The design should incorporate a zipper closure to ensure ease of use. For suggestions on the closure material, see Representative Product Image 4.

4) Edge Stitching Material: The design should utilize genuine leather for edge stitching to convey a modern feel. For insight on the edge stitching material, refer to Representative Product Image 2.

5) Product Shape: The design should feature a square shape to be eye-catching. For guidance on the product shape, see Representative Product Image 3.

3.5 Results of New Product Design

Based on the analysis above, the results from Questionnaire 3 were presented to the design team to guide the creation of a prototype for the woven palm wallet. The design team incorporated emotional descriptors such as compact, distinctive, convenient, and modern into the product design. The prototype of the woven palm wallet, developed according to these specifications, is illustrated in Figure 3.

The wallet made from khlum

designed to be compact, featuring Lay-Song weave pattern and combined with tanned leather. This design enhances the wallet's distinctiveness, beauty, and modernity, making it easy to hold, compact, and convenient to use.

Size 8 x 9 x 2.5 cm

Figure 3. A wallet crafted from Khlum (Donax Canniformis).

From Figure 3, the design specifications for the woven palm wallet are as follows:

        1) Product Size: The wallet is designed to be small, providing a compact feeling during use.

        2) Texture: It features a matte finish that reflects the natural texture of the palm stem, enhancing the product's uniqueness.

        3) Closure Material: The design includes a zip closure for easy opening and closing, adding convenience.

        4) Edge Material: Genuine leather is used for the edges, combined with woven patterns, which adds a modern touch to the product.

        5) Shape: The wallet is designed in a rectangular shape that can be easily folded, opened, and closed, creating an eye-catching appearance.

3.6 Results of Satisfaction Assessment

        After designing the woven palm wallet, the researcher surveyed it to determine consumer satisfaction with the product. The survey results showed that the consumer group, which consisted of both male and female respondents, primarily aged 26-30 years, rated their satisfaction as follows:

        Compactness: Rated the highest, with an average score of 4.72, indicating the highest level of satisfaction.

        Novelty/Distinctiveness: Rated second with an average score of 4.54, reflecting a high level of satisfaction.

        Modernity: Rated closely behind with an average score of 4.52, also indicating high satisfaction.

        Eye-Catching: Rated with an average score of 4.47, confirming high satisfaction.

        Ease of Use: Rated at an average score of 4.46, indicating high satisfaction.

4. Discussion

        The research findings indicate that the newly designed wallet effectively addresses customers' emotional and sensory needs, resulting in high satisfaction. These results align with the study by Surasit et al. [14], which utilized Kansei Engineering in conjunction with the Kano model to design and develop woven sedge lamps, successfully meeting customers' emotional and sensory needs and achieving high satisfaction levels. Similarly, Sirichai [15] applied Kansei Engineering principles in designing and developing dining chairs, discovering that different product sub-attributes elicit varying feelings, facilitating the creation of new product designs that resonate with consumer preferences. Additionally, Surasit et al. [16] demonstrated the

effectiveness of Kansei Engineering in designing and developing TV stands made from palm tree trunks, highlighting how this approach assists designers in defining product attributes that align with consumer needs.

5. Conclusions

This research applied Kansei Engineering techniques to design and develop woven wallets made from Klum, capturing consumers' emotional perceptions and feelings. The study began with creating an initial questionnaire to select emotional descriptors related to the products, resulting in 47 validated words with a corresponding Item Objective Congruence (IOC) score. Experts subsequently reviewed these descriptors, leading to the selection of 6 main attributes and 13 sub-attributes. Next, representative product images were identified using a relationship diagram, revealing 5 images most closely aligned with the selected sub-attributes. Following this, a third questionnaire was developed, and quantitative analysis using Quantification Theory Type 1 (QT1) was performed to find correlations between emotional descriptors and product attributes. The results were further analyzed using multiple linear regression to determine the Multiple Correlation Coefficient (MCC^2), Principal Component Coefficient (PCC), and Category Score (CS) values. The design outcomes demonstrated that the design team effectively incorporated emotional descriptors into the wallet's design, highlighting attributes such as compactness, uniqueness, convenience, modernity, and eye-catching aesthetics. The wallet is designed to be small, with a square shape that can be easily folded open and closed. The surface retains the unique natural matte texture of Klum tree fibers. A zipper mechanism was included for ease of use. At the same time, the edge stitching features a combination of vegetable-tanned leather and woven patterns, enhancing the wallet's elegance, uniqueness, and modern appeal. The research found that the designed Klum-woven wallet effectively meets customers' emotional and sensory needs. The findings can serve as a guideline for the Klum producers' group in the case study, informing the development of future products that align with customer preferences.

6. Acknowledgments

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