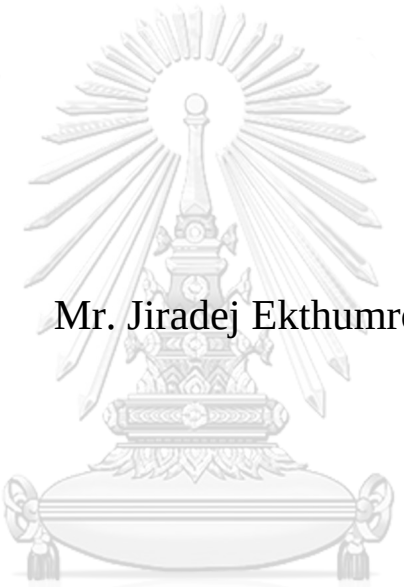
Product Development of Rice Milk Soap

Mr. Jiradej Ekthumrong



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นายจิรเดช เอกธำรง

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
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งานวิจัยนี้มีวัตถุประสงค์ในการพัฒนาข้าวให้กลายเป็นสบู่นมข้าวโดยใช้ Quality Function Deployment (QFD) เพื่อเพิ่มมูลค่าให้สินค้า กระบวนการผลิตข้าวในปัจจุบันจะผลิตข้าวที่แตกหักออกมาด้วยซึ่งเป็นข้าวที่มีมูลค่าต่ำ เพื่อเพิ่มมูลค่าจึงได้มีการศึกษาเพื่อพัฒนาข้าวที่แตกหักให้กลายเป็นสบู่นมข้าว การศึกษานี้ได้มีการรวบรวมข้อมูลลูกค้าผ่านแบบสำรวจเพื่อใช้ในการพัฒนาสินค้าและทำแผนการตลาด ผลของงานวิจัยนี้จะช่วยวิเคราะห์ผลประโยชน์ในการพัฒนาสบู่นมข้าว นอกจากนี้ยังจะแสดงแผนธุรกิจคร่าวๆ ในการนำผลิตภัณฑ์สู่ตลาด

สาขาวิชา	การจัดการทางวิศวกรรม	ลายมือชื่อนิสิต .....
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The objective of this research is to develop rice into rice milk soap using Quality Function Deployment (QFD) in order to add value to the product. The current rice production process can produce some broken rice, which is of low value. In order to increase value, the study is conducted to develop it into rice milk soap product. Quality Function Deployment is used to analyze and develop the product that best answer customer needs. There are data collection on customers through surveys to gain insights used for product development and rough product to market business plan. The result of this research shows the benefits of using broken rice to produce rice milk soap in term of financial benefits. It also shows rough business plan on how the product can be sold in the market including, business strategy and marketing and sales plan.

Field of Study:	Engineering Management	Student's Signature .....
Academic Year:	2019	Advisor's Signature .....
		Co-advisor's Signature .....

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Jiradej Ekthumrong

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

Chapter 1 Introduction

1.1 Background

Rice is one of the world leading food crops. It is being produced in more than hundred countries and consumed by people all over the world. Over 700 million tonnes of rice are being produced annually, with about 470 tonnes of milled rice produced (Ricepedia, n.d.). These rice provide more than 42% of all human calories consumption with over 3.5 billion people depending on them for their daily calories (Ricepedia, n.d.).

Asia is the majority rice producer and consumer with about 90% of world rice being produced and consumed here (Petchseechoung, 2017). Thailand is one of the top rice producers. Rice plantation in Thailand has yield of about 30-32 million tonnes per year. Of these, about 20 million tonnes of milled rice are produced from over 200 producers (Petchseechoung, 2017).

Thawiphon Central Rice Market is one of the many rice producer in Thailand. The company has been operating for over 10 years. The construction of the factory began in 2004 and was completed and started to operate in 2007. The company began as a small factory with rice drying yard, rice drying machine, and rice mill. Over the 10 years it operated, the company continue to develop through building warehouses and expanding existing facilities to increase the capacity. Thawiphon Central Rice market currently has a capacity of producing 450 tonnes of milled rice per day or approximately 164,250 tonnes per year at full capacity.

There are many types of rice and different grade quality that can be produced at Thawiphon Central Rice Market. These includes white rice, brown rice, white glutinous rice, parboiled rice, and Thai jasmine rice with different grade quality. However, the main products of Thawiphon are Thai jasmine rice and white rice 5% broken with most of rice products from Thawiphon Central Rice Market sold locally within Thailand.

Rice milling system to produce different products typically follow 4 main steps. The first step is pre-cleaning. This step is to remove any impurities in the rice paddy from farmers. Next step is de-husking and husk aspiration to remove the husk from the paddy and separate it from the brown rice. Then, the brown rice goes through the process of whitening and polishing to remove the bran and germ. From this step, the white rice is produced. Lastly, rice is graded and separated into different quality. The crucial part of this step is to separate the broken rice from the head rice due to the difference in value. Broken rice is rice that has the length of less than three quarter of the average rice length (Badi, 2013). The overall process is shown in **Error! Reference source not found.**. Depending on the type of final products, some broken rice may be blended together with head rice.

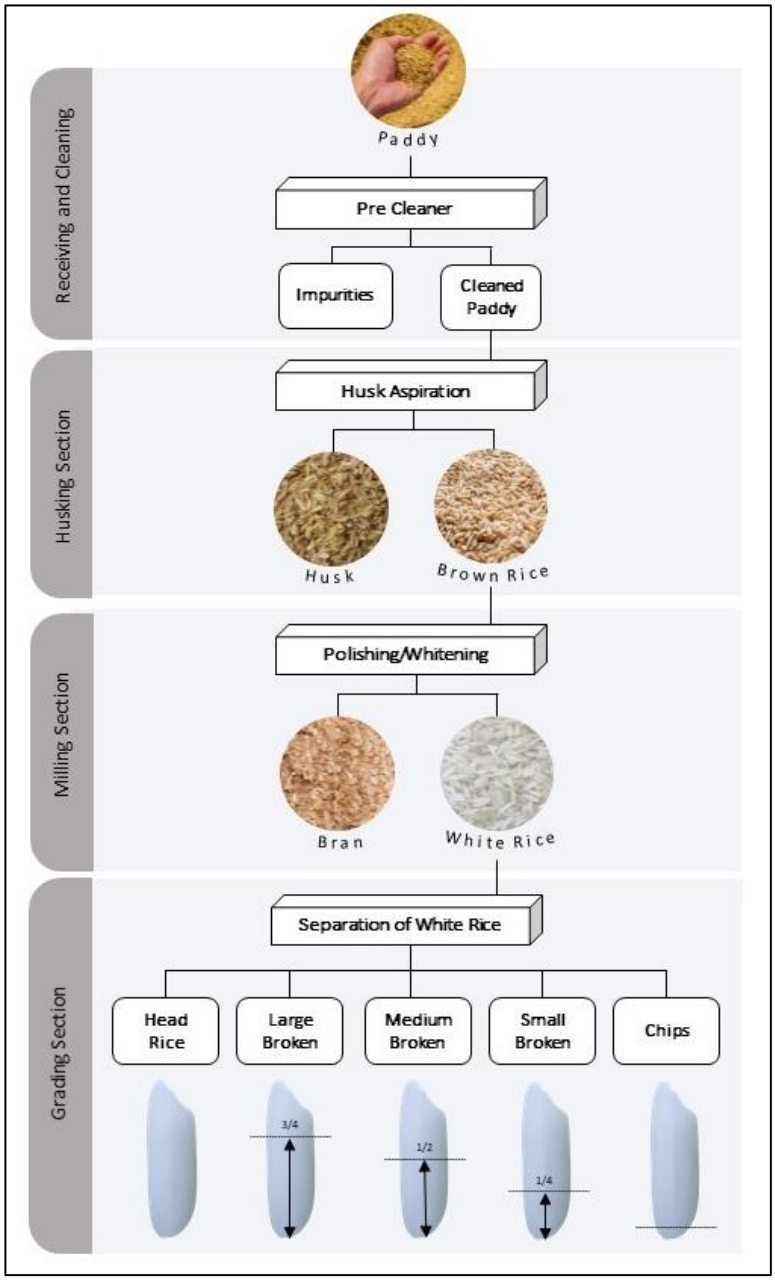


Figure 1 Rice Milling Process

During rice milling process, it is important to create as little of broken rice as possible. Normal jasmine rice and white rice can be sold for approximately 33 baht/kg and 13 baht/kg respectively. Whereas, broken rice is usually only sold by blending it with normal rice or sold to be used as animal feed for approximately 8 baht/kg. The broken rice is caused due to several factors including mechanical operation and

degree of milling causing stress, variety and condition of paddy rice, and the operators (Payman , et al., 2007) (Aghayeghazvini, et al., 2009). Thus, broken rice is considered as economic loss and there have been several studies related to it. For example, study on how to determine percentage of broken rice using image analysis by Aghayeghazvini, Afzal, Heidarisoltanabadi, Malek, and Mollabashiand and the effective parameters of broken rice during paddy hulling by Payman, Bagheri, Alizadeh and Roohi.

1.2 Problem Statement

Thawiphon Central Rice Market tries to minimize the amount of broken rice produced during rice milling process to be as low as possible. Currently, there can be up to 10% of broken rice from the total rice production. After the rice is graded, separated and blended, the company typically have approximately 1-5% of broken rice left. The rice has very low value and is often sold to animal feed producer to produce pig feed for approximately 8 baht/kg.

With the current technology, there will always still be some broken rice produce during the milling process. Due to limited resource and technical capability of Thawiphon Central Rice Market, instead of researching on how to reduce the amount of broken rice during production, the company is trying to find a way to add value to it. One of the many possible value-added products is developing the broken rice into soap. From initial research, the creation of the rice soap is possible but it requires further research to identify the market and create the product that satisfy customers and could be further develop into a business plan.

1.3 Research Objective

The objective of this paper is to develop low value rice into value added product as soap, which can provide extra benefits to Thaiwiphon Central Rice Market in term of increasing optimization, revenue and profitability.

To achieve this objective, tasks that need to be done are:

1) Research on current market and customer behaviour
2) Develop rice soap as product
3) Product finalization
4) Future plan

1.4 Scope of Research

This thesis paper is focused on developing low value rice into value added product as soap. This value-added product should provide opportunity for the rice mill to optimize their current resource and increase revenue and profitability.

Because of the time and resource constraint, this research will mainly concentrate on Thailand market. It will focus on how to develop the soap product that satisfy the local market using resource from Thawiphon Central Rice Market. Future work will also be discussed to show how the result can be used to develop a business plan.

1.5 Expected Benefits

The product development of soap using low value and broken rice from Thawiphon Central Rice Market should provide benefits as follow:

1) Process of making rice soap
2) Value added to broken rice
3) Opportunity to increase revenue and profitability for Thawiphon Central Rice Market

Chapter 2 Literature Review

2.1 Rice Benefits

For many people around the world, rice is an important energy source because rice can contain a lot of calories. However, other than that it also contains other valuable nutrients and minerals. For example, rice can contain proteins, different types of vitamin, and minerals such as calcium, iron, magnesium, selenium and zinc. The amount of nutrient and minerals contain in rice depends on different variety of rice (Kushwaha, 2016). Many of these nutrients are beneficial and common use in skincare product. For example, selenium can be and sometimes used as an ingredient in anti-aging product. B vitamins is also common in skin care product. It is beneficial due to it moisturizing and soothing effect and can also enhance skin healing abilities. Another benefit of B vitamins is its anti-inflammatory effect that help with acne treatment (Burgess, 2005).

2.2 Soap Production

There have been several studies related to soap production using uncommon ingredient. One study by Felix et al, is on the production of soap using waste material such as almond shells, orange peel and used cooking oil. The study shows the importance of reusing and optimizing these waste resources, which there are a lot in Portugal and other Mediterranean regions, for manufacturing soap. The paper performed a study on the final product. This includes the discussion on treatment of cooking oil, determination of saponification index, different soap formulations, colorants, soap evaluation and cost

of production. Overall, the result shows high potential in waste management and could be useful to create value product from these wastes (Félix, et al., 2017).

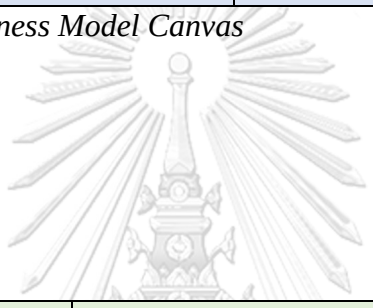
Another study by Atolani et al is production of natural antiseptic soaps from the oils of underutilised tropical seed. Similarly, the study explained the method and materials used to produced natural antiseptic soap. The tropical seeds were used during saponification process as sources of oil or fat, while also providing fragrance. Different mixing ratios were tried to produce different properties soap. The results discuss on how the characteristic of different materials affect the soap product characteristic. Comparing with commercial soaps, the production cost using tropical seed oil is also lower. The paper concluded that oil from tropical seed may be utilised to produce an eco-friendly soap, while providing economic benefit (Atolani, et al., 2016).

2.3 Triple Layered Business Model Canvas

Business Model Canvas is a tool that can be used to structure a business plan. However, according to Joyce and Paquin, 2 extra layers can be added to the canvas to build a more sustainable business model. The additional layers are environmental and social that cover lifecycle perspective and stakeholder perspective. By combining all layers, the business model will help the company generate economic, environmental, and social values. This new model is called Triple Layered Business Model Canvas or TLBMC (Joyce & Paquin, 2016). The example is shown below in Figure 2 Economic Business Model Canvas, Figure 3 Environmental Business Model Canvas, and Figure 4 Social Business Model Canvas.

<table>
<tr><td rowspan="2">Partners</td><td>Activities</td><td rowspan="2" colspan="2">Value Proposition</td><td>Customer Relationship</td><td rowspan="2">Customer Segments</td></tr>
<tr><td>Resources</td><td>Channels</td></tr>
<tr><td colspan="3">Costs</td><td colspan="3">Revenues</td></tr>
</table>

Figure 2 Economic Business Model Canvas



<table>
<tr><td rowspan="2">Supplies and Outsourcing</td><td>Production</td><td rowspan="2" colspan="2">Functional Value</td><td>End of Life</td><td rowspan="2">Use Phase</td></tr>
<tr><td>Materials</td><td>Distribution</td></tr>
<tr><td colspan="3">Environmental Impacts</td><td colspan="3">Environmental Benefits</td></tr>
</table>

Figure 3 Environmental Business Model Canvas

<table>
<tr><td rowspan="2">Local
Communities</td><td>Governance</td><td rowspan="2" colspan="2">Social Value</td><td>Societal
Culture</td><td rowspan="2">End-User</td></tr>
<tr><td>Employees</td><td>Scale of
Outreach</td></tr>
<tr><td colspan="3">Social Impacts</td><td colspan="3">Social Benefits</td></tr>
</table>

Figure 4 Social Business Model Canvas

2.4 Soap Performance Evaluation

The chapter "Soap Bar Performance Evaluation Method" in the book "Soap Manufacturing Technology" provided an overview of quality control and evaluation in soap manufacturing. Nine common variables have been selected for an assessment, which consist of Lather Evaluation, Rate of Wear and Mush, Wet Cracking, Wet-Bar Feel, Mildness to Skin, Fragrance, User Panel Evaluations, Bar Hardness, and Rheological Characterization. In conclusion, the authors indicated the limitation of this paper was an uncertainty of appraisal variables and methods. The assessment will change over time due to new technologies and consumer needs. In addition, the evaluations that this paper used also cannot be implied that every soap manufactures currently uses these procedures due to the fact that the soap manufacturing's internal procedures are never publicly disclosed. The author's sources of information came from the patent art, the scientific and engineering publications. Thus, the research could be used as the introduction to soap assessment procedures (Yarovoy & Post, 2016).

2.5 Product Development

A study by Simon Mosey, "Understanding new-to-market product development in SMEs", is one of many academic researches related to product development. The study focus on how SMEs can build capability for their new product development. The result shows that company should realize that there are several ways to build their capability. It is important to consider all the different factors. The framework, shown in **Error! Reference source not found.**, was created, which show that during the process of developing new product information should be shared between product strategy, new product development management, market intelligence, opportunity identification, and sources of technology and market opportunity. The information from different parts will provide the company the ability to gain knowledge and develop product that satisfy need of the market (Mosey, 2005).

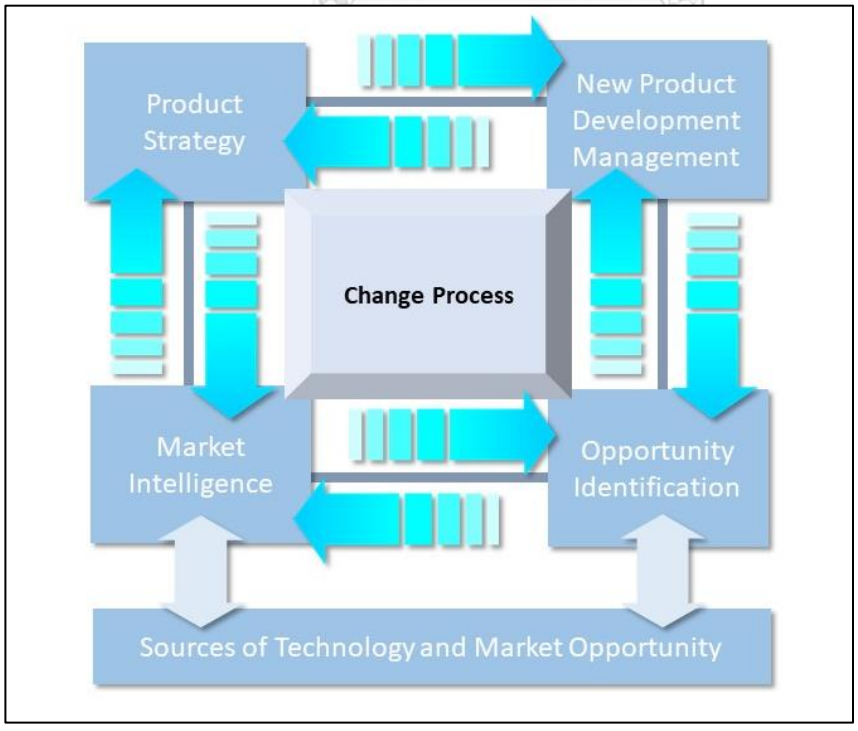


Figure 5 Framework for New-tomarket Development Processes (Mosey, 2005)

Another study by Millward and Lewis shows the “barriers to successful new product development within small manufacturing companies”. By studying the product development of 3 companies, they found that there are 3 main issues that restrict the successful product development. These issues are action of owner and manager, being too focus on time and cost instead of other factors, and failure to understand the importance of product design. They suggested that product development should follow a systematic design process to overcome these issues. The limitation of the study was that it was only done on 3 manufacturing companies in the UK. Further research should increase number of companies for case study and expand the study to companies outside the UK (Millward & Lewis, 2005).

2.6 Value Added Rice Product

With changing trend and innovation, there are many new products that are made from rice. In 2011, Peetachai Dejkraisak and Pornthida Wongphatharakulcreated a company and came up with a new type of rice called Jasberry, which is a combination of jasmine and black rice (Try the World, 2016). The rice creates a positive financial and social impact to local Thai farmers. The product itself is also healthy and organic, which satisfy customer behaviour trend. The company also expand their product and produce pasta, tea, rice flour, and soap that are made from Jasberry rice (Jasberry, n.d.).

There are other products developed from rice through innovation. For example, rice-bran oil, fat free salad dressing, rice energy drink, and egg coating were products that were showcased and won top 4 prizes at the National Innovation Awards in 2011. Other

innovative products include rice snack made from plain sticky rice. The snack can cost up to 960 baht/kg compare to plain sticky rice, which worth only 30 baht/kg. In previous year, there was also way to add value to rice grain by making it into cake flour. This can increase the value of the product from 50 baht/kg to almost 690 baht/kg (Fernquest, 2011).

Chapter 3 Research Methodology

This section is intended to describe the methodology that will be used to achieve the research objective. First, some tools and theories that may assist in creating a successful research paper will be shown. Next, the research approach will be discussed. This will show the steps necessary to write the thesis paper. Then, some of the relevant data required will be shown.

3.1 Tools and Theories

There are many tools and theories related to business strategies. Below are some tools and theories that may be useful in developing a successful business model:

3.1.1 Business Model Canvas

Business Model Canvas can be used to help structure a business plan. The Business Model Canvas cover 9 key drivers for a business. They are customer segments, value propositions, channels, customer relationships, revenue streams, key activities, key resources, key partnerships, and cost structure. These 9 elements provide company with a clear overview of the business plan and can help identify area where the plan need to be improved.

3.1.2 PESTLE Analysis

PESTLE analysis is a tool used to help identify external factors that can affect a business. These factors can have both positive or negative impacts. The tools analyse

various external influence including political, economic, social, technological, legal, and environmental (Carpenter & Dunung, 2012).

3.1.3 SWOT Analysis

SWOT analysis is one of the tool commonly used to develop business strategy. SWOT analysis is an assessment on the company strengths and weaknesses, which is internal, and opportunities and threats, which are external. This information can help identify the company's advantages and disadvantages in the market and come up with a business plan that take advantage of the opportunity using their strength and improve their weaknesses to avoid the external threats (Srdjevic, et al., 2012).

3.1.4 Porter's Five Forces

Porter's Five Forces is a model developed by Michael E. Porter in 1980. The model analyses competitive forces in the market both existing and potential. The five forces are competitive rivalry, bargaining power of suppliers, bargaining power of customers, threat of new entrants, and threat of substitute. This model can help identify the factors that affect competitiveness in the market and assist the company in making a good business plan that maximize the profit (Yunna & Yisheng, 2014).

3.1.5 Marketing Mix – 4P

The 4 P's in marketing mix are product, price, place, and promotions. It is 4 main variables that need to be considered before launching new product. By identifying these variables of the company, it can help the company in formulating the overall marketing strategy (Tomczak, et al., 2018).

3.1.6 Pricing Strategy Matrix

Pricing Strategy Matrix is another tool that can be used to assist formulating overall marketing strategy. This tool can identify the pricing aspect in marketing mix. It considers the costs of production and the market to determine whether the product pricing strategy should be economy pricing, price skimming, penetration pricing, or premium pricing (Prestholdt, 2018).

3.2 Research Approach

The research approach is mainly separated into 4 main parts. The first part is customer and market research. The next part, which is the main part, is developing rice into soap product. The third part is testing of rice soap product. The last part is result, conclusion, and discussion on future works.

3.2.1 Customer and Market Research

For product development and business plan to be successful, an initial research is required. This include 2 parts: market research and customer behaviour research.

3.2.1.1 Current Market Research

Before developing a new product, it is important to have a clear understanding of the existing market. It is crucial for the company to know of what is happening in the market and the current trend. This can be done through researching both online and offline to gather necessary details. This information is then analysed and will help the

company to realize the opportunity and know the threat of the market, including competitor and factors affecting the market.

3.2.1.2 Customer Research

It is also important for the company to understand customer behaviour and perspective, and know of possible consuming trend. Therefore, customer research is also needed. The data needed for analysis can be obtained using quantitative research through survey, where the dependent variable is their interest in the products. Some of independent variables are gender, age, income, type of product, and price. This data can then be analysed to determine customers' interests and behaviour in accordance with various variables.

3.2.2 Development of Rice Soap Production

The next step is the development of rice into rice soap product. Quality function deployment (QFD) can be used as an approach to develop the product. QFD is a process that focus on satisfying customer demand. The process can help company to satisfy the customer as best as possible using the affordable resources. The overall product development process usually involved multiple QFD process (Govers, 1996).

The data from current market research and customer research are used as the starting point of product development. Before starting the first QFD process, the product characteristic, target customer, and competing product need to be identify. The methodology of QFD follows 9 steps, which is known as building a "House of Quality" shown in **Error! Reference source not found.**. The first step is to select product that

is being developed. The next step is to decide the customer that is being focus on. This include describing the customers profile. Then, step 3 is to identify customer requirement, which can be done through various data collection methods. From this, the requirement can be rated by it importance according with the target customer. Step 5 is to benchmark the product with the competitor. The customer requirement is translated into product technical specification as step 6. This is the most important step in QFD methodology. Next step is to show the relationship between the technical specification and customer requirement to identify the project priority. This relationship can then be used to provide target for further development as step 8 and then use this to benchmark our position with the competitors as step 9. Lastly is to show the correlation matrix to represent the trade off on how one change affect another (Govers, 1996).

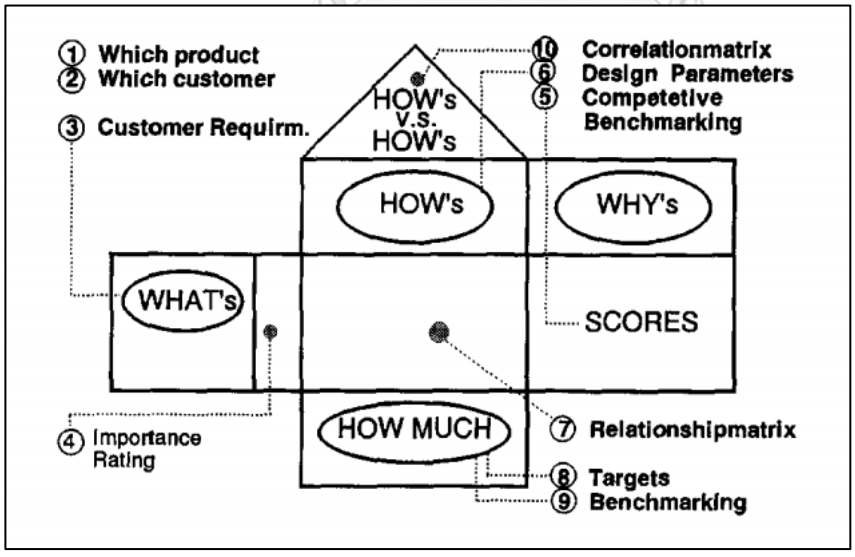


Figure 6 The "House of Quality" (Govers, 1996)

The quality function deployment can help to develop final product that satisfy customer needs. It can also be used to develop the final manufacture operation. Another methodology that can be used in conjunction with QFD is focus group methodology. It is a method to gain insight of a specific group of customer. It is done by gathering a small group of specific customer type to discuss a certain topic (Nyumba, et al., 2018). Through moderator, the discussion is aim to draw customer experience, perspective, and expectation.

Development of Rice Soap Production also includes identifying the equipment and ingredient need in soap production. Some of the equipment that may be needed are container, heating equipment, safety equipment, and measuring equipment such as scale or measuring cup. Water, lye, herbs, and essential oils are some ingredient that may be needed in production in addition to rice.

During this step, the production process will also be study. This is to identify the necessary procedure to make soap. The best production method will be determined such as whether the soap should be made using hot or cold process. The use of different ingredient will also be test to identify the mixture combination. All the information can then be used to produced rice soap product and estimate the cost of production.

3.2.3 Product Testing

The third step is to test the product. This will be done using the information from the initial market and customer research together will the rice soap product developed. By identifying the target market, the sample product will be provided to group of people in

that target market. Survey questionnaire will be used to gather the feedback from the customers. The feedback from customers should include their assessment on various aspect such as product, price and packaging. The result is then analysed to show overall interest and help finalize the product. This step may be done in between process of product development to gather feedback and further improve the product.

3.2.4 Result, Conclusion, and Future work

This part will discuss the result of the product development. It will then show the conclusion of the study. Future work will also be discussed. This may include how this study result could be used to develop into full scale business plan.

3.3 Required Data

3.3.1 Research

- Customer data (age, gender, salary)
- Cleansing product price (Baht/item or baht/kg)
- Competitors (Companies)
- Frequency of purchase (transaction/year)

3.3.2 Product Development

- Cost of ingredients and equipment (baht)
- Cost of product (baht/kg)
- Time to produce (hours)

These are some data that may be required for this research paper to be completed. However, throughout the process of writing the research paper, there may be more data that are required. All data are to be obtained through existing database, online and offline research, survey, and assumption.

Chapter 4 Product Development

This section is intended to discuss on product development on rice soap. This included explanation of production process and ingredients required. Quality Function Deployment is then used to translate customer requirement into functional requirements and then into production attributes. This will also show the importance of each attributes and identify the focus in order to answer customer requirement. Lastly, rice soap product formulation is finalized.

4.1 Rice Soap Production

4.1.1 Ingredient

Required ingredients in producing soap are:

- Various oil such as:
    - Coconut Oil
    - Palm Oil
    - Olive Oil
- Lye, which amount can be calculated based on amount of oil as follow: (Amount of Fat) x (Saponification Value of the Fat) = (Amount of Lye), This amount is for 100% saponification of fat and oil. However less lye may be used for soap to contain some free-floating oil and fat.

Fat/Oil Type	Saponification Value of the Fat
Almond Oil	0.1367

Aloe Vera Butter	0.1788
Aloe Vera Oil	0.1421
Apricot Kernel Oil	0.1378
Avocado Butter	0.1339
Avocado Oil	0.1337
Candelilla Wax	0.0322
Canola Oil	0.1328
Cherry Kernel Oil	0.1389
Cocoa Butter	0.1378
Corn Oil	0.1368
Cottonseed Oil	0.1387
Evening Primrose Oil	0.1362
Flaxseed Oil	0.1358
Grapeseed Oil	0.1321
Hazelnut Oil	0.1369
Hempseed Oil	0.1359
Linseed Oil	0.1358
Macadamia Nut Oil	0.1391
Neem Tree Oil	0.1372
Olive Oil	0.1353
Palm Kernel Oil	0.1777
Palm Oil	0.142
Peach Kernel Oil	0.1361

Peanut Oil	0.1367
Pine Rosin	0.1298
Pumpkin Seed Oil	0.1389
Rapeseed Oil	0.1328
Rice Bran Oil	0.1284
Sesame Seed Oil	0.1336
Shea Butter	0.1296
Soybean Oil	0.1359
Wheat Germ Oil	0.1319

Table 1 Saponification Value

- Water
    - Based on type of lye solution. For example, 50% lye solution will contain 50% lye and 50% water.
- Other ingredients
    - Fragrance
    - Rice
    - Colorant

4.1.2 Production Process

The production process for making cold process soap is as follow:

1. Preparing all ingredients and equipment
2. Prepare lye and water

Figure 7Lye (Left) and Water (Right)

3. Add lye to the water
4. Set aside lye solution for it to cooldown.

Figure 8 Lye Solution

5. Prepare all oil solution use in production

Figure 9 Oil Solution

6. Combine all oil solution together and mix them

Figure 10 Oils Solution Mixture

7. When Lye solution is cooled down, pour the lye solution into the oils.

Figure 11 Mixing of Lye Solution into the Oils Mixture

8. Slowly mix the oil and lye together. The solution will turn into yellow colour.

Figure 12 Mixing of Lye and Oils

9. Prepare other ingredients such as fragrance and rice and add them to the solution

Figure 13 Addition of Other Ingredients

10. Continue mixing until the solution reach medium trace
11. Pour the soap solution into the mold

Figure 14 Soap Solution in Mould

12. Allow the soap solution to sit and become harder in mould. Can take up to 4 days.

13. Remove the soap from the mould and allow the soap to cure for water to evaporate. Can take up to 6 weeks.

Figure 15 Soap Product while Curing

Figure 16 Final Soap Product

4.2 QFD Level 1

This part will show Quality Function Deployment level 1 for soap development. Customer requirements and functional requirements are first listed. Using QFD level 1, the relationship between the 2 can then be identified. These relationships will also be rated according to their importance to show which requirements are the key in product development. Final QFD level 1 will then be shown.

4.2.1 Customer Requirements

Getting customer requirements is the first step in creating level 1 of Quality Function Deployment. This requirement will show what customers are looking for when they are purchasing new soap and voice of customer (VOC) will also be collected to identify which criteria is more important for the customers. This is crucial to be able to develop soap that match what customer want.

Before collecting voice of customer, all customer requirements are identified. The list is made using author judgement and discussion with company owner and other people. They are listed as follow:

Items #	Customer Requirements
1	Price
2	Texture / Feeling of Soap
3	Smell
4	Appearance
5	Benefits of Soap

Table 2 Customer Requirements

There are total of 5 main customer requirements.

1. Price – The price of the soap sold. Customers are looking to buy soap at a reasonable price.
2. Texture / Feeling of Soap – The texture and feeling of the soap when using it in shower or during hand wash. The feeling can be different for different customers as they may have different preferences.
3. Smell – Customers are looking for soap that have good smell in general when they are purchasing. However, there may still be different specific smell preference for each customer.
4. Appearance – How the soap look like both the packaging and the soap itself.
5. Benefits of Soap – Benefits other than good smell that it provides through ingredient and quality of the soap.

From the list of customer requirements, the voice of customer is then collected through survey. Group of people were asked to rank the importance of these requirements when they are purchasing the soap. The result is as follow:

Ranking	Customer Requirements
1	Smell
2	Benefits of Soap
3	Texture / Feeling of Soap
4	Price
5	Appearance

Table 3 Voice of Customers

The result shows that customers first preference when purchasing is the smell of the soap. They then look at other benefits of the soap. Next, they will choose soap that has good texture or gave them good feeling when use. Price is then considered and will be purchased if the price is reasonable. Lastly, appearance is the least importance of the customer requirements.

4.2.2 Functional Requirements

Another part of Quality Function Deployment Level 1 is functional requirements. These requirements are the key attribute in soap product. From literature review, the functional requirements are identified as follow:

Items #	Functional Requirements
1	Odor
2	Wear Rate
3	Crack Resistance
4	Foaming
5	Color
6	Size
7	Chemical Properties
8	Cost per soap

Table 4 Functional Requirements

1. Odor – The smell that the soap produce
2. Wear Rate – How much soap is lost during usage. This value shows how long the soap can last under the same usage. The higher wear rate, the quicker the soap is use up.
3. Crack Resistance – whether soap is easily break under usage. The better crack resistance is typically better as the soap is better stay in shape.
4. Foaming – How well the soap produce foam. This include generation speed, volume, and bubble size.
5. Color – The color of the soap.
6. Size – The size of the soap.
7. Chemical Properties – The chemical composition of each soap or in other word the ingredients used in soap production.
8. Cost per Soap – The cost of producing each soap

4.2.3 Customer Requirements and Functional Requirements Relationship

After listing out all major functional requirements, the relationship with customer requirements can be evaluated. The relationship is shown in **Error! Reference source not found.**. The number represent the level of relevance between the 2 requirements, where 9 is strong relationship, 3 is medium relationship, 1 is weak relationship and empty cell is no relationship between the requirements. This relationship is identified using author judgement.

Demanded Quality (a.k.a. "Customer Requirements" or "Whats") \ Quality Characteristics (a.k.a. "Functional Requirements" or "Hows")	Odor	Wear Rate	Crack Resistance	Foaming	Color	Size	Chemical Propoerties	Cost per Soap
Price								9
Texture/Feeling		3	3	3		1		
Good Smell	9						1	
Appearance					3	3		
Benefits							9	

Table 5 Customers Requirements and Functional Requirements Relationship

4.2.4 Functional Requirement Importance

			Column #	1	2	3	4	5	6	7	8
Row #	Relative Weight	Weight / Importance	Demanded Quality (a.k.a. "Customer Requirements" or "Whats") \ Quality Characteristics (a.k.a. "Functional Requirements" or "Hows")	Odor	Wear Rate	Crack Resistance	Foaming	Color	Size	Chemical Propoerties	Cost per Soap
1	13.3	2	Price								9
2	20.0	3	Texture/Feeling		3	3	3		1		
3	33.3	5	Good Smell	9						1	
4	6.7	1	Appearance					3	3		
5	26.7	4	Benefits							9	

Table 6 Customer Requirements Relative Weight

From the relationship between customers and functional requirements, the importance of each functional requirement can be calculated. This is calculated by first using the ranking of customer requirements. The ranking is translated into weight/importance as shown in**Error! Reference source not found.** on a scale from 1 to 5 with 5 being the most importance or the highest ranking. This is then calculated into relative weight of each customer requirement in percentage.

Next, the importance of each functional requirement can be calculated by multiplying the relationship with customer requirements importance relative weight and then sum all value for each requirement. The importance calculation for each requirement is as followed:

1. Functional Importance of Odor:

   9 x 33.3 = 300

2. Functional Importance of Wear Rate:

   3 x 20.0 = 60

3. Functional Importance of Crack Resistance:

   3 x 20.0 = 60

4. Functional Importance of Foaming:

   3 x 20.0 = 60

5. Functional Importance of Color:

   3 x 6.7 = 20

6. Functional Importance of Size:

   (1 x 20.0) + (3 x 6.7) = 40

7. Functional Importance of Chemical properties:

   (1x 33.3) + (9 x 26.7) = 273.33

8. Functional Importance of Cost per Soap:

   9 x 13.3 = 120

			Column #	1	2	3	4	5	6	7	8
Row #	Relative Weight	Weight / Importance	Quality Characteristics (a.k.a. "Functional Requirements" or "Hows") / Demanded Quality (a.k.a. "Customer Requirements" or "Whats")	Odor	Wear Rate	Crack Resistance	Foaming	Color	Size	Chemical Propoerties	Cost per Soap
1	13.3	2	Price								9
2	20.0	3	Texture/Feeling		3	3	3		1		
3	33.3	5	Good Smell	9						1	
4	6.7	1	Appearance					3	3		
5	26.7	4	Benefits							9	
			Weight / Importance	300	60	60	60	20	40	273.33	120
			Relative Weight	32.1	6.4	6.4	6.4	2.1	4.3	29.3	12.9

Table 7 Functional Requirement Importance

From the importance calculated, the relative weight of each functional requirements can be found as shown in **Error! Reference source not found.**. The table shows that as good smell is ranked number 1, odor is also the main functional requirement with relative weight of 32.1%. The other important requirement is the chemical properties of the soap with relative weight of 29.3%. This is because the chemical properties are what decided what benefit the soap will provide and it also slightly affect the smell of the soap. Next priority is the cost per soap with relative weight of 12.9%. Wear rate, crack resistance, and foaming are the main criteria for texture and feeling of the soap and therefore have the same relative weight of 6.4%. Lastly, the least importance functional requirements are size and color with relative weight of 4.3% and 2.1% respectively.

4.2.5 Competitor Analysis

There are many competitors that produce rice soap of different quality and price. For example, for cost focus, there can be up to 5 brands of rice soap on shelf in local supermarket such as Big C. These products are priced between 30 to 50 Baht per bar soap of 100 to 150 grams. However, as Thawiphon product will be focus on premium quality product, the direct competitors will be premium rice soap producers. The main competitors for premium products are Harnn, Banh, and Thann. The analysis for each competitor is as followed:

1) Harnn – Rice soap of Harnn has a medium price in comparison to other premium product. The product is price at 175 Baht per 100g soap. The soap provide good texture and feeling as well as good appearance in comparison to other brands.

2) Banh – Banh is the cheapest of the three products. The soap is price at 150 baht per 100g soap. Although the appearance is not as appealing as other brands but the soap still provide good smell and benefits.
3) Thann – Thann is the most expensive. The soap is price at 205 baht per 100 g soap. However, the soap provide best smell and highest benefits between the three. The appearance and texture and feeling of the soap is also of high rating.

4.2.6 Final QFD Level 1

Error! Reference source not found. shows the complete Quality Function Deployment Level 1 for soap production. It displays the relationship between customer requirements and functional requirements and translated the importance of customer requirements into importance of functional requirements. In summary, the QFD shows that odor and chemical properties of soap is the key requirement in soap development to satisfy customer wants of good smell and benefits.

				Column #	1	2	3	4	5	6	7	8	Competitive Analysis (0=Worst, 5=Best)		
Row #	Max Relationship Value in Row	Relative Weight	Weight / Importance	Quality Characteristics (a.k.a. "Functional Requirements" or "Hows") / Demanded Quality (a.k.a. "Customer Requirements" or "Whats")	Odor	Wear Rate	Crack Resistance	Foaming	Color	Size	Chemical Propoerties	Cost per Soap	Harnn	Banh	Thann
1	9	13.3	2	Price								9	3	5	2
2	3	20.0	3	Texture/Feeling		3	3	3		1			5	3	4
3	9	33.3	5	Good Smell	9						1		4	4	5
4	3	6.7	1	Appearance					3	3			5	3	4
5	9	26.7	4	Benefits							9		4	4	5
				Difficulty	5	8	8	5	2	1	5	6			
				Max Relationship Value in Column	9	3	3	3	3	3	9	9			
				Weight / Importance	300	60	60	60	20	40	273.33	120			
				Relative Weight	32.1	6.4	6.4	6.4	2.1	4.3	29.3	12.9			

Table 8 Final QFD Level 1

4.3 QFD Level 2

This part will show Quality Function Deployment level 2 for soap development. QFD level 2 will show the relationship and translate the importance of functional requirements into importance of different production attributes.

4.3.1 Production Attributes

First, production attributes need to be identified. These are listed as followed:

Items #	Production Attributes
1	Drying Time
2	Amount of Oil
3	Amount of Lye
4	Amount of Other Ingredients
5	Mixing Time
6	Size of Mold
7	Colorant
8	Quality of Ingredients
9	Cost of Ingredients
10	Cost of Packaging
11	Water to Oil Ratio

Table 9 Production Attributes

1. Drying Time – The time used to let the water evaporate from the soap.
2. Amount of Oil – The amount of different oil used.

3. Amount of Lye – The amount of NaOH used. This affect how much oil is converted into soap and how much oil is left as free flowing oil.
4. Amount of Other Ingredients – Ingredients other than oil and Lye including fragrance, colorant and others such as rice.
5. Mixing Time – The time use to mix all ingredients together. This affect how well the ingredients are mixed and how well the oil is converted into soap.
6. Size of Mould – Mould used to shape the soap. The size of mould affect the size of final soap product.
7. Colorant – The dye used to change color of the soap.
8. Quality of Ingredients – The quality of ingredient used in production. Better quality typically result in higher cost but will be of better chemical properties and therefore give better benefits.
9. Cost of Ingredients – Cost of all ingredients use in each soap production
10. Cost of Packaging – Cost of each packaging per soap
11. Water to Oil Ratio – The ratio between water and oil. The affect how well the soap will foam as well as crack resistance and wear rate.

4.3.2 Functional Requirements and Production Attributes Relationship

Quality Characteristics (a.k.a. "Functional Requirements" or "Hows") / Demanded Quality (a.k.a. "Customer Requirements" or "Whats")	Drying Time	Amount of Oil	Amount of Lye	Amount of other Ingredient	Mixing Time	Size of Mold	Colorant	Quality of Ingredients	Cost of Ingredient	Cost of Packaging	Water to Oil Ratio
Odor		9		9				3			
Wear Rate	9	3	1		3						3
Crack Resistance	3			1	3						3
Foaming				3				3			9
Color		1		1			9				
Size						9					
Chemical Properties		9		3				9			
Cost per Soap									9	3	

Table 10 Functional Requirements and Production Attributes Relationship

The relationship with functional requirements is evaluated after listing out all major production attributes. This is shown in **Error! Reference source not found.**. Similar with QFD 1, the number represent the level of relevance between the 2, where 9 is strong relationship, 3 is medium relationship, 1 is weak relationship and empty cell is no relationship between the requirements. The relationship is identified by author through testing during production process/procedure study.

4.3.3 Production Attributes Importance

Using functional requirements importance calculated in QFD 1, the production attributes importance can be calculated similarly as follow:

1. Attributes Importance of Drying Time

   (9 x 6.7) + (3 x 6.7) = 80.0

2. Attributes Importance of Amount of Oil

(9 x 33.3) + (3 x 6.7) + (3 X 6.7) + (1 x 2.2) + (9 x 26.7) = 582.2

3. Attributes Importance of Amount of Lye

   1 x 6.7 = 6.7

4. Attributes Importance of Amount of Other Ingredients

   (9 x 33.3) + (1 x 6.7) + (3 x 6.7) + (1 x 2.2) + (3 x 26.7) = 408.9

5. Attributes Importance of Mixing Time

   (3 x 6.7) + (3 x 6.7) = 40.0

6. Attributes Importance of Size of Mold

   9 x 4.4 = 40.0

7. Attributes Importance of Colorant

   9 x 2.2 = 20.0

8. Attributes Importance of Quality of Ingredients

   (3 x 33.3) + (3 x 6.7) + (9 X 26.7) = 360.0

9. Attributes Importance of Cost of Ingredients

   9 x 13.3 = 120.0

10. Attributes Importance of Cost of Packaging

    3 x 13.3 40.0

11. Attributes Importance of Water to Oil Ratio

    (3 x 6.7) + (3 x 6.7) + (3 x 6.7) = 60.0

Row #	Max Relationship Value in Row	Relative Weight	Weight / Importance	Demanded Quality (a.k.a. "Customer Requirements" or "Whats") \ Quality Characteristics (a.k.a. "Functional Requirements" or "Hows")	Drying Time	Amount of Oil	Amount of Lye	Amount of other Ingredient	Mixing Time	Size of Mold	Colorant	Quality of Ingredients	Cost of Ingredient	Cost of Packaging	Water to Oil Ratio
				Column #	1	2	3	4	5	6	7	8	9	10	11
1	9	33.3	300	Odor		9		9				3			
2	9	6.7	60	Wear Rate	9	3	1		3						3
3	3	6.7	60	Crack Resistance	3			1	3						3
4	3	6.7	60	Foaming		3		3				3			3
5	9	2.2	20	Color		1		1			9				
6	9	4.4	40	Size						9					
7	9	26.7	240	Chemical Properties		9		3				9			
8	9	13.3	120	Cost per Soap									9	3	
				Max Relationship Value in Column	9	9	1	9	3	9	9	9	9	3	3
				Weight / Importance	80.0	582.2	6.7	408.9	40.0	40.0	20.0	360.0	120.0	40.0	60.0
				Relative Weight	4.6	33.1	0.4	23.3	2.3	2.3	1.1	20.5	6.8	2.3	3.4

Table 11 Production Attributes Importance

The production attributes relative weight importance is then calculated as shown in **Error! Reference source not found.**. It can be analysed that amount of oil, amount of other ingredients and quality of ingredients are three main key focus in production attributes as they have relative weight of 33.1%, 23.3%, and 20.5% respectively. Whereas, amount of lye is the least important in production attributes with relative weight of 0.4%. However, although lye doesn't have importance with functional requirements, it is required in soap making process and there is minimum requirement in relation to oil amount for saponification to happen.

4.3.4 Final QFD Level 2

The complete Quality Function Deployment Level 2 for soap production is shown in **Error! Reference source not found.**. It translated the importance of functional requirements into production attributes importance. The QFD shows that the quality

and amount of oil and other ingredients are the most important factor during production in term of answering customer wants.

				Column #	1	2	3	4	5	6	7	8	9	10	11
Row #	Max Relationship Value in Row	Relative Weight	Weight / Importance	Quality Characteristics (a.k.a. "Functional Requirements" or "Hows") / Demanded Quality (a.k.a. "Customer Requirements" or "Whats")	Drying Time	Amount of Oil	Amount of Lye	Amount of other Ingredient	Mixing Time	Size of Mold	Colorant	Quality of Ingredients	Cost of Ingredient	Cost of Packaging	Water to Oil Ratio
1	9	33.3	300	Odor		9		9				3			
2	9	6.7	60	Wear Rate	9	3	1		3						3
3	3	6.7	60	Crack Resistance	3			1	3						3
4	3	6.7	60	Foaming		3		3				3			3
5	9	2.2	20	Color		1		1			9				
6	9	4.4	40	Size						9					
7	9	26.7	240	Chemical Properties		9		3				9			
8	9	13.3	120	Cost per Soap									9	3	
				Difficulty	6	2	3	2	3	1	2	4	6	3	4
				Max Relationship Value in Column	9	9	1	9	3	9	9	9	9	3	3
				Weight / Importance	80.0	582.2	6.7	408.9	40.0	40.0	20.0	360.0	120.0	40.0	60.0
				Relative Weight	4.6	33.1	0.4	23.3	2.3	2.3	1.1	20.5	6.8	2.3	3.4

Table 12 Final QFD Level 2

4.4 Rice Soap Product

4.4.1 Soap Product Formulation

As Quality Function Deployment Level 2 shown, the focus of production attributes are amount of oil and other ingredient use in production. Many different formulations were tested with focus being on different amount of oil and other ingredients. To focus on different formulation mixture, all other production steps were kept the same while only changing ingredients mixture. This include using the same mould size, drying time, mixing time, same amount of lye, and no colorant on all trials.

After many trials, **Error! Reference source not found.** below shows formulations that is expected to be best suited for customers. The fragrance used during the testing is rice milk fragrance to amplify the smell of rice in the soap. Also, the rice used contains rich

source of vitamin E, which can help repair skin and provide moisturizing to the skin. This is one of the benefits that customers are looking for.

Ingredient	**Formulation 1**	**Formulation 2**	**Formulation 3**
Coconut Oil	15%	22%	18%
Olive Oil	28%	17%	23%
Palm Oil	20%	22%	20%
Lye	9%	10%	10%
Water	21%	22%	21%
Fragrance	2%	1%	2%
Rice	6%	6%	6%

Table 13 Formulation Tested

4.4.2 Product Acceptance Test

Group of people were selected for product acceptance test. They were given all three formulations for trial. Feedbacks were then collected to identify the formulation that should be selected.

Ingredient	Formulation
Coconut Oil	15%
Olive Oil	28%
Palm Oil	20%
Lye	9%
Water	21%
Fragrance	2%
Rice	6%

Table 14 Final Formulation

From acceptance test, # 1 is the formulation that is most preferred. The reason for this is because 2 % fragrance provide a reasonable odour for good smell. Also, the smell of rice fragrance can still be felt, while the other 2 formulation has a stronger smell of coconut oil due to higher proportion. The higher olive oil in formulation 1 make the soap feel milder and gentler and better for sensitive skin.

Chapter 5 Analysis

This section is intended to analyse the benefit of using broken rice to produce rice soap. First, the cost of production for rice soap is identified. Using this information, the value added for rice soap product can then be analysed. This will show the financial benefit of producing rice soap in comparison to selling broken rice as it is currently.

5.1 Cost of Soap

Before analyzing the value added of rice soap, the cost of production per soap need to be calculated. To calculate, first the cost of each ingredients need to be identify as followed.

Ingredients	**Cost per Liter**	**Cost per Kg**
Coconut Oil	200	
Olive Oil		370
Palm Oil	100	
Lye		100
Water	30	
Fragrance	1490	
Rice		

Table 15 Cost of Ingredients

As rice used in soap production is from the rice mill, the cost of rice will not be included in the cost of soap calculation.

Next, as product is typically sold in weight (g or kg) and the cost for some ingredients are in unit per weight, the density for each ingredient need to be identify to calculate the weight of each ingredients. This approximate density of each ingredients is as followed.

Ingredients	**Density (g/ml)**
Coconut Oil	0.903
Olive Oil	0.920
Palm Oil	0.900
Lye	1.515
Water	1.000
Fragrance	1.000
Rice	1.400
Total	**1.013**

Table 16 Density of Ingredients

The approximate density of the soap is 1.012 g/ml. This value is then used to calculate the total volume of soap per 1 kg soap, which is calculated to be approximately 986.8 ml. Using this, the volume together with formulation of soap, the volume of each ingredients can be found by multiplying % volume with total volume per 1 kg soap. The result is as followed.

Ingredients	% Volume	Volume/kg Soap (ml)
Coconut Oil	15%	148.0
Olive Oil	28%	276.3
Palm Oil	20%	197.4
Lye	9%	88.8
Water	20%	197.4
Fragrance	2%	19.7
Rice	6%	59.2
Total	**100%**	**986.8**

Table 17 Volume of Soap

From the volume, the mass of each ingredients can also be calculated by multiplying the density with volume. The mass of each ingredients is shown below.

Ingredients	Density (g/ml)	Mass/kg Soap (kg)
Coconut Oil	0.903	133.7
Olive Oil	0.920	254.2
Palm Oil	0.900	177.6
Lye	1.515	134.5
Water	1.000	197.4
Fragrance	1.000	19.7
Rice	1.400	82.9
Total	**1.013**	**1000**

Table 18 Mass of Soap

From all the information, above, the cost of each ingredients per 1 kg soap can then be found by using cost of ingredients and mass and volume per 1 kg soap.

Ingredients	% Volume	Density (g/ml)	Volume/kg Soap (ml)	Mass/kg Soap (g)	Cost per Liter (Baht)	Cost per kg (Baht)	Cost/kg Soap (Baht)
Coconut Oil	15%	0.903	148.0	133.7	200		29.60
Olive Oil	28%	0.92	276.3	254.2		370	94.05
Palm Oil	20%	0.9	197.4	177.6	100		19.74
Lye	9%	1.515	88.8	134.5		100	13.45
Water	20%	1	197.4	197.4	30		5.92
Fragrance	2%	1	19.7	19.7	1490		29.41
Rice	6%	1.4	59.2	82.9			0.00
Total	**100%**	**1.0134**	**986.8**	**1000**			**192.17**

Table 19 Cost of Soap

From this, the total cost of ingredients per 1 kg soap is calculated to be approximately 192.17 Baht.

Assuming, 1 worker's salary is approximately 13,000 Baht/month and can produce up to 100 kg of soap per month. The cost of labour per 1 kg of soap can be calculated to be approximately 150 Baht per kg. Together with total cost of ingredients, the cost of production per 1 kg of soap is 322.17 Baht. This cost does not include overhead cost and other operating cost.

5.2 Value Analysis

Using the cost of production per 1 kg of soap, the value added by producing rice soap from broken rice can be calculated. Assuming, the rice soap can be sold for at least 1,100 Baht per kg, the profit for 1 kg of rice soap is approximately 778 Baht. This 1 kg of rice soap used approximately 82.9 g of broken rice. With 1 kg of broken rice, approximately 12 kg of rice soap can be produced. This can generate up to 13,200 Baht of revenue or 9,336 Baht of profit per 1 kg of broken rice. In comparison, currently 1 kg of broken rice are sold for only 8 Baht per kg. By using broken rice to produce rice soap, it can add value to the product for more than 9,000 Baht per 1 kg of broken rice

As per assumption above, if one worker can produce up to 100 kg of soap per month, approximately 8.3 kg of broken rice is used in the production. One worker can generate revenue up to 110,000 Baht per month or 77,800 Baht of profit. The same amount of broken rice can only be sold as animal feed for less than 70 Baht.

This shows that if rice soap can be sold in the market, the product can add value to for more than 9,000 baht per 1 kg of broken rice. Also, at maximum capacity for worker, hiring one worker can increase value of broken rice for more than 77,000 Baht per staff per month.

Chapter 6 Rough Product to Market Plan

6.1 Business Summary

6.1.1 Business Name

Thawiphon Central Rice Market

6.1.2 Vision

To become market leader in rice products through development and innovation

6.1.3 Mission

Our mission is to continuously develop rice into new innovative products for our customers' through quality materials and local handmade skills.

6.1.4 Location of Business

701 Moo 6 Tha Tako, Tha Tako District, Nakhon Sawan 60160

6.1.5 Type of Business

Manufacturer, distributor, and seller for rice product

6.1.6 Organization Chart

Initially, Thawiphon Central Rice Market organization structure will be very lean and consist of only 5 key employees, led by the president. The team is separated into 4 main business function, which are finance, sales & marketing, production, and supply chain as shown in **Error! Reference source not found.**. Due to small scale of business in the

beginning, finance and supply chain will consist of only 1 employee each. While, sales & marketing and production will both have supporting staffs to support their business function. This is because both business functions require at least few people in the team for them to be fully and efficiently operational.

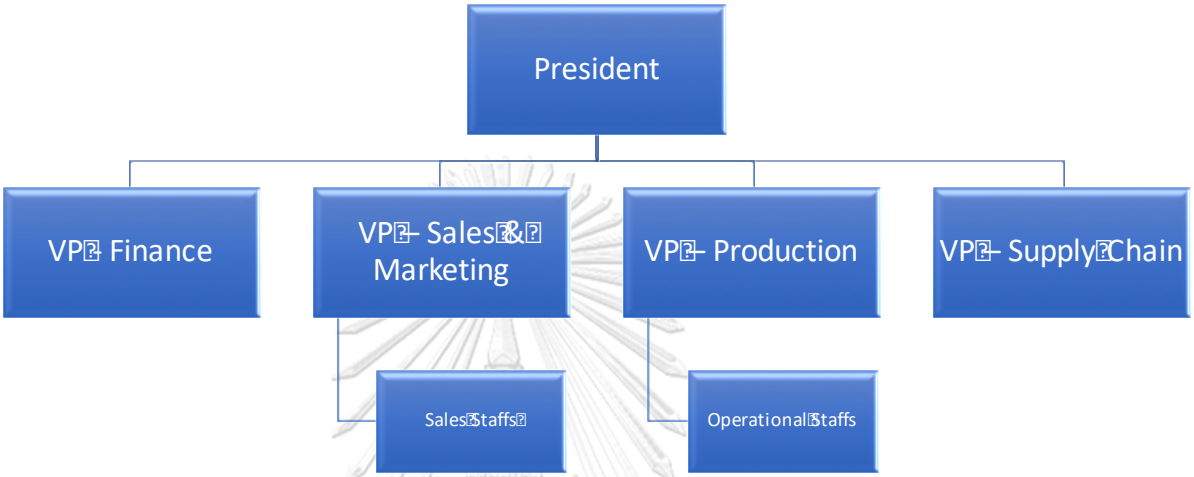


Figure 17 Initial Organization Chart

As the business began to grow, the team will need to be expand. **Error! Reference source not found.** shows how the company organization chart will look like as the company expand. Finance and supply chain would require bigger team to support the company, while sales & marketing and production also need to expand into more than one team to focus on different business purpose. With more staffs, Thawiphon Products should also have admin and human resource team to support their employees. Lastly, company's own legal person may be needed for various legal support both internal and external.

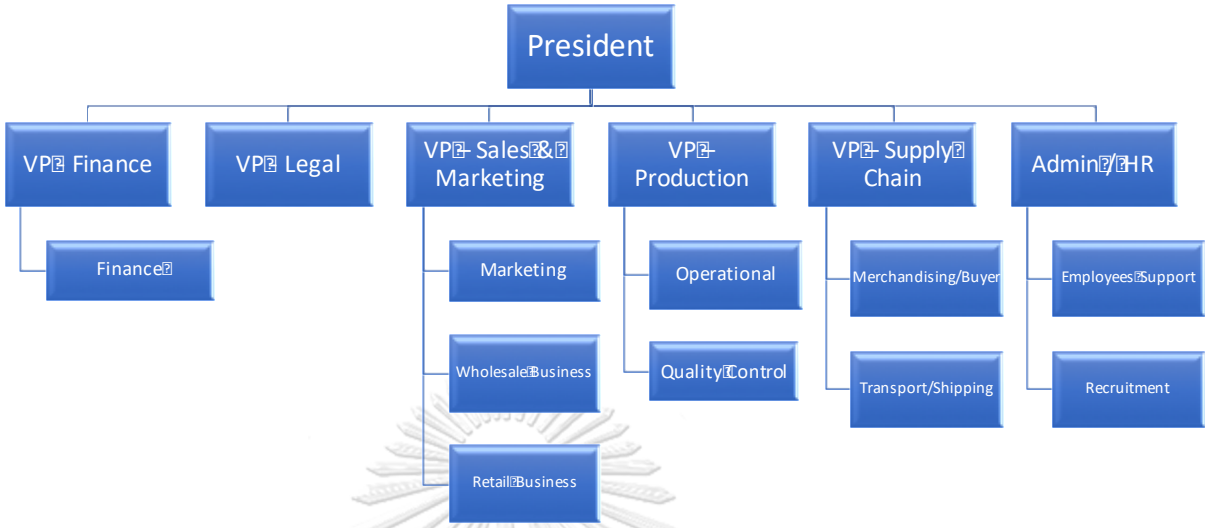


Figure 18 Final Organization Chart

With bigger teams and more employees, to reduce working process and make it more efficient, each team will be allowed to make decision on their business function within certain limit by themselves without all decision going through the president. These decisions will be controlled and monitored by the vice president in each team. Only decision that require high investment or have high business impact in term of company branding will need to be approved by the president and/or the management team. This will make the company more flexible and have quicker reaction to changing business environment.

6.1.7 Business Strategy

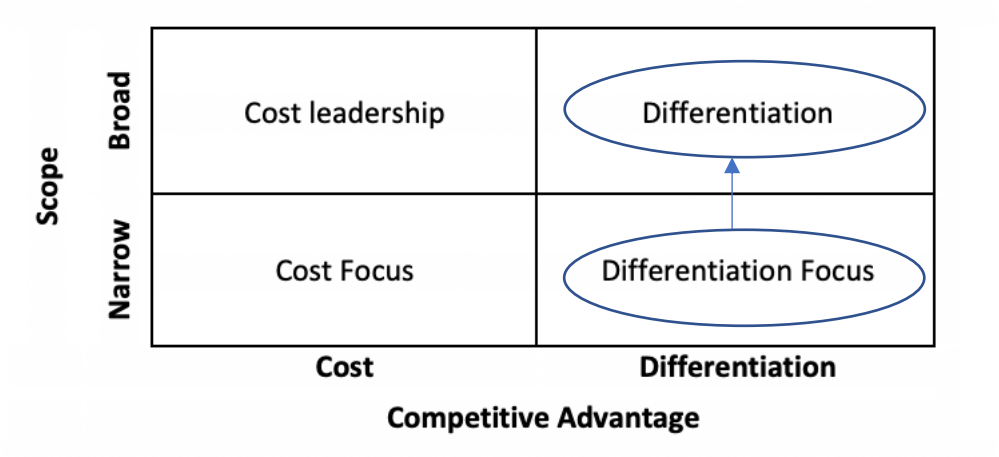


Figure 19 Porter Generic Strategy for Thawiphon Central Rice Market

Using Porter Generic Strategy, differentiation focus is a business strategy suited for Thawiphon Central Rice Market. This is due to its small products line in cleansing products with rice soap being the only product the company has. The product is suited for customers who are looking for advantage of rice soap such as whitening effect or benefit of vitamin E. Also, due to small scale production, the company won't be able to compete with larger company in term of cost of production. For the product to be successful, the benefit of rice soap needs to be focus and shown to customer.

However, as the company expand the product options, the strategy can shift from narrow scope to a wider scope. The expansion may still be rice soap with additional benefit from other additive ingredient or a totally new product line. With bigger scale production, the company can potentially be more efficiently and have lower cost of production as well.

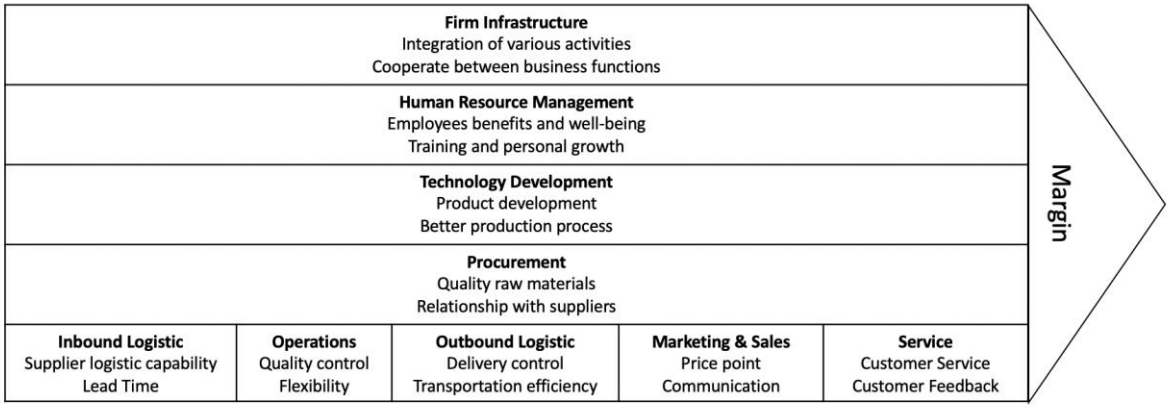


Figure 20 Porter Value Chain for Thawiphon Central Rice Market

Error! Reference source not found. shows collection of activities and requirements for the company to create value for the customers. It is separated into 5 primary activities: inbound logistic, operations, outbound logistic, marketing & sales, and service, and 4 supporting activities: firm infrastructure, human resource management, technology development, and procurement. Improving these activities will not only create more value for the customers but also the company. Below shows how each activity can be value added for the company and the customers.

Primary Activities:

1. Inbound Logistic

   This is the process of receiving all materials from suppliers for production. Key factor of this activity is reliability of supplier logistic and their capability. This ensure that all materials are received within certain period and can create a better production planning. Lead time also need to be considered. Supplier with lower lead time create more flexibility for the company. This lead time may be due to

supplier stock management or distance between supplier and Thawiphon Central Rice Market.

2. Operations

This is the process of manufacturing the product for customers. Key factor of this activity is quality control and production efficiency. It is important that the finish products are in good quality to create customer satisfaction, while producing as little waste as possible to minimize cost of production. Also, flexibility of operational process is important to allow the company to be able to change process as needed in the future.

3. Outbound Logistic

This is the process of delivering the product to the customers. Key factor of this activity is distribution control. This include stock management of final product and delivering method. Good distribution control allows the company to quickly answer customers demand and require as little lead time as possible. Good distribution control together with good transportation efficiency will also minimize operational cost for storage and delivering.

4. Marketing & Sales

This is the process of promoting and selling the product to the customers. Key factor of this activity is price and communication. As Thawiphon Central Rice Market is new to the market, it is important to focus on promoting to show the benefit of the products, while offering a good price point to the customers. This

is to encourage trying of the products and create product acceptance among customers.

5. Service

   This is the process of ensuring customer satisfactions. Key factor of this activity is customer service and feedback. Good customer service ensure that customers are not only receiving product from the company but also help and knowledge as required. Customer feedback is also important for the company to learn and improve their product to better answer customer needs.

Supporting Activities:

1. Firm Infrastructure

   The company should have necessary infrastructure to support the employees. With different business function to operate the business, there should be good cooperation between units and well integrated of company activities to ensure smooth and convenient operation of employees.

2. Human Resource Management

   Employees are very important and core to the company in term of how well the company operates. Therefore, it is crucial how human resource is managed. This include well recruitment process of new employees as well as training and personal development of existing employees. Also, employees benefit and well-being need to be considered to ensure the company can hold on to their staffs.

3. Technology Development

   Product development is important to ensure improvement of products for customers. This will create more value for customers and increase customer satisfaction. Improving production process is also important for more efficient production process and therefore reducing waste and lowering cost of final product.

4. Procurement

   This is the process of obtaining all materials and resource need for the company to operate. Therefore, it is important that there is a good procurement process to ensure good quality of materials used for production at an acceptable price. Relationship with suppliers is also important because of how it can affect negotiation in term of price and other services.

6.2 Marketing and Sales

6.2.1 Marketing Objectives

Short Term (1-2 Years):

1. Create brand awareness for target group to know the product with at least 50% of the customers in 2 years
2. Encourage target group to try the product with at least 20% of the customers in 2 year
3. More point of sales within Bangkok

Long Term (3-5 Years):

1. Increase market share to at least 20% within 4 years
2. Product development to increase product offering for customers
3. Create brand loyalty through product development and promotional activities

6.2.2 STP Marketing

STP marketing strategy is an approach focus on 3 parts, segmentation, targeting, and positioning. Below each part of the strategy is discussed.

6.2.2.1 Segmentation

Segmentation is a process to separate into different group based on geographical, demographic (gender, age, and income), and behaviour. The segmentation of customers is shown as follow:

Geographic Segmentation

Customers is divided into 2 groups based on their geographical location as follow:

1. Bangkok metropolitan region
2. Up-country

Demographic Segmentation

Gender

Gender is separated into 2 groups: Male and female

Age

Age is separated into 3 groups as followed:

1. Age 18-24

   This group is mainly university students who are still being supported financially by their parents. They are a group that have high focus on beauty. As most of them do not have income, they are more price sensitive and have higher preference for proven branded products.

2. Age 25-30

   This group is mainly recent graduate students who are working on the first or second job. Similarly, with university students, they have high focus on beauty. However, they also begin to consider on health. People in this group have income and are willing to pay more for premium product. They are also more willing to try new products and choose based on personal preference rather than society trend.

3. Age 31 and over

   This group is mainly experienced workers who have been working for more than 4-5 years. People in this age group are beginning to have well financial and professional status. They are beginning to focus more on health rather than beauty. Because of this, they often choose product based on personal preference and looking to find products that is best suited for them.

Income

Income is separated into 3 groups:

1. Less than 20,000 baht/month

   This is low income group consisted mainly of people age 18-24.

2. 20,000 – 60,000 baht/month

   This is medium income group consisted mainly of people age 25-30.

3. More than 60,000 baht/month

   This is high income group consisted mainly of people age 31 and above.

Behaviour Segmentation

Customers is segments into 3 groups of behaviour:

1. Brand

   This group of customers that like to use well known and popular product. They like to follow society trend and will often only use products that have been reviewed and proven by other people.

2. Price

   This group of customers is price sensitive. They often choose the cheapest product possible. They have no fix brand preference but will buy the products they feel provide them greatest value in term of money. This group often willing to try new products through promotional and product discount activities.

3. Product

   This is a group of customers that choose what to buy based on their personal preference. They are willing to pay more and do not care about brand if they like the product. This group of people are willing to try new products if they feel that the products can provide benefit and value that they are looking for.

6.2.2.2 Targeting

Using customer segmentation and data collected from performing survey, the main target for rice soap is customers within Bangkok area with age higher than 25 years old. This is because this group of people have higher income and their behaviour is more focus on product than brand and price. Therefore, they are more willing to try new product in comparison to people in age group of 18-24 years old.

6.2.2.3 Positioning

The positioning of Thawiphon rice soap is toward premium product. The company will focus on creating quality product by using quality ingredient that customers can trust. However, due to branding and newness of the brand, the product will be positioned at a lower pricing in comparison to other premium rice soap products. This will encourage trying of the Thawiphon rice soap from existing premium product customers and potentially allow customers who are looking to try premium product at lower price.

6.2.3 Marketing Strategy

From internal and external analysis, market analysis, and competitor analysis, it shows that rice soap is an existing product in the market. However, the product is still not

widely known and is only being used by specific group of customers. Therefore, the company strategy is to be differentiation focus by offering rice soap with good quality that can compete with existing products. The company aim to penetrate the market and create value for customers through offering high quality product at a lower price point in comparison to others.

6.2.3.1 Product

Handmade rice soap is the product for Thawiphon Central Rice Market. The soap is developed using broken Thai jasmine rice product from Thawiphon Central Rice Market. This rice is broken in shape and can be very small in size but still contain high quality nutrition similar to those of normal jasmine rice. The shape of rice is insignificant because it will be blended during the process of soap manufacturing. The rice provides natural source of vitamin E, which help repair the skin and provide moisturizing benefits. This can be used as a good moisturizing agent as well as anti-aging agent. Rice can also give a whitening effect to skin. Not only that the rice soap still provides normal cleansing benefit through use of normal soap ingredient such as fragrant, coconut oil and palm oil. These benefits include good odour, skin moisturizing, and body cleansing.

For packaging, to minimize cost, the product will be package in a paper box that fit the product perfectly. The box will contain basic information of the soap. This include brand, manufacturer, and ingredient used. On the box, photo of the product and the benefits of this products will be shown as well. The use of paper packaging is also more environmental friendly in comparison to plastic packaging.

6.2.3.2 Price

In term of pricing, the price should not be too high as the product is still new to the market. This is so that the product can compete with existing branded products in the market such as Harnn, Banh, and Thann. These 3 brands currently price their product between 150 to 205 baht for 100g rice soap. However, to maintain Thawiphon rice soap product positioning as premium product, the price should also not be too low as this will create brand image that the product is competing with other cost leadership brands such as Ing On, KA-LA, and REYA. These products are currently priced between 30-45 baht per bar soap (130-160g). Because of this, using 9 pricing strategies, Thawiphon rice soap should price the product with high value strategy.

Product or service quality	Price: High	Price: Medium	Price: Low
High	Premium	High value	Superb value
Medium	Over charging	Average	Good value
Low	Rip-off	False economy	Economy

From customer research, consumers, who are looking for premium soap product, are willing to pay more than 150 baht per bar soap. In consideration, together with competitor pricing, Thawiphon rice soap will be price at 150 baht/100g bar soap. This

will make the product one of the best value in the premium market, while still maintaining brand image.

6.2.3.3 Place

Sales for Thawiphon rice soap will be focusing mainly on Bangkok market. To promote products, one of the main sales channel initially will be through promotional booth in events. As customer research show that customers typically buy premium cleansing products from supermarket or online, the company also plan to expand sales to these channels. For online channel, website and social media account will be created, where customers can contact, inquire and order products. The company also plan to penetrate the market through shelfing product in premium supermarket such as Central food hall or villa market.

1. Central Food Hall – 15 Branches around Thailand
2. Villa Market – 34 stores in Thailand, 27 in Bangkok

6.2.3.4 Promotion

The promotional activity will focus on promoting product awareness and encourage target customers to try the product. This will be done through promotional booth in various events, where customers can receive free samples. Promotion and discount will also be used to encourage purchase of the products. Social media and advertisement will be used to communicate with customers to promote the product for more awareness and show benefits of the products.

6.2.4 Communication Plan

Information from STP marketing can be used to identify communication plan suited for target customers as follow:

Demographic and Geographical

People age higher than 25 years old in Bangkok area are mostly workers with medium to high income. Most are office worker with normal working hours between 8:00-17:00, where they commute through driving or public train (BTS/MRT). This group of people are also active on social media throughout the day and at night. They are willing to try new products if the benefit is attractive and constantly looking for most valuable products.

Behaviour

Target customers are looking for product qualities over brand. They are willing to pay more if the product match with their personal preference. However, for similar quality products, they are attracted by the more valuable products.

6.2.4.1 Communication Tactic

Communication tactic will focus on targeting communication toward specific customer group, which in this case is office workers age higher than 25 years old in Bangkok area. Communication is aimed to increase brand awareness and promoting the new product. The product will be advertised through various methods. Communication plan should be of high performance with low cost. The communication of brand and product together with promotion should encourage customers to try the product.

6.2.4.2 Communication Plan

Online Media

As people in the target age group are active on social media, online media is therefore one of the important tools for communicating. Online media is very easy to access by customers. It can be used to share various information including products details or customers reviews. The information online can also be shared among customers easily, thus creating network. It is also easy to create content and promote using online media and therefore it is considered one of main communication tools for promoting the product.

Promotional Booth

Promotional booth can be used as point of contact with customers. Main purpose of promotional booth is to allow customers to have easy access to the product. It can be used to show actual product and promote product details. Free sample can also be given out at the promotional booth. This is to encourage customers to try products. Special offer or promotion discount can be used at the booth to promote purchase as well. Therefore, it can be one of the main points of contact with customers to encourage trial of product and purchase.

Print Media

Print media can be used to promote product information. This include both posters and leaflets. It can be used to promote at many places such as poster in various location, giving out leaflet along public transportation hub, or print media at promotional booth.

The advantage of print media is it can show product information in details and show the main highlight of the product. It is also easy to communicate through print media. To receive greatest benefit of print media, the location is very important and ensure that the people receiving this information are the right target group.

6.2.5 Marketing Budget

Marketing budget for the first year will cover 3 main communication media of online, promotional booth, and print media. The budget is approximated to be around 200,000 Baht. The detail is as followed in Table 20 Marketing Budget.

Media	**Details**	**Length**	**Unit Cost**	**Total Cost**
Online Media	Online Ads	1 year	50,000	50,000
Promotional Booth	Booth fee	12 events	10,000	120,000
Print Media	Leaflet	20,000 pieces	1.50	30,000
Total Marketing Budget				**200,000**

Table 20 Marketing Budget

Chapter 7 Conclusion

This section is intended to summarize all finding from the research, verify research objective, and lastly discuss research conductions and future work.

7.1 Research Finding Discussions

The finding of this research is separated into 3 parts. The first part is finalization of rice soap product. The second part is the added value of the product. Lastly, the final part is product to market plan.

Using Quality Function Deployment, it is identified that to answer customer requirement of good smell and benefits, the focus on production is the formulation of rice soap or in other word the amount of different ingredients used. From this, to find the best formulation, all other production steps were kept the same while only changing ingredients. After many trials, 3 formulations were chosen before one were selected by customers as final formulation.

The formulation shown in Table 21 is the formulation that best answer customer wants. This is due to the good smell of rice fragrance together with gentle and mildness of the soap from olive oil. The rice used also provide good benefits such as skin reparation and moisturizing.

Ingredient	Formulation
Coconut Oil	15%
Olive Oil	28%
Palm Oil	20%
Lye	9%
Water	21%
Fragrance	2%
Rice	6%

Table 21 Final Formulation of Rice Soap

From the final formulation, value added benefits is then calculated. The calculation shows that 1 kg of broken rice can generate up to 13,200 baht of revenue or 9,336 Baht of profit by developing it into rice soap compare to 8 Baht per kg currently sold as animal feed. Rice soap can add value more than 9,000 baht per 1 kg of broken rice. Also calculation for financial benefit per 1 worker hire is identified. If product is well sold in the market, one staff can add profit of more than 77,000 Baht per month.

Lastly, market research and survey show that there is market for rice soap product. By positioning the product as high value premium product, the target customer is customers within Bangkok area age higher than 25 years old. This group has medium to high income and are willing to try new quality product. The plan is to promote product through promotional booth and online media to encourage trying of products before slowly increasing point of sales through premium supermarket.

7.2 Conclusion to Research Objectives

The research objective of this paper is to develop low value rice into value added product to provide extra benefits to Thawiphon Central Rice Market. All tasks were completed including research on market and customer, developing rice soap as product, finalization of product and product to market plan. The result shows that the research align with the objective. By developing low value rice into rice soap product, it provided the company with extra revenue and profitability as shown in the research.

7.3 Research Conductions

7.3.1 What Went Well

Quality Function Deployment help identify the focus in developing the product. It also shows relationship between different level. This help to identify what need to change in production attributes in order to change functional requirement to answer customer requirement. In the future, if the voice of customers were to change, the production attributes can easily be assessed to answer this change.

Customer surveys also went well. It provides great insight on customers to create customer requirement for QFD level 1. The information was also used to come up with product to market plan. It helps in identifying target customers and to come up with marketing and sales plan.

7.3.2 What Went Bad

What went bad is time management of this research. The time planned to conduct this research was underestimated and many steps took longer than expected. This cause

rushing of performing research and writing in the end. Customer surveys took longer than planned to collect enough customers insight. Creating Quality Function Deployment also took longer than expected. This is because of the details and identifying the relationship between each requirement. It is important to align all requirement between each level to have a well made QFD. Lastly, as the time used to cure the soap for water to evaporate can take a very long time, if there is a mistake in production, a lot of time can be wasted. Even though, the focus of product testing was formulation, it is important not to rush other procedure. By rushing other procedure, the product was not in the quality that is expected, and production need to be redo.

Because of all the delayed, there was less time than expected to perform writing of this research. Therefore, the writing was rush and some details may be missed in the paper. Also, more research may be done if time management was better planned.

7.4 Future Work

There are few things that can be done in the future to improve the quality of this research. Firstly, customer survey was only done in a small group of people. Higher number of surveys can provide a more accurate customer insight. It will give a more accurate customer requirement which can better translate into more accurate production attributes through Quality Function Deployment.

As this study focus only on product formulation, another thing that can be done in future is a study on other production attributes and how it can affect customer decision making. This study was done by keeping all other attributes constant while only

changing the amount of ingredient. In the future, product trial may test while keeping formulation constant and changing other attributes to see which type of soap customers prefer. For example, different in size of product, color, or rate of foaming affect customer decisions.

Like customer survey, product acceptance was done with small group of people only. To accurately choose best formulation, more study may need to be done before finalizing the formulation for actual production. Different formulation may also be put into production to see which one receive the best feedback from the market.

Lastly, a more study on detail business plan is needed before launching the product to market. This is to have more understanding of the market and create a more detail planning for promoting product. This will provide a better plan and potentially create a more successful launch of the product.

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APPENDIX

Appendix 1 Survey Details

Total Participants: 30 People

Gender:
Male -13
Female -17

Age:
18-25 – 5
25-30 – 14
31-40 – 8
>40 – 3

Income:
<20,000 – 4
20,000-60,000 – 18
>60,000 – 8

Where to buy
Online – 5
Supermarket – 18
Mini mart – 5
Others – 2

Only buy proven brand?
Yes – 18
No – 12

Only buy when there is promotion?
Yes – 13
No – 17

Try if recommend by others?
Yes – 23
No – 7

Always buy same product?
Yes – 20
No -10

Ranking criteria

1. Smell
2. Product benefits
3. Texture/feeling of soap
4. Price
5. Appearance

Would you try rice bar soap?
Yes – 22
No – 8

What can influence to try?

1. Sample
2. Recommendation
3. Product benefits
4. Price/promotion

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