Empowering the economic capacity of a historic community in Ayutthaya: a drinking water business

Interactive Science and Social Project Report

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Submitted to:

Phranakhon Si Ayutthaya Rajabhat University and Khlong Takien community

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Abstract

This report recounts the building of groundwork, which could lead to an increase in the economic capacity through the sales of bottled drinking water in Khlong Takien Subdistrict, in 2018. The project was developed to analyze, address problems and come up with possible solutions to increase the sales of bottled drinking water in the community. The methods and approaches that contribute to our findings and recommendations including laboratory testing of the water quality, administrative law expert interviews, questionnaire survey, and interviews with people in the community. Through cumulative analysis based on researches, interviews, surveys, participant observations, the team was able to draw conclusions about the project. The team also came up with recommendations for the community such as solutions involving administrative law regarding land issues, promotion and marketing, and the FDA process which will assist the community to increase its economic capacity in the future.

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Executive Summary

Background

Ayutthaya is located in the central part of Thailand where floods occur annually. During 2011, there was a heavy flooding in all areas in Thailand including Ayutthaya. As a result, Khlong Takien Sub-district has developed its drinking water facility since 2011 to supply drinking water during flooding to the people in the community. Initially, the facility was built to solve the community crisis. The facility became well-known and trusted by people in the community. Now, as part of the facility's own development, it is planning to improve its economic capacity by increasing the sale volume of bottled water in order to sustain its operations in the long term. The goal of our project therefore is to build a groundwork, which will lead to an increase of the economic capacity from the sales of bottled water in Khlong Takien Sub-district.

From visiting Khlong Takien Sub-district and its facilities and conducting researches, our team members combined all findings and found that the main issues are: (a) the filtration tank and facilities are located on public land, (b) a certified water quality test had never been conducted, and (c) the income of selling bottled water is low. From the findings, the team came up with four objectives: (1) assure the water quality, (2) understand customer perspective on drinking water quality, (3) create a manual which will lead to an approval from FDA and Halal, and (4) create a marketing strategy. In order to achieve these objectives, methodology was selected; data collection and researches were carried out and analyzed, solutions to address problems and recommendations for each objective were thought up.

Methodology

Objective 1: Assure water quality

According to FDA regulations, water quality needs to be certified by the Department of Medical Sciences or any organizations which are approved by the Ministry of Public Health. The community drinking water has never been certified for water quality - only the Total Dissolved Solid (TDS) meter test has been done. Therefore, the team needs to collect and send water samples to Food Research and Testing Laboratory (FRTL) of the Faculty of Science at Chulalongkorn University, one of the testing organizations approved by the Ministry of Public Health. This will assure that the current facilities produce water that meets FDA standards. In the future, the testing procedure also has to be done regularly to obtain official certification.

Objective 2: Understand customer perspectives about drinking water quality

Two methods were employed to understand the customer perspectives towards drinking water quality and the reasons behind their purchasing decisions. The first method is interviewing

people in the community in order to obtain their views and opinions as to the qualitative information on drinking water products. The second method is collecting data from a survey questionnaire, which provided more detailed information than the interviews. The questionnaire focused more on problem issues and can obtain quantitative data and statistics to support our findings.

Objective 3: Create a manual for an approval from the FDA and Halal

From the team's findings, the filtration tank and facilities are located on public land but without legal records; therefore, a House Registration Book cannot be issued. One of the document requirements for FDA is a House Registration Book for the land used for the drinking water facilities. Therefore, two issues that needed dealing with were (1) how to obtain the legal right to use land, and then (2) how to obtain FDA approval.

3.1 How to obtain the legal use land

The land on which the water production facilities is located on is public land, obtaining the right to use the land involves understanding administrative law. Our team needed to study the administrative law and process. The team made a research on this through interviews with public organizations, lawyers and specialists and asked for recommendations. This included a study of administrative law related to our problems, related public organizations through their websites, and literature reviews on the use of public land. The public organizations that the team interviewed were Sub-district Administration Organization, District Office of Khlong Takien, and the Department of Public Health in Ayutthaya. As a result we received recommendations and different approaches on how to obtain the legal use of land.

3.2 How to obtain FDA approval

Normally the process for obtaining FDA approval can be found on the Ministry of Public Health website. However, for our particular case is a community business which requires more documents and negotiation for a commitment in the community. The community needs to understand the nature of the water facility. A chairperson also has to be selected to head a committee for the operation of the water facility. To help us do this we contacted and interviewed officers at the Department of Public Health. From the Department we were able to get some sample documents of similar cases of drinking water business in other communities that have successfully received the FDA approval.

Objective 4: Create a marketing plan

To create a marketing plan, data on customer behavior was collected tough participant observations, interviews, and survey questionnaires which were designed to understand their behavior towards drinking water and key factors affecting customer purchasing decisions. Apart from the product itself, the team considered elements such as branding and packaging,

distribution, advertising, and pricing. The factors were incorporated into the marketing strategy. Data obtained is used to see how each element can be improved to increase the economic capacity from the sales of bottled water in Khlong Takien.

Recommendations

Recommendation 1: Producers should maintain water filtration and facility process and also check the water quality using TDS meter on a regular basis. According to the results from FRTL, the community water quality should meet all the FDA requirements. If the community can continue to strictly follow the existing production process, it will be easier for them to obtain FDA approval in the future.

Recommendation 2: Producers should improve the distribution network. Once the product has a brand, for example; “Big River” brand, the bottled water should be distributed and sold in most grocery stores in Khlong Takien. This will increase product exposure to more groups of people. If people becomes more aware that the water has been produced in their own community, it is likely that they will support the local business and sales will increased.

Recommendation 3: Producers should create a product campaign. Reduce the selling price as a promotion for a few months when launching the product. According to the survey results, customers mostly choose more well-known brands after they have tried it, found the product safe and thus have a brand loyalty. However, from our research the customers have also mentioned that if they have a chance to try a new lower priced brand with similar water quality as the more well-known brand, they would definitely select the lower priced one. Therefore, the lower price at the product launching time can be a way to attract new customers to try our water.

Recommendation 4: Producers should promote through advertising after launching the brand. In order to achieve consumer’s interest after the product launch, advertisements on vinyl boards and brochures should be placed make the product more visible in the community. Vinyl board can be placed in busy areas of the village, near street vendors and restaurants as well as grocery stores where the products are sold. The advertisements will mean customers will come to recognize the product and the brand quickly. Brochures can be distributed in places such as fresh markets as well as grocery stores. The brochures will give basic information of the product such as the background as a community product, the production process, and trustworthy water quality. These advertising tools, which allow consumers to become more aware of the new brand. In addition, it is not costly to produce vinyl board and brochures and is at the same time an effective method.

Recommendation 5: The village headman and the village committee should relocate the filtration tank and facility. Then rent a piece of land to obtain a proper House Registration to obtain FDA's approval. Since the bottled water facility is located on public land without proper land usage rights, it will take a long time to complete the official process required to legalize the land usage and obtain any legal rights. In addition, the outcome is also uncertain. A relocation of the facilities is an alternative solution to avoid legal implications and a long delay to move forward to obtain FDA's approval. The team recommends renting a piece of land since it does not require a large capital investment at the beginning. We expect the profit from the sales will be able to cover the rental expense.

Deliverables

1. *FDA and related administrative law manuals*

The manual contains the description of how to obtain FDA's approval and related laws regarding the public land use right. It has a summary of steps as well as list of documents required as part of the approval process. There are also sample documents, which were provided by FDA when the team visited its office for a consultation on the matter.

2. *Marketing Plan*

In order to achieve the objective of increasing the sales of drinking water, a marketing plan was established and assessed. The plan outlines marketing activities and advertising strategies for the coming years. It also includes the current market situation, SWOT analyses, marketing strategies, financial objectives and controls.

3. *Brochure*

As part of the marketing plan, a brochure is used as a tool to promote the product by educating consumers with regards to bottled water, the production process such as reverse osmosis and UV radiation, and water quality.

4. *Label*

The brand and its label are designed to provide product an attractive identity, which will help customers to notice and remember it. A QR code will be attached. Its content will describe the community's history, and the water production processes, which make the consumer more aware of Jom Hae village's cultural background.

5. *Vinyl board*

Vinyl board is another part of advertising. The board will help people to know more about Jom Hae drinking water product. The board includes information about our brand, where the water came from, and what process is used in its production.

Chapter 1: Introduction

During the 2011 monsoon season in Thailand, Jom Hae village in Ayutthaya Province was one of the areas that was completely flooded. During the flood, the severest problem was the lack of drinking water. Boats had to be hired to transport drinking water from outside areas into the community at fairly high cost. Jom Hae village is located near the Chao Phraya River, therefore the water level may rise at anytime and flooding can occur every year. As a result, the village chief and people in community came up with an idea to produce their own drinking water to serve people in the community. This idea was incorporated into the "Civil State Project", for which the government offered funds to local villages to develop their community. People in community can filter the water using water purifier. This method is less costly less transporting water by boats when flooding occurs. After the filtration and drinking water facilities were built to serve community for many years, the community now plans to sell the drinking water to a wider group of consumers as a way to increase community income, which in turn can support and help develop the village as a whole. Currently, the income from drinking water is approximately 7,000 baht per month with a profit of 3,500 baht. Moreover, an increase in sales and water volume expansion will mean more employment for its population in different areas such as in water production, maintenance, delivery, quality control and many more.

The goal of this project is to increase the sales of bottled water by creating a label for the bottled water, to make local bottled water more attractive and to make it more reliable by being certified by national health authorities. Furthermore, marketing strategies like distribution of the product to neighboring villages can help increase the sales volume. Survey questionnaires were used to obtain customers' opinions, which can be used to improve the product and provide information on how to satisfy our customers' preferences and satisfaction.

However, before receiving the approval from authority and wider distribution, our product quality has to be guaranteed with FDA and HALAL criteria. If the quality of product is not up to standards, the project will have to turn its main focus to improving the water quality.

Therefore, the main activity in this project is to achieve quality approval from the government authorities (FDA and HALAL). Only if we are certified will the brand will be trustworthy for our consumers. Therefore, the steps to be approved by FDA and HALAL were set up.

The main sponsor in this project is the Faculty of Sciences of Phranakhon Si Ayutthaya Rajabhat University[1]. The university is currently conducting "The Way of Life to Sustainable Living Project", which educates and give support to the village communities in Ayutthaya Province.

Chapter 2: Background

To design the project, background information and references from secondary data, our project sponsor, local people, and details about the production process, are gathered to understand and assess the current situation. In addition, the information regarding FDA and Halal is also collected. This information is used to design the methodology in the subsequent chapters.

The background chapter is divided into five main sections:
(2.1) Background on Khlong Takien Subdistrict
(2.2) Background on Jom Hae village and drinking water facility
(2.3) Jom Hae drinking water production process
(2.4) Phranakhon Si Ayutthaya Rajabhat University, the sponsor
(2.5) Food and Drug Administration (FDA) and Halal

2.1 Background on Khlong Takien Subdistrict

Khlong Takien is a subdistrict in Ayutthaya province. It is located near Chao Phraya River. The river is essential for people in the community who depends on it for agriculture, farming, fishing and other industries. The location of Khlong Takien is situated 10 kilometers from Ayutthaya city center with a total area of 3.14 square kilometer [2]. Khlong Takien is special for being a historic community, where most of the local population are Thai-Muslims and Thai-Buddhists who have been living together for over a hundred years. There are 13 villages in Khlong Takien, and its topography is part the lowland areas along Chao Phraya River. Chao Phraya River is the major natural water source for the areas, which it passes through, including of course Khlong Takien. However, Jom Hae village, Village 12, is the focus in this project because it is the first village in the area that has established its own drinking water facility.

2.2 Background of Jom Hae village and drinking water business

2.2.1 Jom Hae village

- Population

The population of people living in Jom Hae village is approximately 730 who are mostly Thai-Muslims. In the entire Khlong Takien Subdistrict: 95% of the population are Thai-Muslims while the other 5% are Thai-Buddhists.

- Geography

Jom Hae village is situated in an alluvial plain near the Chao Phraya River. The land is slightly above sea level and is lowering as the years go by. The river's water level may rise at

any time. Flooding occurs every year and can last for approximately 2-3 months. For this reason, Jom Hae people are not in farming and agriculture as in other parts of central Thailand.

Furthermore, Jom Hae village's another name is the "Big River" because, though it is merely a small village in Khlong Takien, it is directly connected to Chao Phraya River.

- Occupation

Most of the local people are factory employees, merchants, and fishermen. Fishing net weaving and chicken coop making used to be the main occupations for Jom Hae villagers, local people now tend to work in the factories because of modern economic growth which brings with it social changes.

2.2.2 History of Jom Hae's drinking water facility

In 2011, Thailand was hit by the worst and severest floods in five decades for many months. This incident affected many areas, especially on the northern and the central regions of the country. The Khlong Takien community was one of the most severely affected areas, leading to a lack of clean drinking water. The affected people had to wait for help from the government. Donations from the government included clothes, foods, drugs, and bottled water. To prevent a similar hardship from heavy flooding, the community developed their own drinking water facility in 2011. Initially, the facility was built to deal with the immediate crisis; however, since 2017, the community came to a decision together to commercialize the drinking water they produce by investing in a bottle capping machine and started to sell it water within the community. Now, the village would like to develop the facility and increase it water production volume further. Consequently with this development it hopes to improve the community's economy as a whole.

2.3 Jom Hae drinking water production process

2.3.1 Raw water resources

Underground water is selected as a suitable water resource, which is transported to filtering system. The water output is for consumption in households of the community because it is the cleanest compared with other water sources. The underground water is under the control of Department of Ground Water Resources. In order to get access to underground water, permission from the Department is needed.

2.3.2 Water filtration machine

The filtering system involves many machineries and processes. First, the underground water is transported from underground to the first machine to filter large objects such as stones

and coarse sand in the water. Three other filtration machines which is connected to the first machine are used to filter chemical substances. After these filtration steps, a reverse osmosis water purification machine if used to remove contaminants that create taste and odor in the water. After that, the water is then stored in a large stainless steel container and then is introduced into UV sterilization machine in order to be sterilized before being passed on to a vending machine and is ready for consumption. However, in the case of bottled drinking water, the water which is stored in a large stainless container and sterilized with ultraviolet light would go through the fine filtration machine again. Then the water is filled into plastic bottles and enclosed with lids.

2.3.3 Bottling

Water from the last filtration machine is transferred to a pumping water system using a pressure pump in a closed room and is put into bottles. A dozen bottled water is arranged on a hydraulic pump machine, then water is pumped into the bottles. The bottles are closed with lids using Pneumatic Capping Machine. Next, the bottled water, 600mL in volume, is packed into plastic bags, 12 bottles per bag. Finally the finished product is distributed to retailers and customers. Based on the interview with the producer, the drinking water facility is capable of more production.

2.3.4 The particulars of the drinking water product

The final product is a clear labelless bottled water without any branding. The cost of production is around 1.85 baht to 2 baht per bottle due to machine maintenance cost at times. The bottled water is sold at a retail price of 5 baht per bottle while the wholesale price is 30 baht for a dozen.

2.4 Our project sponsor: Phranakhon Si Ayutthaya Rajabhat University

Phranakhon Si Ayutthaya Rajabhat University, the main sponsor of the drinking water project, was originally a teacher training college at Wang Lung during 2411-2453 BE. Later it became a university offering Bachelor Degree programs. The main curriculum followed the western education system as the foundation of the education system in Thailand. In 2518 BE., the Faculty of Science and Technology was established offering a Bachelor Degree in Physics Physics as its first science major.

The funding for this project is derived from part of the annual government budget for Thailand Institute of Science and Technological Research. In its researches, the institute has adopted the Sustainable Community Development Model to strengthen the economy of communities. Phranakhon Si Ayutthaya Rajabhat University has supported research projects that involve development of community drinking water. The Institute's mission is to provide

academic knowledge to develop higher education learning, apply scientific and technological knowledge to develop communities. It does this with a special emphasis on good governance and sufficiency economy. It also support others stakeholders outside the university in the local community.

The Sponsor's Challenges in accomplishing its mission and the proposed project

- Government authority and legal enforcement

The legal factor is the essential challenge for this project because if the community tries to launch their products outside their village in order to increase sales. The drinking water bottles need to obtain an approval, as a label of quality, from the Food and Drug Administration (FDA) which is under the authority of Ministry of Public Health. Obtaining the FDA approved label is key to achieve the sales increase because it also provides quality assurance for consumers. Without the FDA label, customers and distributors may not be confident in the product, and to expand the sales to areas outside the village may be difficult or not as successful.

- Budget

Expanding product sales requires additional funding: more budget for producing more bottled water, bottled and cap, brand and label, transportation as well as promotion and advertising expenses.

2.5 FDA and HALAL

Food and Drugs Administration Department of the Ministry of Public Health or better known as FDA plays a major role in protecting consumers' health and preventing diseases by assuring the quality of foods, drugs, medical supplies, and cosmetics (the latter is also classified as health products). It ensures that health products have acceptable quality and safety standards. It also promotes appropriate consumer behaviors by providing reliable and accurate scientific details on its approved products and educating consumers how to use the products appropriately.

Putting the FDA symbol on a product nametag requires an official approval. The details which are required for an approval are as follows:

- The location of the production sites, tools, machines and equipments used.
- The factory's sanitary measures and conditions as well as staffs or employees who must meet the Good Manufacturing Practice or MP standards.

Figure 2.1 FDA symbol

FDA's Vision

- FDA is a national organization which controls the quality, safety, and efficiency of health products and make sure they are produced according to the law and universally accepted methods and principles.
- It also develops the consumers' potential for self-care in consuming the health products in an appropriate way.

Criteria

To satisfy FDA criteria, the production process must follow these steps:

1. There must be a quality checking system of the manufacturing process. Regular checks and control of the production process and the factory's machineries and equipments. The factory sanitation must meet the standards with staffs to assure the production meet the criteria of Good Manufacturing (GM) practice.
2. There must be a quality checking systems of the products, packaging standards, and accurate information on the label. The FDA symbol must be inside the closed packaging. [3]

E-submission for an FDA certification is also possible if the company has all the required documents and product identification number from the Ministry of Public Health (first 8 digits form total 13 digits)

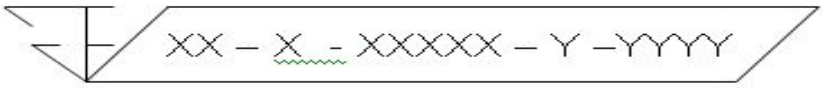

Figure 2.2 FDA code

In order to receive a 5-digit FDA code, the applicant can submit required documents for an approval of the health products by registering in the E-submission system. After the documents have been checked by the Ministry of Public Health, files of the documents

will be uploaded into the system. There is a registration fee, after the fee is paid, the applicant will obtain FDA approval documents.

HALAL

Figure 2.3 Halal symbol

Halal symbol indicates that the food products or drinks were produced following the Islamic law and are appropriate for Halal consumers. According to the statistics, most of the population in Jom Hae village are Muslims. The Halal label is therefore necessary and useful for Halal people. The criterias for Halal label approval are almost the same as those of FDA. Generally, a product needs to pass the FDA's test before it can go through Halal criteria check. The latter focuses on Halal special regulations such as no animal is allowed to be around the production area. The example of animals that are prohibited in the production line are pigs, boars, dogs, snakes, monkeys, carnivorous animals with claws and fangs such as lions, tigers, bears, and other similar animals. [5]

2.6 Structure of governance

The government offices and officials who are involved in the process of obtaining a House Registration Book - which is a necessary document in our FDA approval process, are Village Chief, District Chief, Subdistrict Administrative Office, and the Department of Land of the Ministry of interior.

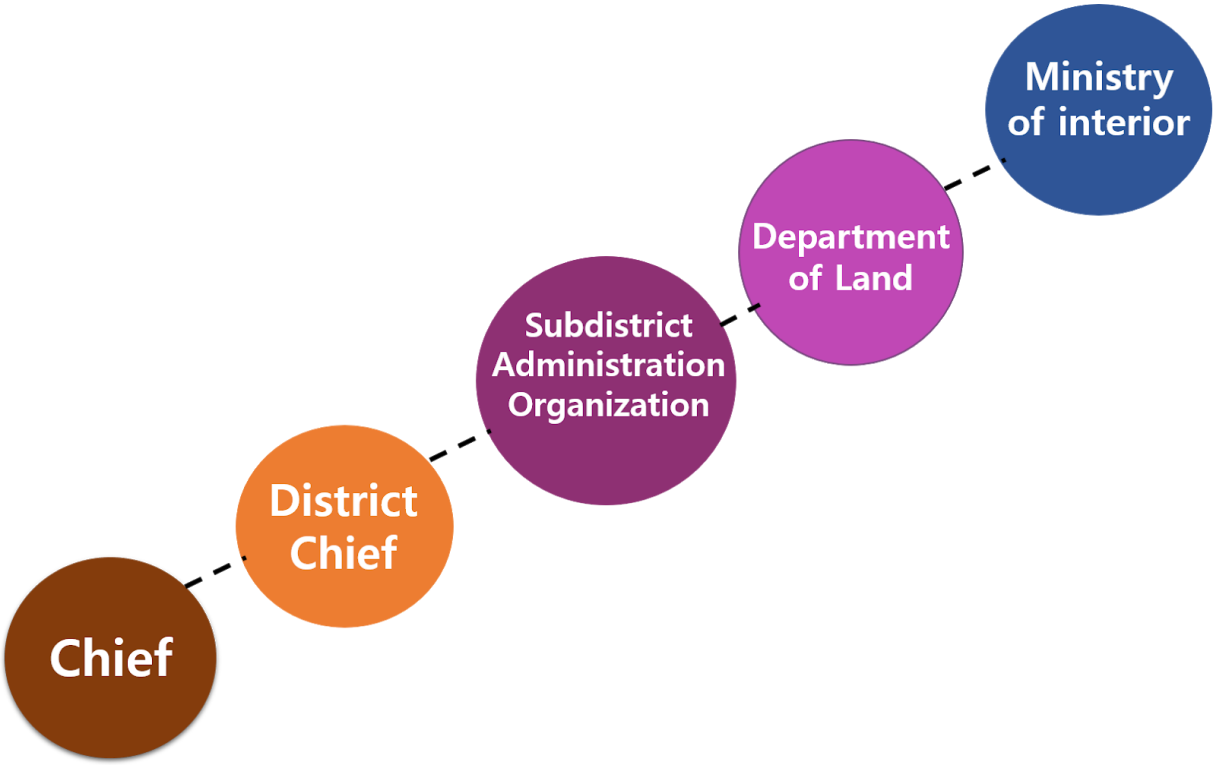

Figure 2.4 The associated government officers and administrative organizations which are involved in the process of obtaining a house registration number

The Chief is the head of the community and is responsible for any activity or event that takes place in the community. Normally, the Village Chief is the person who has a close relationship with the people in the community and also knows the most about his people, activities in the village, and issues in the community. To obtain the house registration for our drinking facilities, the Chief is the key officer who will submit the petition to the government offices concerned.

The District Chief is the person who oversees land management and title deeds documents. He/she has four main responsibilities: (1) implement the decisions of the local authority, (2) provide advice to members of the local authority and any community board, (3) ensure that all the functions, duties, and powers delegated, imposed or conferred by any official Acts, governmental regulations or by law to any person employed by the local authority, are properly exercised or performed, and finally (4) ensure an effective and efficient economic planning and implementation of the plans by the local authority.

Subdistrict Administrative Office deals with and acts as a support to its subdistrict activities, provides public facilities, and manages local authority, etc. Someone who wants to

start a company or business, needs to apply and register with the Subdistrict Administrative Office who will ensure that the profits from the sales will be used for the community.

The Department of Land is responsible for issuing title deeds, registering the right land use, and maintaining public land areas belonging to the state. The Department of Land provides the history and the legal information on the usage of land.

The Ministry of Interior is responsible for policing, emergency management, national security, registration, supervision of local governments, conduct of elections, public administration and immigration matters. The Ministry holds the most important authority and responsibility on the other local governmental offices.

Chapter 3: Methodology

The goal of this project is to build a groundwork which will lead to an increase in the economic capacity through the sales of bottled water in Khlong Takien sub-district.

To achieve the above main goal, the following objectives have to be fulfilled:

Objective 1 : Assure the water quality
Objective 2 : Understand customer perspective about drinking water quality
Objective 3 : Create a roadmap - according to the official laws and regulations- leading to the approval from FDA and HALAL
Objective 4 : Create a marketing plan

3.1 Assure the water quality

To assure the quality of the drinking water, the producer used the Total Dissolved Solids or TDS equipment to check the product quality every two months. TDS determines the quantity of the colloid solids or those dissolved in the water including ions, minerals (salts) and metals. A TDS meter is associated directly with the purity of drinking water as well as quality of the filter machine in water treatment system. The total solid dissolved in water is measured in part per million unit or ppm or mg/L.

Moreover, the United States Environmental Protection Agency (EPA), a government agency concerning the American environment and its impact on human health, certify that the quality of drinking water product must not exhibit TDS level more than 500 ppm and if TDS level exceeds 1000 ppm, the water is not appropriate for consumption due to excess potassium, chloride and sodium ions content. Though these contents do not affect human health in the short term, the toxic ions such as cadmium, lead and arsenic are harmful to consumers' health. In

general, the high TDS measurement quantity not exceeding 500 ppm does not affect consumers' health but it affects the variation of taste - bitterness or saltiness - and the smell of the drinking water.

The team took Jom Hae's bottled drinking water product to test the water quality at Research and Testing Center at Faculty of Science, Chulalongkorn University and also to ensure the quality of bottled drinking water in Jom Hae community.

Figure 3.1 TDS meter

Source: https://www.amazon.in/Wasser-Meter-Purity-Tester-Leather/dp/B06Y5R75X9

3.2 Understand customers' perspective on drinking water quality

In order to understand the customers' perspective towards the quality of drinking water, a questionnaire survey approach was selected to collect data and relevant facts. The team's approach included designing the sampling group, preparing issues to focus on in the questionnaire, and preparing for extended interviews.

3.2.1 Sampling group: Population and sampling design

Population sampling is a statistical analysis process which takes representative samples from an entire population with a sufficient size of samples.

Population

The total population involved in the research was composed of two groups which are:

1.1 Target population

The target population is the total group of people in whom researchers are interested and will use the data from this group to reach generalised conclusions. The target population usually has varying characteristics. To meet the set of research criteria, the total population in 13 villages within Khlong Takien sub-district have to generalize the study findings. Based on the population statistics of a total of 13 villages, the total population of Khlong Takien sub-district is 4,998 of which 2,401 are male and 2,598 are female.[6]

1.2 Accessible population

Accessible population is the population in the research to which the team can apply the conclusions. This population is a subset or a part of the target population and is also known as the study population. Out of the total of 13 villages of Khlong Takien, Jom Hae, the 12th village in Klong Takien district, was one which the team had reasonable access. It has a total population of 600 people of which 296 are male and 304 are female.[6]

Samples

Randomly selected samples by the sampling method was used to select people in Jom Hae village to identify the equal opportunities for selection in the study in quantitative sampling research of the known population in probability samples as in the finite population *(Yamane 1973)* [7] formula below.

$$n = \frac{N}{1+Ne^2}; \qquad n = \frac{4,998}{1+(4,998)(0.15)^2} = 44.05$$

$$n = \frac{600}{1+(600)(0.15)^2} = 41.38$$

n = sample size from total population, N = finite population (from Jom Hae village population or from all the villagers of 13 villages in Klong Takien district population), e = sampling error (15%) = 0.15 [8]

The total sample size from the target population in Klong Takien sub-district comprised of 44 people and the total sample size from the accessible population in Jom Hae village was 41. In this research, the questionnaire surveys were divided into 3 types; (1) questions and close-ended questionnaires, (2) text input type questionnaire with open-ended questions, and (3) ordering/rating type questionnaire which allow respondents to rate their order of preference. The third type of survey allowed the team to analyze the respondent data and obtain a ranking result. The samples were randomly collected from other surrounding villages of Khlong Takien

sub-district and specifically from Jom Hae village, to obtain further supporting data which can be used to draw more accurate conclusions on how to improve the local drinking water product.

3.2.2 Data collection from survey questionnaire

The purpose of the survey questionnaire which consisted of a series of questions was to gathering information from respondents [9]. The team distributed the questionnaire sheets to people in community and collected, which were then classified and analyzed. The method was selected to allow respondents to take time to complete the questions and it also allowed them to maintain their anonymity. However, the method also had disadvantages, for instance, the written data obtained might not accurately convey feelings and emotional responses and the respondents could lack interest in providing detailed and accurate responses. [10].

3.2.3 Group interviews

Because of the disadvantages of questionnaire survey, the team compensated this by collecting more information by way of extended interview questions. The extended interview questions are based on the survey questions in the sheets that were distributed. The team went through the questionnaire one by one with the respondent and marked down the answer in each question. In addition, the team also asked the respondent the reasons and rationales for the answers given. Through the extended interviews, additional data was collected. For instance, one question was: "What is the key factor that makes customers decide to purchase Jom Hae drinking water?" and after the respondent wrote his/her answer in the question sheet, the interviewee would ask him/her to explain further about his/her answer. Additional related questions to that answer were then asked. So more detailed information was gathered from these verbal interviews.

3.3 Create a roadmap according to official laws and regulations leading to an approval from FDA and HALAL

In order to expand the sales of bottled drinking water and ensure the consumers' confidence in the product, FDA and Halal endorsements are necessary.

Background research and planning

- Documentary research

  Researches were done to collect relevant documents and background on Food and Drug Administration (FDA) and Halal of their requirements and approval procedures. In addition, calls and direct interviews with officers of related government offices were

made to ensure the team fully understand the required documents as well as the approval procedures.

The purpose of Food and Drug Administration (FDA) certification is to ensure the products meet the quality and safety standards. Since the bottled drinking water in Khlong Takien has not yet been certified by the FDA, one way to improve and ensure the quality of the product is to obtain the FDA certification. Ayutthaya Public Health Office is the representative of FDA in this matter.

The information which can be obtained from FDA website are as follows":

- Contact number
- FDA approval process
- FDA criteria
- Documents necessary for an approval such as lists of machineries and equipment in the manufacturing process, a request form to register the company and its location

Halal Certification Organization is under the charge of the Central Islamic Committee of Thailand. This organization is also important for the drinking water business in Khlong Takien since the people in the community and the surrounding areas are almost all Muslim-Thais. Our products therefore must meet their needs.

The information which can be obtained from Halal are as follows:

- Contact number
- Halal approval process
- Halal criteria and types of food products which can be certified
- Background on Halal label and Muslim practices

3.4 Create a marketing plan

Based on the team's assessment of the current situation and data collected from the survey on customers' perspective towards water quality, the marketing plan was drawn up focusing on 3 areas which are: label and brand, distribution and promotion & advertising.

3.4.1 Label and brand

Label and brand are symbols that can influence the customers to buy the product and helps the brand to be recognizable and more visible. Currently the bottled drinking water product has no brand. Consumers purchase the water because they know and trust the producer by word

of mouth. The sales of the water is limited to Khlong Takien community. Therefore, if we want to expand the sales, a brand would create an identity outside the community. The name of the brand should reflect a local characteristic of Khlong Takien for brand recognition purposes. We can come up with a few names and brand logos and then involve the people in Khlong Takien and the surrounding community to select or express their views of possible name and overall design for their bottle water product.

Once the name and design has been finalised, the label on the bottle can include a QR code, which provides product information for consumers as shown on advertising brochures. Product information can include the drinking water's history, the production process, and the water quality.

3.4.2 Distribution

Transportation

Transportation is another factor to consider when creating an efficient marketing plan. An observation method was used to decide the kind of transportation that will meet the customers' needs. Our team members observed how people obtained drinking water, whether they buy the water themselves or they depend on any particular delivery service. An effective distribution system and method of transportation must match the customers' convenience and be able to compete with other brands' distribution method. To find out customers' preferences, interviews were conducted regarding convenient delivery methods and fees.

3.4.3 Advertisement

Vinyl Board

To promote the product, vinyl boards can be used. The board will display FDA quality approval and the UV radiation and RO technology used in its production. Advertisement boards will be placed in different and visible locations and in Khlong Takien as well as in the surrounding communities.

Brochure

Brochure is a very effective marketing tool to inform the customers about the drinking water product: the background history of the business, how the water is produced in the community, about the production process that is reliable and has been certified. To promote our drinking water, booths can be set up where brochures will be given out.

Chapter 4: Results and Analysis

Methodologies and approaches such as participant observations, interviews of people, survey questionnaires for people both inside and outside the village, gathering information from government organizations were carried out as described in Chapter 3. The information and data collected were then put together and analyzed to identify key findings and issues. The key findings will help us reach the goal and objectives of this project and provide important basis on which we can select the best solutions to problems and suggest recommendations for the project sponsor and the local people of Khlong Takien Sub-district.

4.1 Assure the water quality

Before launching bottled drinking water in a wider market, water quality is the most important issue that the producer must address. The production process should be strictly controlled with regular testing in order to produce a high-quality product. Water quality is the main criteria for obtaining FDA certification and is also the deciding factor in creating consumers' confidence in the product and consequently its marketing and sales.

Finding #1: The result from TDS meter shows that the quality of Jom Hae drinking water is up to standard

Results from measurements by TDS meter proved Jom Hae drinking water is proved to be safe and suitable for drinking. The TDS meter measures all anions and cations that are present in the water by measuring the electric conductivity of the water. According to the interview of a staff who routinely checks the water filtration process, every 2 months, TDS meter is employed to test the water quality and the average result is 16 ppm. If the result is higher, a maintenance procedure of the filtration process will be carried out in order to decrease the TDS level to the level it should be. Normally before the water passed through the water filtration process, the measured value shown on TDS equipment was approximately 500-600 ppm, after the filtration the value decreased to approximately 16 ppm for RO water. It is evident that water filtration process of Jom Hae community was working efficiently. The value of water output on TDS equipment was not exceeding 30 ppm, which is the standard value for ideal drinking water as shown in **figure 4.1**.

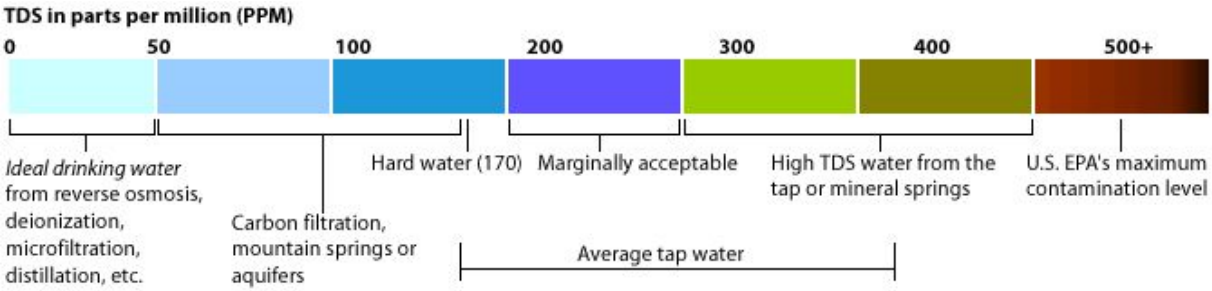

Figure 4.1 TDS measurement standard

Source: http://www.toxicwatersolution.com/Water-Quality-and-Water-Toxicity/How-to-Test-Water/Total-Dissolved-Solids-TDS/

Finding #2: The results from the TDS measurement was relatively close to that of well-known brands.

The major reason which leads to more confidence in the water quality of Khlong Takien facility is the finding that the results from its TDS measurement is comparable with the measured results of other global drinking water brands such as Nestle. The same production method is used by Nestle. The measured result of Nestle was 30 ppm while the measured value from Jom Hae village was 16 ppm, which almost the same as that of the Nestle. Khlong Takien water facility looks to renowned brands as a standard to stabilize its water filtration process. If the resulting measurement is higher than that of the renowned brand, the water filtration process has to be examined and corrected to produce a lower TDS level.

Finding #3: The results from water quality testing by the Food Research and Testing Laboratory (FRTL) matched all criteria of drinking water quality of the Ministry of Public Health.

In order to obtain a quality report for FDA and to increase consumers' confidence, the water quality test has to be conducted in a reliable laboratory. Our project team took Jom Hae's bottled drinking water product to be tested at the Food Research and Testing Laboratory (FRTL) of the Faculty of Science at Chulalongkorn University. A sample of Jom Hae drinking water was thoroughly tested using biological, chemical, and physical processes. The lists of FRTL tests are identical to the requirements of FDA and the Department of Public Health.

After 3 weeks of testing, FRTL reports that all of the results from biological, physical, and chemical processes passed every FDA criteria (See Appendix attached).

4.2 Understand customers' perspective on drinking water quality

Mixed methods were used to understand the customers' perspective towards drinking water quality and understand what the reasons behind their purchasing decisions. The first method was to interview people in the community to obtain their views and thoughts about the

information about the drinking water. The data acquired from these interview is therefore qualitative. The second method was to collect data from survey questionnaires, which would give more specific information than the interview method, and is therefore quantitative data. The questionnaires were focused on problem issues. The results are quantitative information and statistics gained can be analyzed and used to make conclusions.

4.2.1 Information obtained from interviews of people in the community

The project team interviewed consumers of drinking water products since these customer groups are the ones who have the most impact on the business. The information from existing customers would allow us to understand their perception of the product, purchasing decisions, as well as product attributes that were important to them. This information is used for preparing a marketing plan. Apart from customers' opinions, perspectives of producers' and the Chief should also be considered. The Chief of the Village is the one who has the authority to make the final decision. Opinions from all of these groups of people will impact the success of the product sales increase. In terms of drinking water quality, according to the interview results, it was an important factor for customers even though people in Jom Hae village already trust the water quality. However, if the water quality has not been certified as safe by FDA, it is very unlikely that customer groups outside the village would purchase Jom Hae water.

Finding #3: People in the community still buy Jom Hae village water even though it has not been certified by the Department of Public Health of Ayutthaya Province.

The results from the surveys and interviews from local people show that although Jom Hae water has not been certified as official safe and clean by the Department of Public Health of Ayutthaya, the people in the community still strongly believe in the quality of the water and buys the drinking water from the facility.

The reason given for being confident in the safety of bottled drinking water product was: Jom Hae water tastes good, is colorless and has no smell therefore they feel that the water is just as good as other brands.

Finding #4: Neighboring villages order bottled drinking water from Jom Hae village although some villages have already installed the water filtration machine within their area.

The results from participant observations in surveys and interviews showed that consumers of the water are from Jom Hae and neighboring villagers such as Moo 9. Currently, the water filtration machines are installed in several areas surrounding Jom Hae village; however, we found that it was unusual that most people still prefer buying water from Jom Hae village. So the team interviewed other producers and visited other villages' production facility

with their water filtration machines, then observed and compared the differences between the villages. The researchers found that other production facility, such as in Moo 9 of Khlong Takien Subdistrict, did not have the machinery which was essential trapping sediments and removing solid particles from the water. The process without sediment trapper affects the water quality leaving a presence of contaminants, which are harmful if consumed in high quantity. Therefore, people in neighboring villages chose Jom Hae drinking water instead and buy their village drinking water for other purposes, for example, for domestic animals like chickens and ducks, or for washing and cleaning the house.

In addition to interviewing the producers, the team also interviewed the distributor who was the wholesalers who buy a large quantity of Jom Hae water and deliver them to households and schools in the villages. A distributor of Moo 9 stated that people in the community including herself were more confident in the quality Jom Hae drinking water because of the appearance of the water, its taste and smell: "I feel very confident in Jom Hae drinking water because of its taste, color and odors. I have seen the water filtration machine at Jom Hae village. It is effective and clean. Therefore, although the water quality has not been certified by the authority and does not have a FDA approval, this fact cannot change my decision. I still choose to order from Jom Hae village. Moreover, I believe that neighbors of the community feel the same as me "

4.2.2 Information obtained from survey questionnaires

Finding#5, The quality of Jom Hae drinking water is the primary reason why people in community choose to buy it over other brand.

According to the survey questionnaires collected in, the team surveyed 85 local people living in Jom Hae and its neighboring villages such as Moo 9 of Khlong Takien subdistrict. It was found that most people consumed Jom Hae water because of their confidence in the quality (as shown in **Figure 4.2)**. 57%, more than half of the people living in Khlong Takien subdistrict choose to buy Jom Hae drinking water due to its good quality. 14% of the people answering the questionnaire chose it for the cheaper price, 11% chose it because it was a local product and also 11% chose it because it was convenient to buy and finally 7% chose it for other reasons such as color, odor and packaging. Quality was the most important factor for consumers.

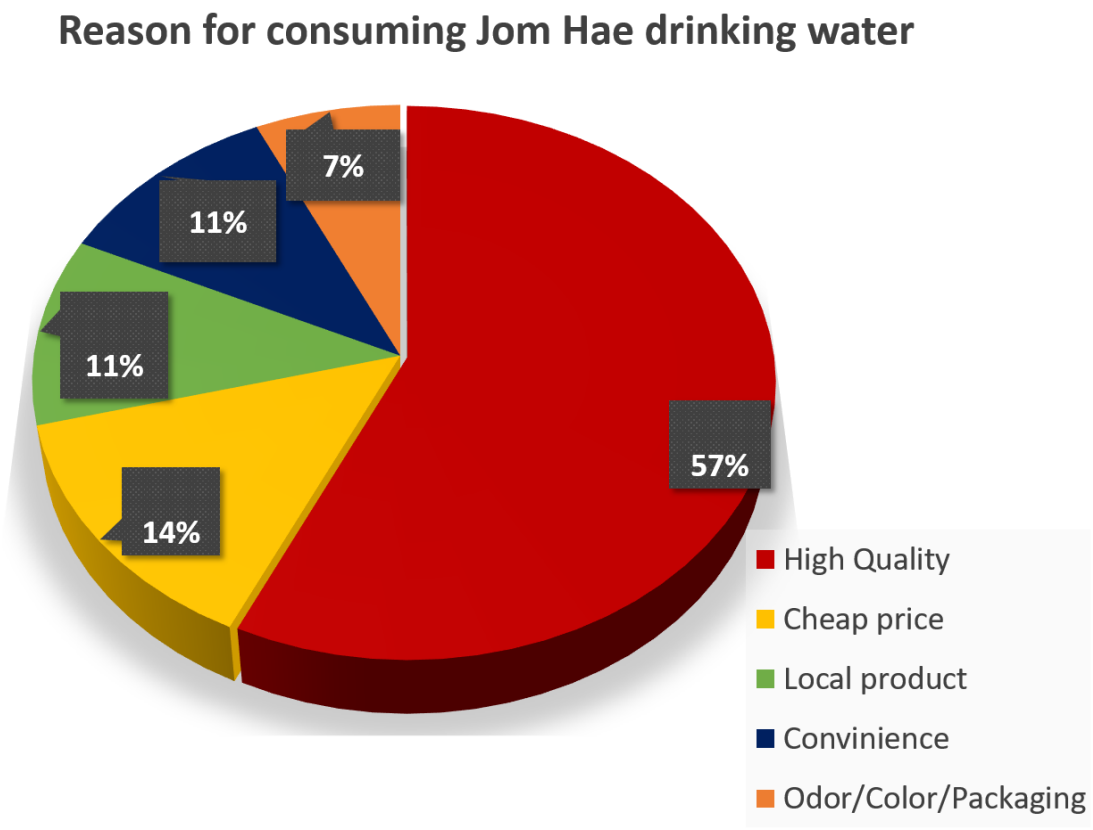

Figure 4.2 A pie chart illustrating the reasons for choosing Jom Hae drinking water

4.3 Create a manual to obtain an approval from FDA and HALAL

In order to create a manual to satisfy FDA requirement, the project team conducted research and gathered information through literature review, the Internet, and government websites and interviews with government officers. After assessing the information from these different sources and we finally came up with a summarized version of a manual so that people in the community can use it in the future.

According to the criteria for a HALAL approval, most of the documents and criteria are similar to those of FDA criteria and all need to be submitted to the Department of Public Health for an approval. Halal Drinking water production does not have as many regulations or restrictions in terms of ingredients. Therefore, before obtaining HALAL label, it was easier to satisfy FDA's criteria first.

Finding #6: Location of the filtration tank facility on public land as the main obstacle to obtaining FDA approval.

The filtration tank of water production facility is located on public land, and public land does not have a house number. Without a house address number, FDA cannot issue an approval.

The project team learnt from the village chief who informed us that the water filtration and packing facilities are located on public land. It was also necessary to check that the land has never owned by any private enterprise. Fortunately, after checking with Subdistrict Administrative Office, a surveyor sheet clearly stated that the land is definitely public land and not a private property.

Normally public land is a place where people in the community can make use of without having a house registration number. Public land can be used for community's activities and public transportation such as roads. However, this piece of land is used as a water filtration facility and for bottled drinking water production. At first, the facility was not meant to be a profit making one. Therefore, they did not need to obtain a FDA certificate. Presently however, the community sees it as an opportunity to expand the production and increase sales improves the overall economy of the villages.

In order to obtain the FDA label, a house number is required since it will also designate the responsible for the use of land. The project team therefore had to find a way to have a house registration number for a piece of public land which is not often the case.

Finding #7: Doing business on public land is illegal.

After finding out that the facility is located on public land, the team had to investigate further on regulations regarding the use of public land. The team consulted with a professor and specialist on Administrative Law from Faculty of Political Science. He confirmed that doing business on public land is illegal. If the community continues to conduct its business, the authorities have the right to expropriate the land and the village chief can be charged for public land invasion.

Finding #8: The only office which can grant a house number on public land is the Minister of Interior.

The professor and Administrative Law specialist from the Faculty of Political Science also informed us that to get an approval to use public land we need to go to the Ministry of Interior. Therefore, the team's task was first make the production at the facility a legal one. A petition needs to be sent to several government offices and will be finalized in the end at the Ministry of Interior.

4.3.1 Information obtained from the Department of Public Health of Ayutthaya

We visited the Department of Health in Ayutthaya and was given case studies of successful FDA applicants to study as examples. One sample case study documents that has been

successfully approved by FDA belong to Khlong Pak Kran, located 6 kilometers from Khlong Takien subdistrict.

Unlike private enterprises, additional documents need to be submitted in the case of community development project. When there is a production involved in the project., there needs to be an individual who would take the legal responsibility for any problem or issues related to the products.

4.3.2 Information obtained from Khlong Takien subdistrict office

The main problem was how to get a house registration so we went to consult number the Deputy District Chief who has the official responsibility regarding house registrations. Deputy District Chief provided us with useful information regarding the basic rules and regulations for getting a house number and also a temporary house number for constructions on public land [11]. However, Deputy District Chief informed us that even though it is legally possible to get a house number on public land, he does not have the authority to grant it. An application needs to be sent to a number of government offices namely Ayutthaya Provincial Land Office, the Department of Land, and the Ministry of Interior. In our case, the Minister of Interior has the authority to give the permission for the subdistrict to grant a house number. The steps on how to obtain a house registration number is shown in **figure 4.3**

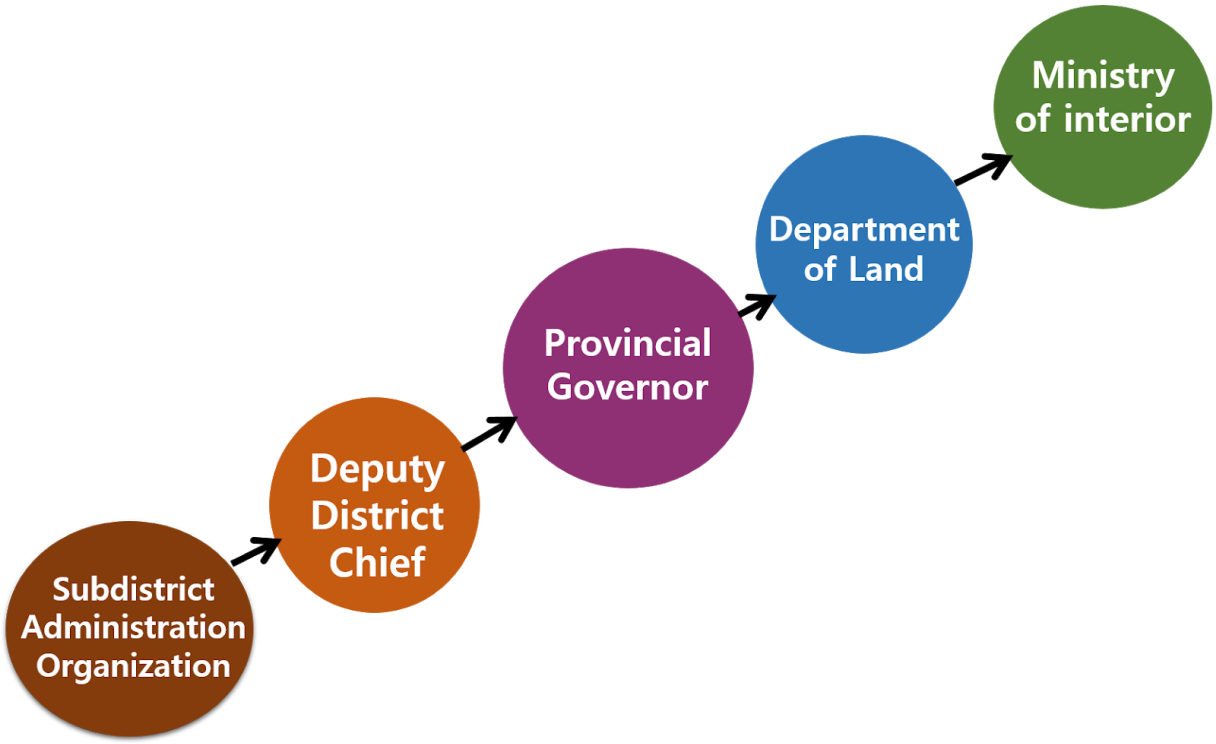

Figure 4.3 A flow chart indicating the steps on how to obtain a house registration number

4.4 Create a marketing plan

To create a marketing plan, we used the data on customer behavior and customer satisfaction from participant observations. Important factors in creating a plan are branding and packaging, distribution plan, advertising and price.

4.4.1 Branding and packaging

Firstly, we decided to improve the bottled water packaging and create label for Jom Hae water. Branding gives reliability and a product's appearance is important, with better packaging the product will look good and attractive. The team studied the target groups from inside and outside village and created a brand "Big River". The name was selected according to survey results. The survey questionnaires offered three choices of possible product brand. The three originated from interviewing the village chief and the team's ideas based on Khlong Takien historical and cultural background. Our team also designed labels for Jom Hae bottled water. The water with different labels then were sold. The sales results were then analyzed.

Finding #9: Both local people in Jom Hae village and Moo 9 prefer "Big River" as a brand name for Jom Hae village bottled water.

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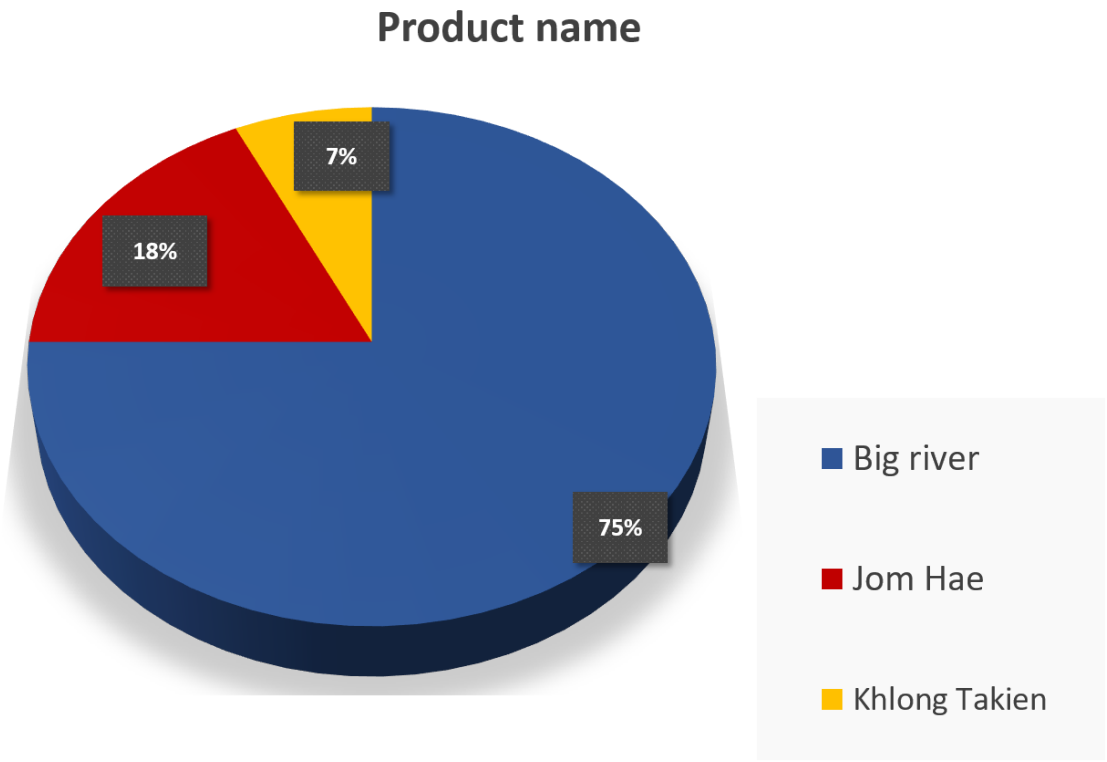

Figure 4.4 A pie chart illustrating the preferences for different brand names for Jom Hae drinking water

According to the results (**Figure 4.4)** obtained from interviewing people and collecting data in survey questionnaires, 75% of the target group preferred "Big River", 18% and 7% preferred "Jom Hae" and "Khlong Takien" respectively. People in community prefered "Big River" was because it is a historic name of Jom Hae village which is located on the Chao Phraya River.

4.4.2 Distribution Plan

A distribution plan consisted of two parts: distribution channels and transportation. To increase the sales, distribution of Jom Hae bottled water is an important concern that needs to be carefully planned.

<u>Distribution channels</u>

Distribution channels should be expanded the channel by persuading distributors both outside and inside the village to reach more customers. The production team needs to include places such as convenience stores, markets or restaurants and again which are inside and outside Khlong Takien sub-district. This widespread distribution can reduce

cost and work from delivering product to customers and therefore gain more profit from distribution. Increasing the number of distributors can have a positive impact on the sales volume. However, decision on new distribution channels can be settled and finalized after obtaining FDA approval.

Finding #10: Most local people purchase bottled water from convenient store

The survey questionnaires in Jom Hae village area results are shown in **Figure 4.5**. 20 out of 44 respondents usually purchase bottled water from grocery stores. They reported that compared with other stores in the local village, the grocery stores are the most convenient sue to the location and offers cheaper price. Delivery service is the second most important factor. Local people chose Jom Hae bottled water because of they offer a convenient delivery service. Grocery stores in Khlong Takien sub-district and its delivery service can be another channel to increase the sales volume.

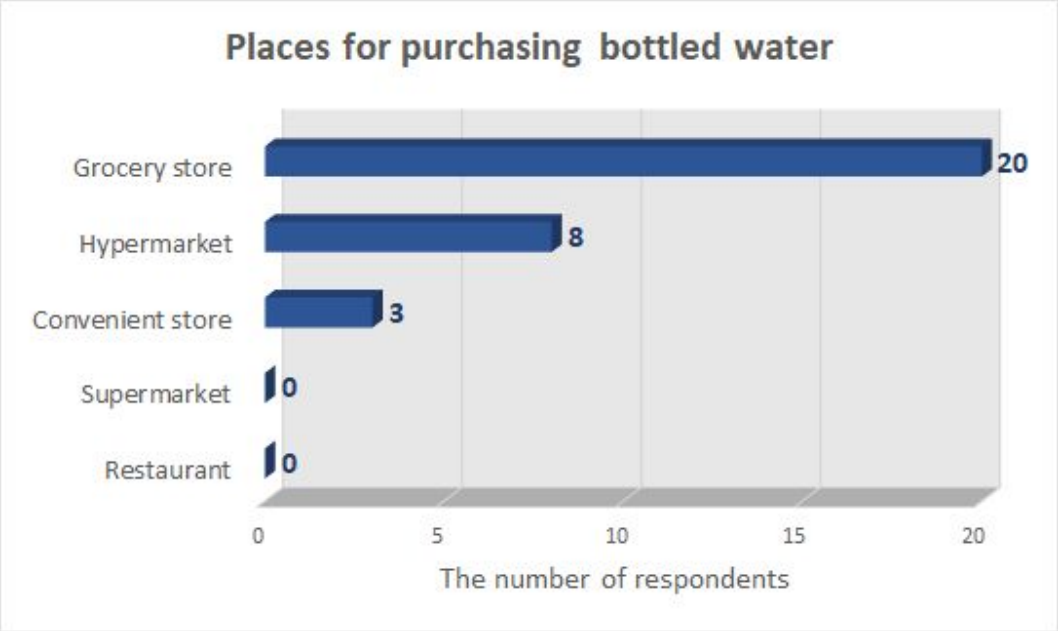

Figure 4.5 A bar chart illustrating the places where people in Jom Hae village usually purchase bottled water

Transportation

Delivery service from the producer to the customer is an important factor that will help increase the economic capacity in Khlong Takien sub-district. The delivery method

provides convenience to customers who mainly stays in their houses and have senior members. To illustrate, most villagers in Khlong Takien sub-district are women, children and the elderly. The young people have gone to work in the city for higher salaries. The women, children and elderly cannot carry gallons of water from the water filtration machines back to their home. Delivery service therefore is a perfect answer to this. Therefore, Having a delivery service is definitely a strong selling point for Jom Hae bottled water.

Finding #11: Transportations by motorcycles and trucks from the producer provide convenience to customers both inside and outside the village.

After interviewing the customers around the area, convenience is their biggest concern. If there is a delivery service, the sales will increase. The neighboring villages also have elderly customers like in Jom Hae. Currently, the village chief has a delivery service on motorcycles and trucks which is available to homes inside and outside the village. The delivery fee depends on the distance.

4.4.3 Advertising

To promote bottled water in Khlong Takien sub-district, advertisement boards will be created and placed in the market in order to make the local product visible to customer both inside and outside the village. Even through bottled water of Jom Hae village have not yet obtained the approval of FDA and HALAL, advertising the product to potential customers can be a way to introduce the water to the local people. The adverts will ensure their customers that water quality has been guaranteed at least by already existing customers and a laboratory report of safe water quality. This will continue to keep the presence of Jom Hae bottled water for existing customer and introduce it to potential customers or visitors to Jom Hae village. The advertisements will include the location of the bottled water production facilities.

Finding #12: Jom Hae bottled water advertisement can provide the recognition for people outside the village.

In order to attract the customers' attention, advertisements are an interesting channel for promoting the products. Moreover, the chief of Jom Hae village has suggested that the advertisements inform consumers that their water quality has been approved by laboratory tests and it is a high quality product, even if it has no FDA and HALAL symbols yet. The advertisement of water quality approval will make the product appear more reliable for potential customers. Advertising vinyl boards can educate people about the manufacturing process of the water, assure people outside the village by showing the results from laboratory test and create

better recognition of Jom Hae product for consumers who visits the area. Building recognition and trust from consumers takes time. Therefore, the advertisements aim not only to increase the present sales volume but also that of the future.

4.4.4 Price

When consumers decide to purchase the products that are almost identical but coming from different producers, some people, especially the local people, consider pricing as the deciding factor rather than quality of the product, the look of the product or where the product comes from. Pricing therefore should be considered in our marketing plan.

Finding #13: The local people tend to purchase bottled water at 5 Baht.

In **Figure 4.6**, the pie chart shows 62% of the local people in Khlong Takien subdistrict usually spend 5 baht for a bottled water. Most people decide to buy low-priced bottled water in their daily life for financial reasons. To illustrate, between Nestle bottled water or a bottled water of less well-known or unknown brand of a lower price, the local will choose the less well-known or even unknown bottled water. Moreover, distributors at the convenience stores in Moo 9 reports that lower-priced products are better sold than higher-priced products, even if the former are unknown. However, setting the final product price at less than 5 baht might not be the best choice for Jom Hae drinking water because some customers were not confident on the quality of the products which are too cheap as well. In an interview of a local in Moo 9: “I’m not confident about the water quality of bottled water that costs less than 5 baht per bottle. So, if I decide to buy some bottled water at low-price, 5 baht is cheap enough for me.” Therefore, setting the price at 5 baht seems to offer a good chance of selling more water and increasing the sales volume.

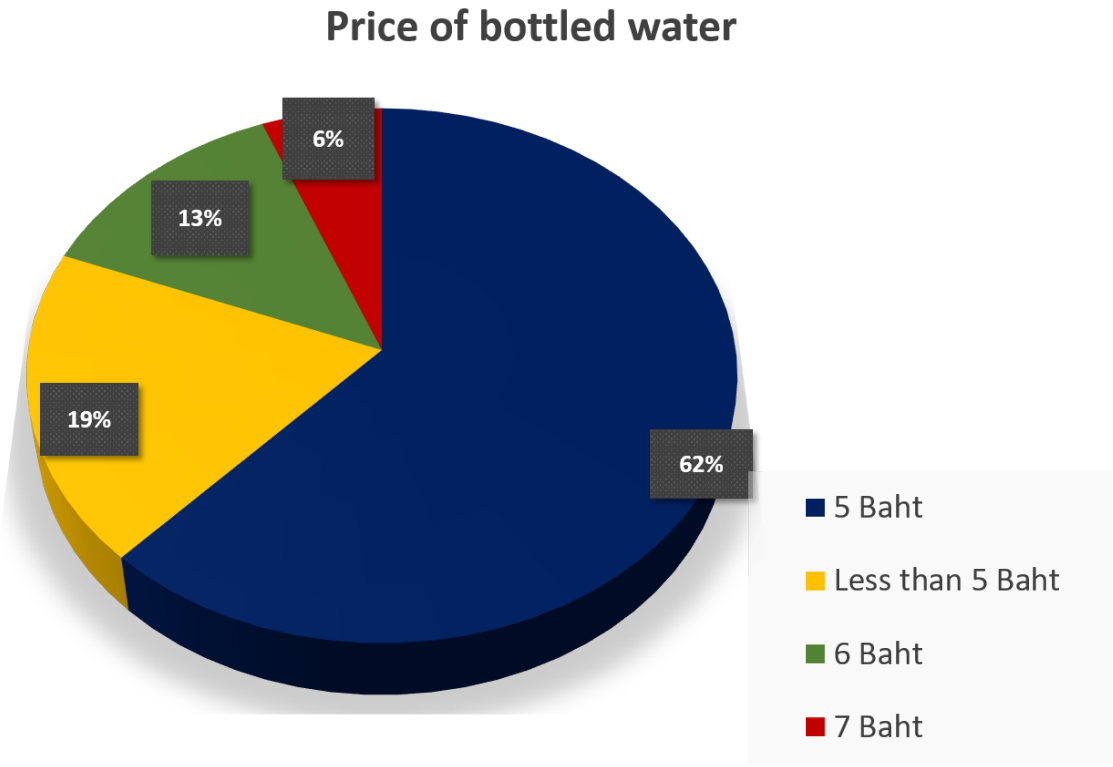

Figure 4.6 A pie chart illustrating the percentage of water sold at different prices

4.4.5 Booths

The team decided to organize a booth activity at Chor Fah market in Khlong Takien sub-district in order to obtain information on factors which will be useful in creating a marketing plan. The objectives of creating booth were (1) to finalize the brand label Big River brand, (2) understanding customer behavior about drinking water (3) to advertise Big River brand and (4) collect the data to set a suitable price. The booth activity was an opportunity for the team to meet customers who were already familiar with Jom Hae water as well as others who did not know about it. The team was able to interview and obtained interesting and useful data from target groups in the term of customers' behavior and perspectives on Jom Hae drinking water and drinking water in general.

Finding #14: The suitable label for Big River was be chosen after interviewing people in the Chor Fah market.

The results from the interview and survey questionnaires at the booth, **Figure 4.7**. 54 interviewees and 29 interviewees preferred design #1 and design #2, respectively. 24 out of 54 people said they chose #1 because the color was more attractive and also the label was easy to

read. For those who chose #2, 11 out of 29 people it is because it looked clearer and brighter than Design #1. In conclusion, interviewees preferred Design #1 more than Design #2.

Design#1

Design#2

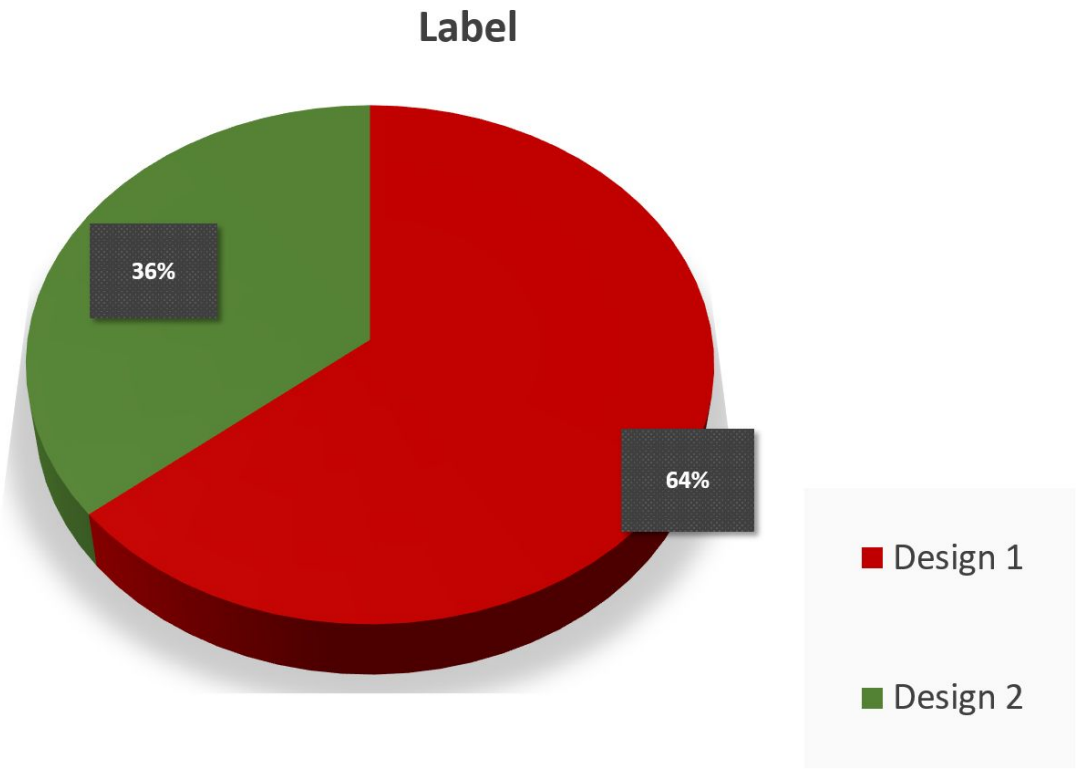

Figure 4.7 A pie chart illustrating the interviewee's preferred label design

Finding #15: Over half of the interviewees chose "Nestle" because they are more familiar with the brand and are confident in its water quality.

The results from the booth activity, **Figure 4.8** indicate that most interviewees decided to choose "Nestle" drinking water more than locally produced brands. Even though Nestle is the most expensive product at the booth at 7 baht a bottle when other brands are 5 baht, consumers said that they chose Nestle because Nestle is well-known and is high quality water. Therefore, the price was not the most important factor for their purchasing decision. On the other hand, water quality and familiarity of the product were the most influential factors for them.

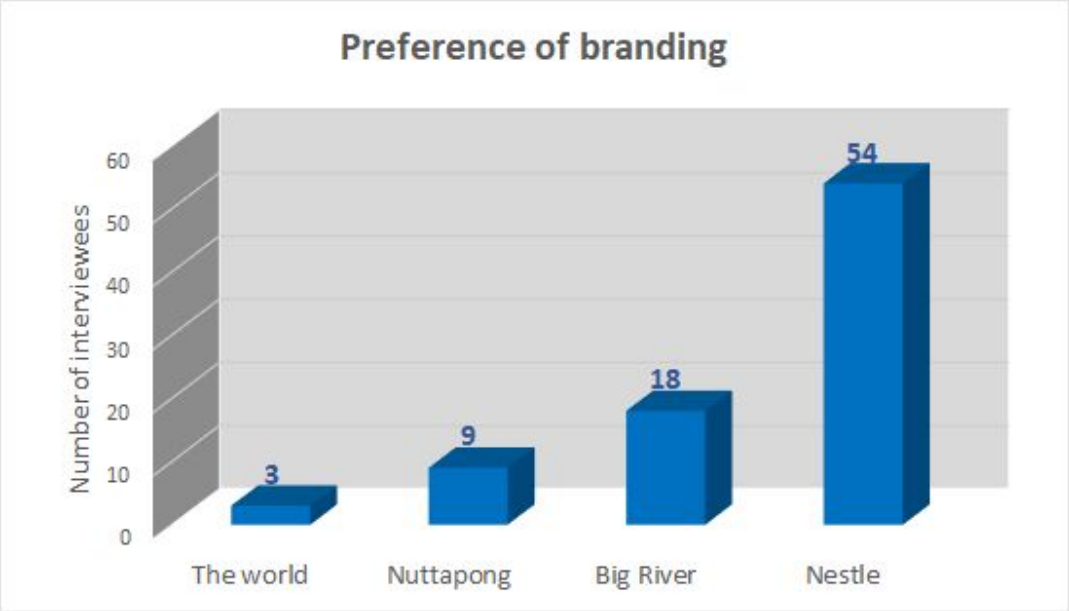

Figure 4.8 A bar chart illustrating the preferences of interviewees

Finding #16: The price that customers tend to purchase Big River drinking water product is at 4 baht per bottle.

During booth activity, some customers will change their minds and try Big River drinking water, if the product is less expensive than the other local brand. Price is one of the factosr that has an effect on customer purchasing decisions when the quality and reliability are equal. From booth interview results, the most suitable and reasonable price to launch Big River drinking water product is 4 baht per bottle **Figure 4.9**. Setting the price like this will make Big River an economical alternative for customers who have a low purchasing power.

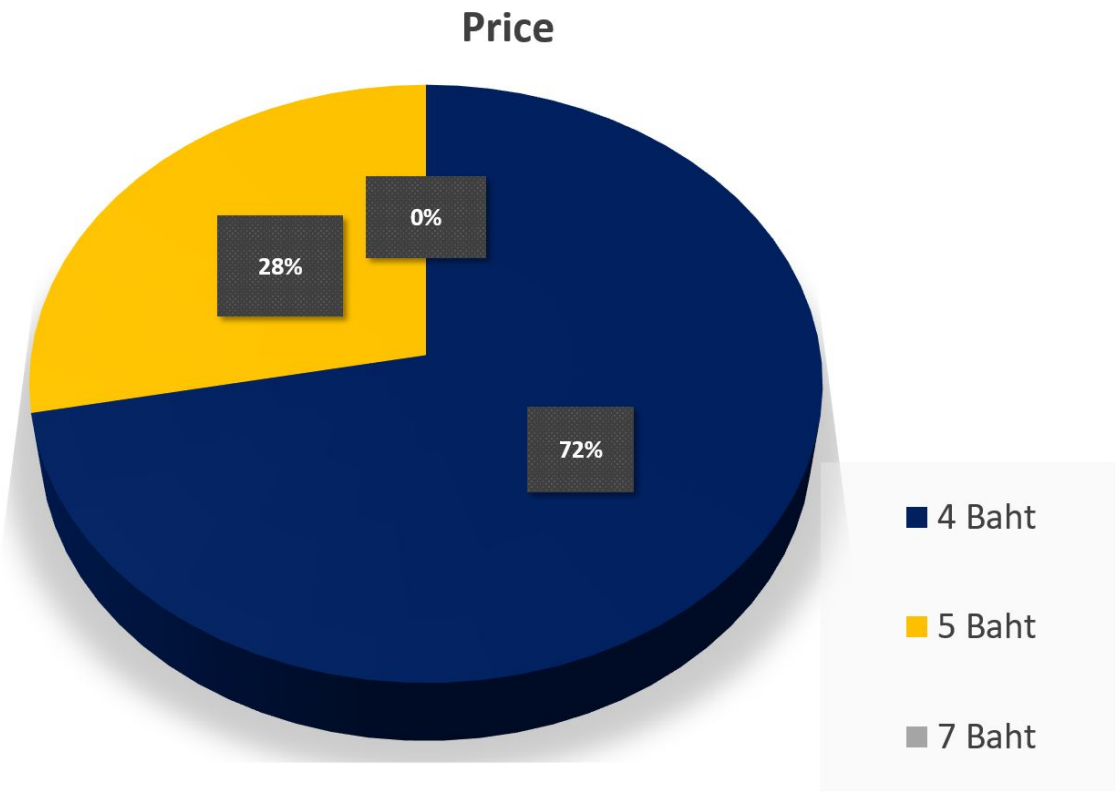

Figure 4.9 A pie chart illustrating the most suitable price for Big River

Chapter 5: Conclusions and recommendations

Conclusions

During 2011, there was a heavy flooding all areas in Thailand including Ayutthaya. As a result, the community developed drinking water facility in the same year to supply drinking water during flooding to people in the community. Initially, the facility was built to solve the immediate crisis. Later it became better known and trusted for it good water quality by the people in the community. Now, the water facility producers plans to improve its economic capacity by increasing the sales volume of bottled water in order to continue and sustain its operation in the long term. To increase the sales, the community plans to have FDA approval in order to expand the market share. However, they still cannot meet all the requirements of FDA. Therefore, our project main goal is to build a groundwork which finally can increase the economic capacity from the sales of bottled water in Khlong Takien sub-district.

After interviews, collecting survey data, contacting governmental organizations, creating marketing strategies, and consulting with specialists on administrative regulations, the team was

able to come up with recommendations and a manual regarding relevant administrative laws, how to obtain FDA approval, and marketing strategies. All deliverables could be used as a guideline for sustainable development of the community in the future.

Recommendations

Recommendation 1: The water filtration process and facility must be strictly maintained and checked up for its quality of water using TDS meter on a regular basis.

Total Dissolved Solid (TDS) is an equipment, which measures in unit parts per million (ppm), and indicating the pureness of water by measuring electrical conductivity of solid particles that can affect human health such as salt, minerals or metal in cation and anion forms. **[**12] The measured value from TDS meter should be less than 50 ppm. The present measurable level of Jom Hae drinking water from TDS meter is 16 ppm, which is within the set standard so Jom Hae's water quality is acceptable for drinking.

The results from Food Research and Testing Laboratory (FRTL) of the Faculty of Science at Chulalongkorn university indicated that the water quality of Jom Hae drinking water meets all requirement for FDA criteria. If the facility can maintain all the processes as is and carry out a check up procedure on TDS meter regularly, a future FDA approval should not pose any difficulty

Recommendation 2: Distribution network can be improved.

"Big River" bottled water should be distributed and sold in most grocery stores in Khlong Takien sub-district. That way the product will be exposed to more groups of people especially people outside the village.

Recommendation 3: A product promotion campaign should be organized

Once the products are distributed to more grocery stores, in order to attract consumers' attention, a launching sale campaign should be considered. One option is to reduce the selling price as a promotion for a few months. Usually, the bottled water is sold at 5 baht per bottle therefore the sale price can be temporarily be lowered to 4 baht per bottle. The results from the questionnaire surveys and interviews indicated that price is an important factor to customer buying decision. People prefer to buy the lower price products. Alternatively, a promotion such as 2 bottles for 9 baht can also be considered.

Recommendation 4: Advertisements should be made

In order to promote products, vinyl board and brochure adverts should be produced. Vinyl board can be placed in front of the village, in street restaurants as well as at grocery stores. The advertisements should allow customers to easily see and recognize the product and the brand. The brochures can be distributed in places like markets and grocery stores. The cost of producing vinyl board and brochure is not expensive and should be cost effective and should include contact information.

Recommendation 5: The village chief and the village committee should relocate the filtration tank and facility and rent land to obtain a house registration for FDA approval

To obtain FDA's certification, one of the key documentation required is the home registration of the facilities. The drinking water facility is located on public land, which limits it dealings with the authorities.

Conducting a business on public land is illegal. The government can expropriate the land and the chief can be charged for public land invasion. Therefore, the team recommends two possibilities which are (1) legalize the land use and stay in the same location and (2) relocate the facility.

If land usage can be made legal and the facility can then stay in the same location, the advantage is the processing cost, the community will have to spend more funds in re-establishing its facility in a new location. This costs include land purchase or rent, new building cost, and moving of facilities and installation costs. If the community chooses not to relocate, they need to go through the process of obtaining a legal use of the land as recommended in Figure 5.1. In this case, the process can take a long time and involve several government organizations. This approach may not be easy because the long processing time and the petition can be denied.

The team's second recommendation is to relocate the facility. Even though it will involve a lot of relocation and installation cost but the village can legally obtain a house number and do not have to go against the law or go through the complicated aforementioned process which may or may not be successful. In relocating the facility, the team recommends two possibilities which are (1) rent a new piece of land and (2) buy a new piece of land. Among these two options, the we suggest renting. Renting will be more feasible in terms of funding, production cost and profit calculation. The breakeven point will require a shorter period of time.

Calculations

1. <u>Buying land</u>

Figure 5.1 A graph showing the break-even point graph if buying land

Fixed cost: 700,000 baht

Variable cost: 2.8 baht per unit

x: no. of units

y: sales volume (baht)

Total revenue: y = 5x ---------- (1)

Total cost: y = 2.8x + 700,000 -------- (2)

(1) = (2); $5x = 2.8x + 700{,}000$

$2.2x = 700{,}000$

$x = 318{,}181$unit (Total units at break-even point)

The number of years (z) $= \frac{\textit{total no. of bottles sold}}{\textit{number of water bottles sold per year}}$

$= \frac{318{,}181}{27{,}360 + z(120)}$ if; the sales = 190 dozen per month

(27,360 units per year)

and increasing 10 dozen of bottles sold in each year

$$Z\,(27{,}360) + 120\,z^2 = 318{,}181$$

$$120\,z^2 + 27{,}360z - 318{,}181 = 0$$

$$z = \mathbf{11}, -239$$

In conclusion, it will take 11 years in order to pay for the investment funds used to buy land

2. Rent land

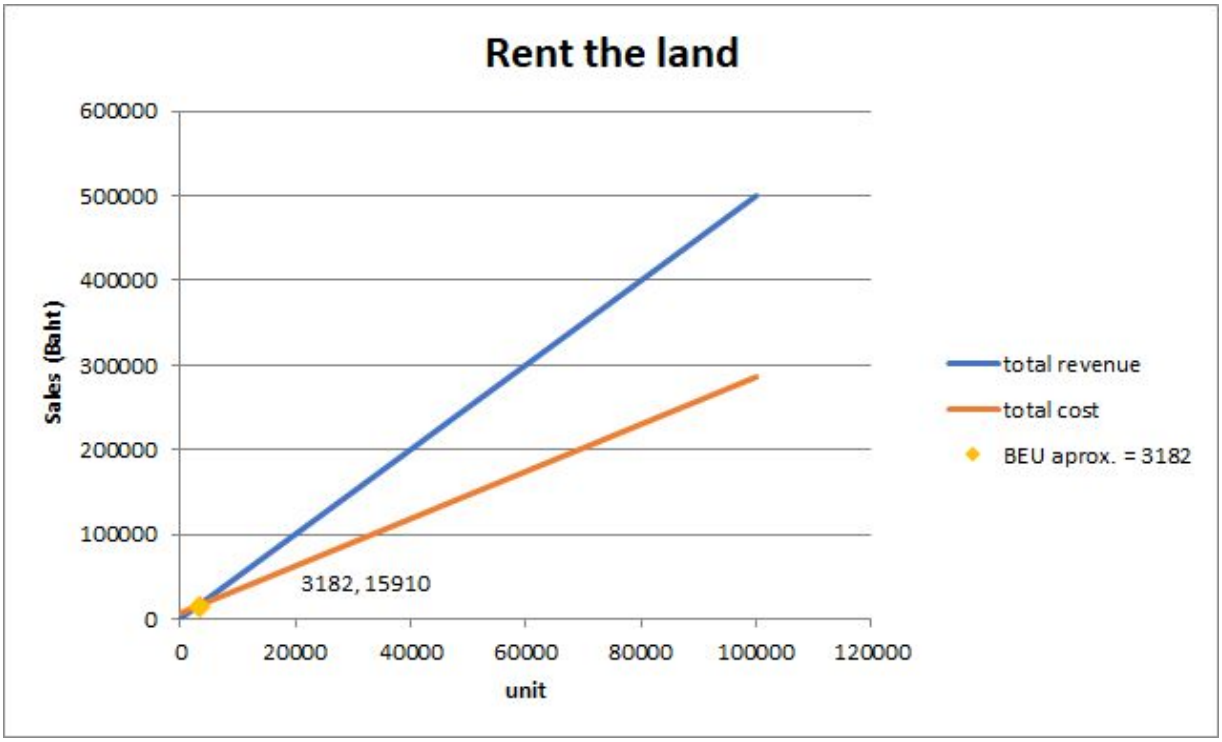

Figure 5.2 A graph showing the break-even point if renting land

Fixed cost: 7,000 baht
Variable cost: 2.8 baht per unit
x: no of units
y: sales volume(baht)

Total revenue:y = 5x ---------- (1)
Total cost: y = 2.8x + 7,000 ---------- (2)

(1) = (2); 5x = 2.8x + 7,000

$2.2x = 7{,}000$

$x = 3{,}181$ units (Total unit at Break-even point)

$= 265$ dozen

The number of bottles sold should be 265 dozens per month in order to pay the total cost in that month. However, in each year, the bottles sold will increase 10 dozens per year. In the first year, the units of bottles sold is expected to be 190 dozens.

1^{st} year = 190 dozen per year

2^{nd} year = 200 dozen per year

3^{rd} year = 210 dozen per year

4^{th} year = 220 dozen per year

5^{th} year = 230 dozen per year

6^{th} year = 240 dozen per year

7^{th} year = 250 dozen per year

8^{th} year = 260 dozen per year

8^{th} **year and a half = 265 dozen per year**

In conclusion, it will take 8 years and a half to pay back all investment funds to rent the land.

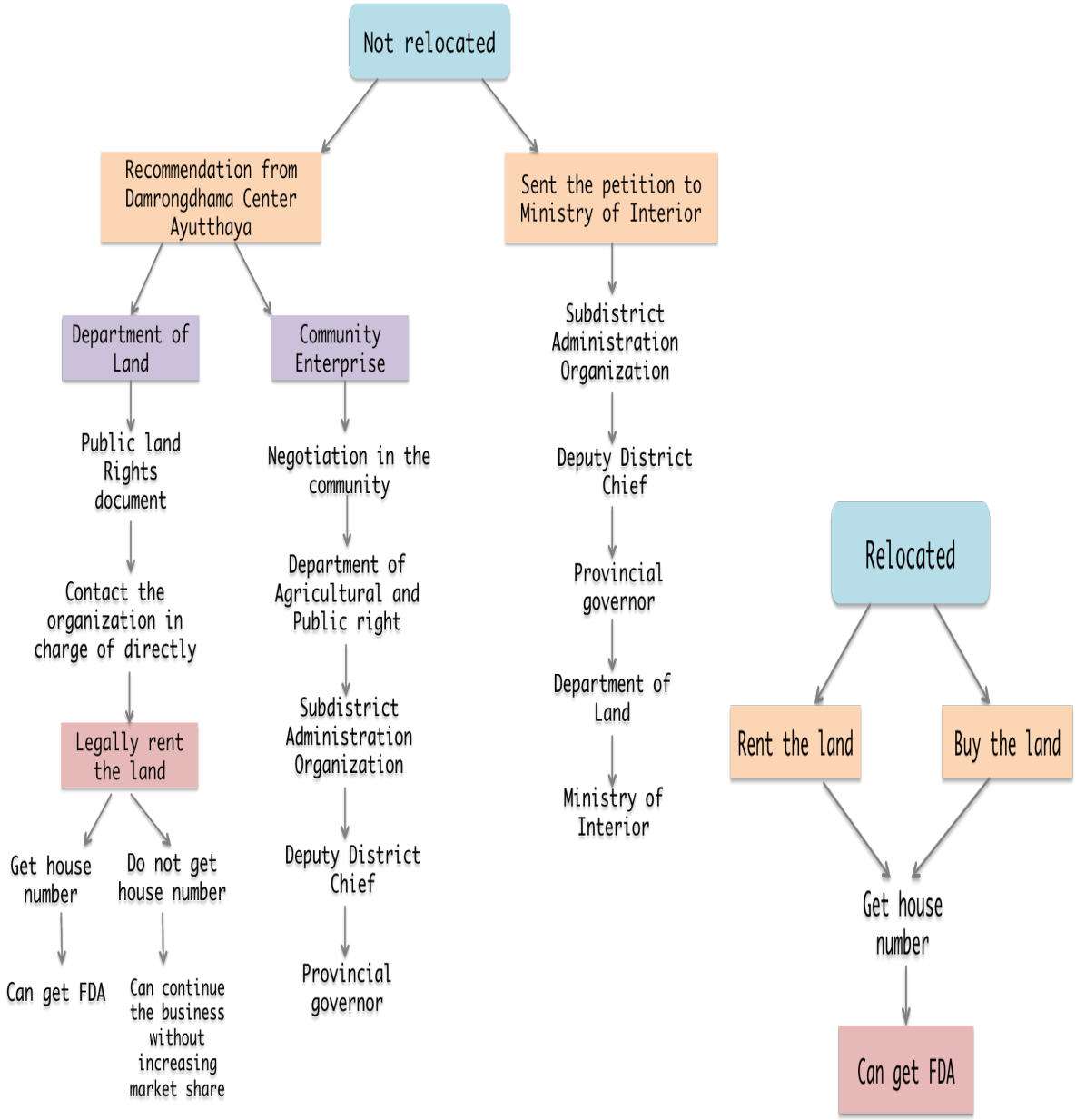

Figure 5.3 A flow chart showing two scenarios to obtain a house number

Deliverables

1. *FDA and related administrative law manuals*

The information in the manual contains FDA approval process and related laws regarding the legal use of public land. The FDA manual consists of summary steps as well as lists of documents required as part of the approval process. There are also sample documents which were provided by the FDA officer when the team visited and consulted with FDA.

2. *Marketing Plan*

In order to achieve the marketing goal, a marketing plan is drawn up and analyzed. It outlines marketing and advertising approaches for the coming years [13]. The plan includes current marketing situation, SWOT analysis, marketing strategies, financial objectives and controls. The marketing plan will provides clear directions and options and give guidelines to Jom Hae community on how to increase production and sale based on the team's assessment of the current situation.

3. *Brochure*

As part of the marketing plan, a brochure is created and intended as a tool to promote the product by educating consumers regarding bottled water which has passed through the processes of reverse osmosis and UV radiation. These processes are standard processes and are widely used in most drinking water manufacturing companies.

4. *Label*

The label and brand are also designed to provide an identity for the product which will help customers to remember the brand. "Big River" was selected since it is a historical name of Jom Hae village which is directly connected to the main Chao Phraya River. The details on label also describe the methods which are used for manufacturing the water and the original location of the factory, the net volume of water and a QR code. The QR code will tell about the community's history Hae's community and its people. It will also give details about the water production process.

5. *Vinyl board*

Vinyl board is to be used as part of advertising. The board will help people to know more about Jom Hae drinking water product. The board will have information such the brand, where water came from, and what production processes are used. The consumers are expected to be able to see the vinyl boards which needs to be placed in different locations and allow people from other villages to know of the product. Furthermore, the cost of producing vinyl board is not expensive.

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The Appendices

Appendix A

Survey Questionnaire

Behaviour of customers of Jom Hae drinking water at Khlong Takien sub-district in Ayutthaya province

Instruction: Each statement is followed by a choice of responses. Please check the response that corresponds to your personal information as well as your opinion. Please Tick in the boxes provided.

Part 1: Personal information

1. Gender

▫ Male ▫ Female

2. Age

▫ Less than 18 years ▫ 18-24 years ▫ 25-34 years

▫ 35-45 years ▫ More than 45 years

3.Educational Qualification

▫ Secondary School ▫ Diploma ▫ Bachelor degree

▫ Master degree

▫ Others (please specify) : _____

4.Average monthly salary

▫ Less than 5,000 baht ▫ 5,000-10,000 baht ▫ 10,001-15,000 baht

▫ 15,001-30,000 baht ▫ More than 30,000 baht

Part 2: Customer's perspectives on Jom Hae drinking water quality

5. Do you know Jom Hae drinking water?

▫Yes ▫No

(If choose 'yes' , please go to 6 . If choose 'no', go to 11.)

6. How do you feel about the groundwater quality in Khlong Takien subdistrict?

□ Extremely unsatisfied

□ Unsatisfied

□ Nautral

□ Satisfied

7. Please write 1-5, the reason for which you think people decide to buy Jom Hae drinking water by arranging from the first reason to the last reason. (1 is the most important - 5 is the least important)

___ High quality

___ Price

___ Odor/ Color/ Packaging

___ Local product

___ Convenience

8.What factors can influence to an increase of product sales? (Can choose more than one)

□Water Filtration techniques

□ Reverse osmosis

□ Osmosis

□ Boil up with high temperature

□ Others (please specify) : _____

□ Price

□ Less than 5 baht

□ 5 - 7 baht

□ 8 - 10 baht

□ More than 10 baht

□ Brand

□ Color

□ Logo

□ Symbol

□ Bottle quality

□ Thin plastic bottle

□ Thick plastic bottle

□ Turbid plastic bottle

□ Others (please specify) :_____

9. Which do you think is the most suitable brand name for Jom Hae bottled water? Why?

□ Big river

□ Khlong Takien

□ Jom Hae

□ KT

□ Others (please specify) : _____

Because _____

10. What color would you choose for a label on Jom Hae bottled water?

□ White - Black- Light blue

□ White - Light blue - Navy blue

□ Black - Light blue - Navy blue

□ Light blue - Navy blue - Purple

□ Others (please specify) : _____

11. What brand of bottled drinking water do you usually buy?

□ Nesle □ Crystal □ Namtip

□ Chang □ Singha □ 7 - 11

□ Others (please specify) : _____

12. Check the reason for your answer to Question 11.

□ Low cost

□ Easy to buy

□ High quality

□ Others (please specify) : _____

13.How many bottles of water do you drink a day?

□ 3 - 4 bottles

□ 5 - 7 bottles

□ More than 7 bottles

14.What is the price of bottled water that you usually buy?

□ Less than 5 baht

□ 5 baht

□ 7 baht

□ 10 baht

□ Others (please specify) : _____

15.Where do you usually buy bottled water?

□ Delivery store

□ Grocery

□ Convenience store

□ Supermarket

□ Restaurant

□ Others (please specify) : _____

16.What is the main reason for drinking bottled water?

□ Good physical health

□ Quench

□ Freshen

□ Good external appearance

□ Others (please specify) : _____

17. How would you rate the importance on FDA and Halal logo when you choose which brand of bottled water to buy?

□ Extremely important

□ Very important

□ Important

□ Somewhat important

□ Not at all important

18. How would you rate the trustworthiness of FDA logo?

□ Strongly trust

□ Trust

▫ No opinion

▫ Distrust

▫ Strongly distrust

Appendix B

Interview Questions

- Producer
  - Are there any containers that give to consume for filling drinking water
  - Did you send the water product to any store in community? If yes, where did you send to?
  - How many stores are there in the community?
  - In one day, how many people buy our product?
  - What positive effects did the water production project have on you family?
  - What are your roles in the water manufacturing process?
  - Are there any machineries, equipment or ways that can check that water quality meet the standards set by FDA and Halal?
  - Where did the water filtration machines come from?
- Sponsor
  - What are the objectives of this project?
  - What do you expect from our study?
  - Why do you support Jom Hae drinking water business?
  - Where does the budget for this project come from?
- The village Chief
  - Why was the drinking water business started?
  - What are the main problems that you encounter in selling the product?
  - Can you sell any bottled water in Jom Hae village? or do you sell only water from the storage tank?
  - Where does the income of 5,000 baht of the income come from?
  - How is the quality of life of your local people, what is the livelihood of the local people?
  - How important is this water production business? How does it affect the community?
  - What kinds of activities can be organised or developed using the income from selling bottled water?

- What are the problems that community is facing?
- Why has the drinking water not been approved by FDA?
- Where does the water come from?
- What negative effects does the water production have , if any, on community?
- How much does the drinking water cost per litre?
- Where do you get the water filtration machines?
- How did you get ground water resources? Has it been approved by the authorities?

- Consumers
  - Do you buy and drink Jom Hae drinking water?

YES

- Why do you choose a local water brand instead of other brand?
- How far is the water filtration machine from your house ?
- How many times do you use water filtration machine a day ?
- Why do you prefer to drink water from water filtration machine instead of boiling tap water?
- Are you satisfied with local bottled water, do you like it?
- In what aspect do you think Jom Hae drinking water should be improved?
- Does FDA and Halal label affect your decision to buy drinking water?

NO

- Why do you not buy Jom Hae drinking water?
- If Jom Hae drinking water is improved, is there any chance that you will buy it?

Appendix C

Lists of FDA Required Documents

1. A registration of food production line certificate
2. A certificate for manufacturing location for non-industrial business
3. A commercial registration certificate
4. A letter of consent
5. A power of attorney letter
6. A taxpayer identification number

7. A house registration book or copy, a house number
8. A letter of certification from Sub-district Administration Organization
9. Description of machines and equipment used
10. A location map and production site plan
11. Photographs of the facilities
12. A water quality certificate issued by the Department of Medical Science of the Ministry of Public Health or other organizations that is certified by Ministry of Public Health

Appendix D

Criteria for ensuring water quality

Physical qualifications

1. Color : Limited to 20 hazen unit
2. Odor : Odorless except for chlorine
3. Turbidity: Limited to 5.0 silica-scale
4. Acidity (pH) : Between 6.5 and 8.5

Chemical qualifications

1. Total solid : Limited to 500.0 mg/L
2. Total Hardness : Limited to 100.0 mg/L
3. Arsenic (As) : Not more than 0.05 mg/L
4. Barium (Ba) : Not more than 1.0 mg/L
5. Cadmium (Cd) : Not more than 0.005 mg/L
6. Chloride (Cl) : Limited to 250.0 mg/L
7. Chromium (Cr) : Limit 0.05 mg/L
8. Copper (Cu) : Limit 1.0 mg/L

9. Iron (Fe) : Limit 0.3 mg/L
10. Lead (Pb) : Limit 0.05 mg/L
11. Manganese (Mn) : 0.05 mg//L
12. Mercury (Hg) : 0.002 mg//L
13. Nitrate : Limit 4.0 mg/L
14. Phenols : Limit 0.001 mg/L
15. Selenium (Se) : Limit 0.01 mg/L
16. Silver (Ag) : Limit 0.05 mg/L
17. Sulfate(SO4) : Limit 250.0 mg/L
18. Zinc (Zn) : Limit 5.0 mg/L
19. Fluoride (F) : Limit 1.5 mg/L

Micro-organism qualifications

1. Chloroform bacteria must be less than 2.2 per 100 ml. of water.
2. Must not have E.coli Bacteria
3. Must not have micro-organism that can cause disease

Packaging qualifications

1. Containers that are used for storing must have lids or cork and must be sealed properly.
2. Other materials used to seal the bottle that is not cork, can be a plastic lid or anything that can tightly seal the water inside the bottle.

Label qualifications

Every process of in water production and its label must meet to the standards set by the Department of Public Health

Appendix E

The water quality test results from Food Research and Testing Laboratory (FRTL) at Faculty of Science, Chulalongkorn University

ห้องปฏิบัติการวิจัยและทดสอบอาหาร
คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ชั้น 16 อาคารมหามกุฏ ถนนพญาไท
ปทุมวัน กรุงเทพฯ 10330

เลขที่รายงาน : M 0090/18
วันที่รายงาน : 12 กุมภาพันธ์ 2561
รหัสตัวอย่าง : 180338
หน้าที่ 1 ของจำนวน 3 หน้า

เริ่มรายงาน

รายงานการทดสอบ

ชื่อผู้ขอรับบริการ : นายปกรณ์ เสมสายันห์
ที่อยู่ผู้ขอรับบริการ : 33 หมู่ 12 ต. คลองตะเคียน อ. พระนครศรีอยุธยา จ. พระนครศรีอยุธยา 13000

ชื่อตัวอย่าง/ รายละเอียดตัวอย่าง : Big River, ของเหลวใส บรรจุในขวดพลาสติกใสปิดสนิท
ปริมาตรบรรจุ 600 มิลลิลิตร จำนวน 17 ขวด

ผู้สุ่มตัวอย่าง : ผู้ส่งตัวอย่างเป็นผู้สุ่มตัวอย่าง
วันที่รับตัวอย่าง : 26 มกราคม 2561
วันที่เริ่มทดสอบ : 29 มกราคม 2561

ผลการทดสอบ

รายการที่ทดสอบ	ผล	วิธีทดสอบ
E. coli	< 1.1 MPN/100 ml	FDA BAM, Online, 2013 (Chapter 4)
Coliforms	< 1.1 MPN/100 ml	ISO 4831 : 2006
S. aureus	Not detected in 100 ml	In-house method based on Standard Method for the Examination of Water and Wastewater 22nd 2012 (9213B-6)
C. perfringens	Not detected in 100 ml	The Microbiological of Drinking Water, 2010 (Part6)
Salmonella spp.	Not detected in 100 ml	Standard Method for the Examination of Water and Wastewater 22nd 2012 (9260B)

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รหัสตัวอย่าง : 180338

เริ่มรายงาน

รายงานการทดสอบ(ต่อ)

ผลการทดสอบ (ต่อ)

รายการทดสอบ	ผล	วิธีทดสอบ	Detection limit
สี (Color)**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 2120 C	0.7 Pt-Co Unit
กลิ่น (Odor)	Normal	TIS 257-2006	-
ความขุ่น (Turbidity)**	< 0.1 NTU	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 2130 B	-
ความเป็นกรด-ด่าง (pH)	6.78	Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 4500-H^+ B	-
ปริมาณสารทั้งหมด (Total Solids)	<10 mg/L	Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 2540 B	-
ความกระด้างทั้งหมด (Total Hardness as $CaCO_3$)	<1.00 mg/L	Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 2340 C	-
สารหนู (As)	Not detected	In-house method based on Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 3120 B, 3030 E	0.027 mg/L
แบเรียม (Ba)**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 3500 by ICP-OES technique	0.0005 mg/L
แคดเมียม (Cd)	Not detected	In-house method based on Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 3120 B, 3030 E	0.004 mg/L
คลอไรด์ (Cl)	<4.00 mg/L	Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 4500-Cl^- B	-
โครเมียม (Cr)	Not detected	In-house method based on Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 3120 B, 3030 E	0.005 mg/L
ทองแดง (Cu)	Not detected		0.016 mg/L
เหล็ก (Fe)	Not detected		0.010 mg/L
ตะกั่ว (Pb)	Not detected		0.027 mg/L
แมงกานีส (Mn)	Not detected		0.008 mg/L
ปรอท (Hg)**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 3500 by ICP-OES technique	0.00003 mg/L

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เลขที่รายงาน : M 0090/18
วันที่รายงาน : 12 กุมภาพันธ์ 2561
รหัสตัวอย่าง : 180338
หน้าที่ 3 ของจำนวน 3 หน้า

เริ่มรายงาน

รายงานการทดสอบ(ต่อ)

ผลการทดสอบ (ต่อ)

รายการทดสอบ	ผล	วิธีทดสอบ	Detection limit
ไนเตรต (as N)**	.< 1.1 mg/L	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 4500-NO_3-B	-
ฟีนอล (Phenol)**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 5530 BC	0.0002 mg/L
ซีลีเนียม (Se)**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 3500 by ICP-OES technique	0.0003 mg/L
เงิน (Ag)**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 3500 by ICP-OES technique	0.0006 mg/L
ซัลเฟต (SO_4^{2-})**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 4500-SO_4^{2-}-E	0.072 mg/L
สังกะสี (Zn)	Not detected	In-house method based on Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 3120 B, 3030 E	0.061 mg/L
ฟลูออไรด์ (as F^-)**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF (2012) Part 4500-F^- D	0.002 mg/L
อะลูมิเนียม (Al)	Not detected	In-house method based on Standard Methods for the Examination of Water and Wastewater APHA,AWWA,WEF, 22nd Edition 2012 Part 3120 B, 3030 E	0.138 mg/L
เอบีเอส (Alky benzene Sulfonate)**	< 0.1 mg/L	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 5540 C	-
ไซยาไนด์ (Cyanide)**	Not detected	Standard Methods for the Examination of Water and Wastewater APHA, AWWA, WEF, 22nd Edition 2012, Part 4500-CN E	0.006 mg/L

หมายเหตุ : ** = รายการทดสอบรับเหมาช่วงงานทดสอบ

สิ้นสุดรายงาน

อนุมัติ โดย

ลงชื่อ .....
(นางสาวอัจจิมา ก่ำพรม)
ผู้จัดการด้านวิชาการ
ห้องปฏิบัติการจุลชีววิทยา

ลงชื่อ .....
(รองศาสตราจารย์ ดร.สุเมธ ตันตระเธียร)
รองผู้อำนวยการ

ลงชื่อ .....
(ศาสตราจารย์ ดร.ศิริรัตน์ กีกผล)
ผู้อำนวยการ

ผลการทดสอบนี้รับรองเฉพาะตัวอย่างที่ได้ทดสอบเท่านั้น
ห้ามนำรายงานการทดสอบนี้ไปประกาศโฆษณาและต้องไม่ถูกทำสำเนา (ยกเว้นทำทั้งฉบับ)
โดยไม่ได้รับความยินยอมเป็นลายลักษณ์อักษรจากห้องปฏิบัติการ

F-QM-0031/R03