Upgrading local food products for community businesses in Thailand

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Abstract - The purpose of this research was to use Quality Function Deployment for outer package design in community businesses. The research was conducted by employing the mixed methods. The qualitative research method was used for in-depth interview with seven experts. The quantitative research was carried out by using the questionnaires to find the needs of customers. The sample size was 385 people. The sample requirements were then converted into the technical specification to create a House of Quality, along with the interpretation of results and design of the outer package of chili paste products.

The results obtained from the qualitative study can be categorized into 3 groups: 1 design 2 material properties and 3 appearances of the package. The results of the quantitative research revealed the requirements of specific properties for outer package design. The material used for its manufacture was the double wall corrugated cardboard which was suitable for outer package.

Keywords — Quality Function Deployment, Outer Package, Chili Paste

I. INTRODUCTION

Valaya Alongkorn Rajabhat University under the Royal Patronage, Pathum Thani campus was assigned to enhance the efficiency of community in the area of Pathum Thani and Sa Kaeo provinces in Thailand. Therefore, the research team had provided various academic services for those community. The research team focused on educating about increasing income of communities in Pathum Thani province in order to generate income and have the sustainability of the community. The research team collaborated with the Industrial Technology Program, Faculty of Industrial Technology to survey the area within Pathum Thani province. Consequently, the research team found that farmer housewife group of Khlong Song Ruamjai, Pathum Thani province had the high potentiality and readiness to improve their efficiency. Currently, this farmer housewife group had a total of 23 group members (Khlong Luang District Agricultural Office, 2020) whose main occupations were farmer and self-employed. Furthermore, they also grew various types of mushrooms such as Bhutanese mushrooms, fairy mushrooms for selling to the markets. In addition, they also had an additional career in generating income for members by producing the products such as the tamarind chili paste, grilled fish chili paste, lotus seed chili paste, bamboo shoots, steamed bamboo shoots with curry paste, and orange juice [1]. [2]. The survey also found that the farmer housewife group has the famous products including chili paste, grilled fish chili paste, mushroom chili paste, lotus seed chili, tamarind paste and various types of chili paste. Each type of chili paste was recognized and awarded OTOP from Pathum Thani province and many other organizations. Their products were available for selling in both wholesale and retail trade. For retail trade of chili paste products, farmer housewife group had designed the package by using the glass and plastic bottles.

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From Figure 1, it was found that when they sold the product, if one to five bottles of chili paste, they would put Figure 1 shows that the award received and the current package of chili paste the chili paste bottles in a plastic bag for the buyer. If a set of six bottles, then they would use a cardboard box as the outer package as shown in Figure 1. From the interview with the members of farmer housewife group and buyers, the research team found that most buyers preferred to buy one to four bottles of chili paste at a time, so there was no external package for buyers. Addition, when bringing the products of the farmer housewife group to be sold with the same products in department stores or convenience stores, they faced the problems that many buyers would not be able to find the products of the farmer housewife group because of similar labels and brands and with the OTOP logo, which was a common logo. These could make the difficult for buyers to find the farmer housewife group products. From the obtained information, the research team also found that if the buyers bought a pack of six chili paste bottles, they could easily find them because the outer package was distinctive and different from the other brands. Therefore, the research team discovered the problem of packaging differentiation, and we had consulted the farmer housewife group with their findings. As a result, farmer housewife group would like to develop outer package to differentiate their products, and the products of the farmer housewife group can be recognized by buyers.

Therefore, the research team has been interested in and applied Quality Function Deployment (QFD) theory to help design outer package for the product of the farmer housewife group in order to differentiate their product and easily recognize the farmer housewife group's products.

II. RESEARCH OBJECTIVES

The purpose of this study was to improve the outer package of chili paste which produced by the farmer housewife group of Khlong Song Ruamjai, Pathum Thani province using QFD technique.

III. LITERATURE REVIEW

Analysis of customer needs

House of Quality (HOQ) [3],[16],[17],[18] is defined as a tabular tool that shows the relationship between customer feedback in the sense of what features are needed in a product or service (Voice of Customer) to know the “What” of customer desires and then focus on what each customer needs. There are several methods for collecting customer feedback such as fill out the questionnaires, one-on-one interviews, focus group interviews, etc. These methods are used to
assess the customer needs. After that, Voice of Customer requirements are translated into technical requirements or Substitute Quality Characteristics (SQCs). In House of quality [4] [19] [20] [21], as Figure 2 shows the components of House of Quality, the research team needs to analyze and synthesize each component as follows.

![House of Quality Diagram]

**Figure 2 shows the composition of the House of Quality [5].**

A) Left wall (Customer Requirement) refers to what the user can expect from the product.

B) Right wall (Prioritize Customer Requirement) means to prioritize what the user would like to (planning matrix) separated into categories such as user testing, rating and unique selling points, etc.

C) Ceiling (Technical Descriptors), or second class, are technical descriptor or voice of the organization that correspond to the product in terms of specification, condition, design and other engineering parameters.

D) Inside the room or the house, it shows the relationship between the customer's needs and the technical details or it can be said that it translates to the customer's needs into engineering specifications.

E) Roof (interrelationship between technical descriptors) is used to express the internal relationship between technical details by presenting the technical similarities and differences of the given details.

F) Floor room (Prioritized technical descriptors) or folk is a technical detail that is prioritized such as comparison with competitors, the rate of difficulty and the value of the aim.

**IV. RESEARCH METHODS**

The process was in accordance with the research framework as in Figure 3 represented the research framework.
The research process was as follows.

1. Determination of details for study design [6], [23], [24] was a research methodology with the following steps.

   Step 1 was to find customer requirement. This process was a qualitative research by collecting data using in-depth interviews. Selection of group representatives from farmer housewife members group consisted of chairman, secretary and member, representatives of customers who consumed chili paste and distributors. Contributors must be able to provide all the insights the research team needs. The purposive sampling method was used to obtain the number of informants as follows: three representatives of the farmer housewife group, two customer representatives and two distributors, totaling seven persons. These people identified the need for the outer package of the chili paste. After that all the requirements were gathered and then grouped and reorganized.

2. The R.C. Turner & L. Carlson concept [7] was used as a guide in the second step of the voice survey of consumer needs. There was a mixed method research process where customer demand or voice of the customer is arranged through a qualitative research tool, affinity diagram. Information is summarized into categories by selecting specific needs related to style, design, strengths and weaknesses for further application. In the quantitative research, data was collected using questionnaire tools to conveniently determine the significance score and the application of QFD technique and the study guidelines of Amonrat and Attakorn [8] were used as a guideline for constructing questionnaires. For this quantitative research, data from small shop furniture buyers in Bangkok and its vicinity was studied. It was a survey of opinions towards the form of outer packaging design. The survey was selected from an unknown population. Therefore, the research team selected a population based on people who had bought pastes by distributing questionnaires online and through farmer housewife group stores and dealers. The population cohorts were determined according to Yamane's calculation table at a 95% confidence level, using the table values or use the formula to calculate as Equation 1.
n = \frac{N}{1 + Ne^2} \quad (1)

Let n is the minimum acceptable sample size.

N is the number of populations

e is an acceptable error.

The random sample had an acceptable error of 5%. The sample size was not less than 385 people. The research team collected the data of 400 people to obtain the complete information and prevent any errors in the data collection. Selection of sample groups for data collection using accidental selection was as follows:

1) The sample group, both male and female, aged 18 years and over because they had maturity in making decisions on purchasing products.

2) People who had purchased farmer housewife group chili paste products and cooperated in answering a questionnaire.

Data analysis used questionnaire requirements to create questionnaires in the survey to determine the level of significance and each requirement. In the questionnaire, the scores were divided into 5 levels of importance and need and defined the meaning as follows.

5 - Most important
4 - Very important
3 - Medium important
2 - Less important
1 - Not important

Since the data obtained from the questionnaire were selected based on the score scale, the most reliable way to calculate the mean was the geometric mean. The method of interpreting questionnaire results was based on the average according to the scoring criteria as follows:

Highest score - lowest score = \frac{(5-1)}{5} = 0.8

4.21 - 5.00 Satisfaction and needs are at the highest level.
3.41 - 4.20 Satisfaction and needs are at a high level.
2.61 - 3.40 Satisfaction and needs are at a moderate level.
1.81 - 2.60 Satisfaction and needs are at a low level.
1.00 - 1.80 Satisfaction and needs are at the least.

Then the sample needs converted into technical requirement to build a House of Quality (HOQ) and used it for packaging design to best meet customer needs. Data could be compared with competitors to create a product's selling point by using House of Quality as an analysis tool,
as shown in Figure 3. In the construction of a correlation matrix, it was the process of defining the relationship between what the clientele needs and the representative of the quality characteristics by scoring the relationship of the requirements. Identifying numbers instead of relationships could be done using QFD. This time, the research team had determined the relationship values as follows:

Let @ = High correlation (5)
O = moderate correlation (3)
X = low correlation (1)

The correlation was done by taking the results obtained from the analysis of each metric and the results based on the needs used in response to the import demand and the level of importance for each of the needs used in the response. This showed how much each need could be met depending on the level of importance being metric [5]. The results were then used to design the outer packaging of the chili paste products of the farmer housewife group of Khlong Song Ruamjai, Pathum Thani Province. At this stage, qualitative research was conducted using focus group discussion. Participants analyzed in this process consisted of two experienced sales people who were distributors of various types of chili paste with at least five years of sales experience, two representatives of packaging designers for one person, product user representative and three representatives of the farmer housewife group of Khlong Song Ruamjai to summarize the patterns and issues and make final adjustments before forming the prototype packaging and taking it to the next step [9].

V. Research Results

The results of the voice of customer survey after arranging customer needs and grouping those needs into categories based on brainstorming techniques from relevant parties could be categorized into three groups:
1 Design
2 Material properties
3 Appearance of the package

The details of the needs as in Figure 5 showed the details of the needs of each group. The details of customer needs of each group consisted of Group 1, "design" with 5 requirements: 1 The packaging pattern is beautiful 2 It is a packaging that can clearly see the product inside. 3 The packaging must show the value of ingredients and nutrients. 4 The packaging must clearly show the date of manufacture and expiration date. 5 The packaging must have a style that communicates
with consumers, looks attractive and suitable as a souvenir. Group 2 "material properties" were demanding, including: 1. The packaging is lightweight. 2 The packaging is easy to carry around. 3 Packaging is easy to transport in large quantities. Group 3, "appearance of the package", were demanding: 1. The packaging is tensile and does not easily break when hit with sharp objects. 2 The package can maintain its shape when it is in motion. 3. The package is sealed to prevent insects or animals from penetrating.

![Figure 5](image.png)

**Figure 5 shows a detailed table about the in-depth requirements of the informant.**

After that, all three groups of needs were put into questionnaires to determine the importance of each requirement. The results of the aggregated user group were correlated in the next step, with constraints on the design, workflows and prioritization of each requirement. Figure 6 shows the relationship between user needs and quality elements.

Figure 6 shows the relationship between the user's needs and the qualitative components. Figure 6 shows a table of relationships between user requirements and quality elements. It was found that there were four important factors used in the design:

1. Material flexibility
2. Patterns and text can be printed on the material.
3. Pattern and text design
4. Packaging dimensions
Based on the four factors that influenced the design, the research team took the key factors into consideration with the designers and farmer housewife group to draw up a draft of the outer packaging and select the materials used for the production. In this design, the farmer housewife group had a design requirement: the material used for the outer packaging requires a double-walled corrugate cardboard, E-flute, 1.0-1.8 mm.

![Corrugated Carton Box](image)

**Figure 7 shows the characteristics of the corrugation [10].**

The KI type of light brown kraft paper was defined as the farmer housewife group type of corrugated cardboard, which was already used in the manufacture of the 6-bottle outer package and there were a lot of raw materials used in production. Most importantly, for the uniqueness of the same material, the existing corrugated cardboard was used. The farmer housewife group requirements for using corrugated raw materials were consistent with the key factors of the four studies. This was because, from the corrugated cardboard property testing of the Industrial Standards Institute [11], it could be concluded that corrugated cardboard had a material elasticity that can withstand a pressure of at least 130N and did not result in damage to the internal packaging. Moreover, the properties of corrugated cardboard could also print patterns and texts beautifully and clearly. The distinctive properties of corrugated cardboard were thus helping to correct a key factor in the design of outer package of chili pastes. In the design process of the research team, brainstorming principles were used to develop outer package by incorporating essential factors into design requirements: pattern and text design. This corresponded to the properties of corrugated paper that patterns and text could be printed on the corrugated board without affecting the packaging properties. The results of the test of the corrugation pressure resistance was averaged at 891kg / 33.2cm² (Flat Crush). Process index value Short-term capability (Cpk) was 0.63. According to Alongkot's qualification tests [12] for corrugated cardboard specifications and properties, research team and designers were able to develop two types of outer package as shown in Figure 8 and Figure 9.
Figure 8 shows a packaging prototype in pattern 1.

Figure 9 shows a packaging prototype in pattern 2.

The farmer housewife group used the main trademark as a strand feature. Figure 10 shows the farmer housewife group's trademark.

Figure 10 shows an example of a brand or trademark

In addition, the research team had designed a sample of the exterior design to be a prototype for the development

Figure 11 shows an example of the outer package pattern of chili paste product.

From the design of the outer package of the chili paste, the research team and designers had selected the colors and dimensions of the package and used to make them as a model for the farmer housewife group to consider. The farmer housewife group did not allow publishing of color, dimension and prototype designs due to under development. The research team was therefore
unable to present the colors, dimensions and prototypes of package. The research team analyzed the two packaging styles by defining the evaluation criteria for the weight and significance of the packaging designs as shown in Table 1.

Table 1 shows the weighting and significance values of the requirements.

<table>
<thead>
<tr>
<th>Requirements of selection of packaging forms</th>
<th>Significance weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost price of packaging when manufacturing</td>
<td>20</td>
</tr>
<tr>
<td>The packaging can keep the condition of the product inside safe.</td>
<td>30</td>
</tr>
<tr>
<td>The package can maintain its shape when it is transported or moved.</td>
<td>30</td>
</tr>
<tr>
<td>Packaging is easy to transport in bulk.</td>
<td>20</td>
</tr>
</tbody>
</table>

Based on the farmer housewife group representative scoring criteria, research team and designers concluded that the choice of packaging as pattern 1 because this pattern was of the highest importance. Figure 11 illustrated a scoring table on the two patterns of packaging concept.

Figure 11 shows the concept scoring table.

<table>
<thead>
<tr>
<th>Selection</th>
<th>Weight</th>
<th>Type 1</th>
<th>Type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Cost price of packaging when manufacturing</td>
<td>20%</td>
<td>5</td>
<td>1.0</td>
</tr>
<tr>
<td>2 The packaging can keep the product inside safe</td>
<td>30%</td>
<td>4</td>
<td>1.2</td>
</tr>
<tr>
<td>3 Packaging can maintain its shape when it is transported or moved.</td>
<td>30%</td>
<td>5</td>
<td>1.5</td>
</tr>
<tr>
<td>4 packaging is easy to transport in bulk</td>
<td>20%</td>
<td>5</td>
<td>1.0</td>
</tr>
<tr>
<td>Total Score Rank</td>
<td>100%</td>
<td>19</td>
<td>4.7</td>
</tr>
</tbody>
</table>

A joint analysis of the research team, designers and farmer housewife group found that the pattern 1 was suitable as an outer package of chili paste.

CONCLUSION AND DISCUSSIONS

From the new product development phase using the QFD process, the final product was analyzed by a group of product design specialists, research team and representatives of farmer housewife group to figure out the selling points and points that should fix the package before they are brought to market. According to a joint analysis, it concluded that the developed packaging had a strong potential to increase sales of farmer housewife group’s chili paste products in terms
of differentiation in packaging which makes it easy for consumers to separate products. In addition to the expert analyzes, the research team found that their research was consistent with [13], [14], [15], [25], [26] with a similar survey process but Charcrit [5] did not survey competitors. This was so because it was the production of potted plants for the community, so there was no need for competitor components. However, the results were consistent, that is, it made users more satisfied with the newly developed product.

Therefore, the result of designing new package was more distinctive than other products, meets customer needs and could create a unique identity of housewife group chili paste as a selling point for chili paste. In addition, the application of QFD technique to farmer housewife group had resulted in improved and improved packaging design processes and reduced product design time. It could also help to build a prototype of the packaging design process for other new product designs.

The suggestion of this research was found that the data collection was only collected from consumers in the Pathum Thani area, therefore lacking diversity and still unable to lead to the desired results at the national level. If further development was carried out, data from all over the country and abroad must be collected in order to produce results that were international and acceptable to both domestic and international.

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