An Enhancement of Community Product: A casestudy of single sun-dried Snake-head Fish

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Abstract - The research on An Enhancement of Community Product: A case study of single sun-dried snake-head Fish aims to upgrade a single sun-dried snake-head fish product of the Ang Thong Fisheries and Processing Cooperative Group, Huai Kan Lan Subdistrict, Wiset Chai Chan District, Ang Thong Province, Thailand. The purpose of this research was to raise the level of the single sun-dried snake-head fish product to meet the community product standard and add value to the snake-head fish. The result of the research was that single sun-dried snake-head fish product with a standardized production, branded, labeled, and standardized packaging, with a moisture content according to the community product standard for single sun-dried snake-head fish (THAI COMMUNITY PRODUCT STANDARD. 298/2549. ), and can increase the value of the single sun-dried snake-head fish product. At present, the single sun-dried snake-head fish costs 250 baht per kilogram. The cost of producing the original single sun-dried snake-head fish, as usual, was averaged at 217.70 baht per kilogram. Therefore, the profit was about 32.30 baht per kilogram. However, if it was upgraded with a dryer and had packaging that was hygienic and can be stored for longer than before, more beautiful colors, it can be sold for around 350 baht per kilogram. The cost increased by 228.05 baht per kilogram. Therefore, profits were about 121.95 baht per kilogram, or if selling single sun-dried snake-head fish processed with a dryer and with hygienic packaging, it can increase the profit more than selling traditional single sun-dried snake-head fish at an average of 89.65 baht per kilogram. The aim of 1% processing from 1.5 million kilograms of fresh fish (whole group fish) can be processed 15,000 kilograms and could increase the profit from the sale of single sun-dried snake-head fish with the correct packaging more hygienic than the traditional single sun-dried snake-head fish sales of 1,344,750 baht. Therefore, research funding was 656,500 baht. The break-even point for producing dehydrated single sun-dried snake-head fish with hygienic packaging was 7,323 kilograms. The payback period was approximately 179 days, so the investment can be returned.

Keywords— Enhancement, single sun-dried, snake-head Fish, Thailand

I. INTRODUCTION
At present, Ang Thong Fisheries and Processing Cooperative Group, Huai Khan Lan Subdistrict, Wiset Chai Chan District, Ang Thong Province has an annual output of about 1,500,000 kilograms of snake-head fish per year. From the current situation of snake-head fish farming, it was found that the group would face problems in the farming system and faced the problem of falling prices that there was no middleman to buy the snake-head fish of the farmers, resulting in the farmers suffering a loss. This was because the middlemen went out to buy snake-head fish from abroad that was 3 times cheaper than farmers and related government agencies came out to find a solution for the survival of snake-head fish farmers.

At present, the group made strikers by drying in the sun, but the quality control was inconsistent due to weather conditions, sunlight, dirt and flies contamination, resulting in inconsistent quality products. Storage and extending life were uncertain. Sometimes single sun-dried fish had a bad
smell because it was not thoroughly dry. The top was dry, but the underside was not dry. Turning
around was difficult, time-consuming, and labor-intensive. In addition, the production of single
sun-dried fish that relied on general natural drying was often encountered with handling problems
when inclement weather such as rain or problems with various insect-borne diseases that can cause
contamination in products and cause future problems to the health of consumers. To solve the
problem, the research team had an idea to raise the level of single sun-dried snake-head fish to
meet the community product standard (THAI COMMUNITY PRODUCT STANDARD, 298/2549) to add the value of snake-head fish to meet the needs of consumers and raise the level of single sun-dried snake-head fish products to increase the community's income.

II. RESEARCH OBJECTIVES
To raise the level of snake-head fish products to meet the community product standard (THAI COMMUNITY PRODUCT STANDARD, 298/2549) and add value to single sun-dried snake-head fish.

III. LITERATURE REVIEW
Dehydration refers to the removal of water from the desired product using heat that comes from
sources such as the use of microwave heat. [1] The microwave system was used to remove water
from sardines using a 500W microwave, or it was the development of a dryer that combines
multiple dehydration energy. According to the research of [2], there were 3 types of experiments:
1) Natural sunlight drying of snake-head fish had 60% moisture content of snake-head fish. 2) Sun-dried snake-head fish with a solar incubator, the moisture content of snake-head fish was 49%. 3) Sun-dried snake-head fish with solar aquariums together with electricity had 34% moisture in the snake-head fish meat. All three methods were compliant with the community product standards for single sun-dried snake-head fish (TCPS. 298/2549) that single sun-dried snake-head fish products had a water activity value not more than 0.85, or commonly used and easy to find, the humidity did not exceed 65%. Water activity is an important value that can predict or determine the period of product storage.

Dehumidification in snake-head fish meat was, therefore, an important issue in extending the
life of snake-head fish meat, but at present, there were several methods of dehumidification that
were suitable for Ang Thong fishery and processing cooperatives with many elderly groups. The
ideal method was to dehumidify with a heat pump drying system because the temperature can be
easily controlled and the operating system was simple. According to the research of [3], the heat
pump drying system was used to dehumidify fruits and vegetables, which can reduce humidity
effectively. This was consistent with research from [4-6] that the heat pump drying system was
used to dehumidify food because the use of heat pump drying system was to slowly reduce the
humidity and make the color of the food more beautiful and appetizing.

The heat pump drying system had a working principle similar to that of an air conditioner. In
air conditioners, cooling was used, but heat pump drying was an application that took advantage
of heat to allow heat to remove moisture in the food and to get the cool back. Therefore, heat pump
drying was community-appropriate technology, was easy to use, and easy to maintain. Based on
the research [7] that developed a heat pump drying system using R134A refrigerant, a refrigerant
used in air conditioners in Thailand which was suitable for use in communities that do not require
high technology. The heat pump drying system was also a development suitable for use in food
dehumidification, according to a study of [8] that used a heat pump drying system to dehumidify,
which can reduce the average steam volume by approximately 5.2 kg/hour. This was consistent
with research [9] that introduced a heat pump drying system by designing a 3-stage experiment at 40, 50, 60 °C, effectively and achieving the desired product color. This was in line with research from [10] using heat pump drying to dehumidify mushrooms. Research showed that it can reduce mushroom weight. Fresh mushroom from 90kg weight can be reduced to 75.2kg in 670 minutes. Therefore, the use of the heat pump drying system for dehumidification in single sun-dried snake-head fish was a technology suitable for raising and increasing the value of single sun-dried snake-head fish.

In Thailand, there were continuous product upgrades, for example, One Tambon One Product (OTOP), which can increase the level and increase income within the community. The research of [11] had upgraded fresh cherry tomatoes and dehydrated cherry tomatoes to be of higher quality, outstanding products of Nakhon Pathom Province, and able to be exported abroad. This was in line with the research of [12] which was raising local food in Buriram province to increase value, strengthening the community, making use of free time, and increasing income for the community. In addition, products available in the popular market had been upgraded to be more quality, according to the research of [13] that developed the quality of the famous souvenirs of pork cabbage in Chiang Mai Province through the standard of oil used to fry the pork rind, etc. Therefore, raising the level of single sun-dried snake-head fish as folk wisdom for preserving food so that food can be kept for several days was a matter that should promote and support the production of single sun-dried snake-head fish to meet the quality standards to increase the income of the community.

IV. RESEARCH METHODS

An Enhancement of Community Product: A case study of single sun-dried snake-head Fish was standardized and value-added of single sun-dried snake-head fish. In this research, the research steps were as follows

1. Study the preliminary data of Ang thong Fishery Cooperative Group in terms of processing quantity of single sun-dried snake-head fish, current weathering conditions, sun drying equipment, and current single sun-dried snake-head fish products.
2. Study the need for raising the level of the group to bring the demand to develop a standardized and value-added single sun-dried snake-head fish product.
3. Develop a production process to ensure hygienic and standardized single sun-dried snake-head fish.
4. Study the moisture content between the naturally single sun-dried snake-head fish and the developed single sun-dried snake-head fish that had been developed to meet the standard, develop the brand, label, and packaging to meet the community product standard for single sun-dried snake-head fish (TCPS. 298/2549).
5. Summarize the results of the elevation of single sun-dried snake-head fish both in terms of product upgrading and product value enhancement.

V. RESEARCH RESULTS

The research on An Enhancement of Community Product: A case study of single sun-dried snake-head Fish can be summarized as follows:

1. The preliminary study results of Ang Thong Fisheries and Processing Cooperatives in terms of processing quantity, the time required, ease of use, and single sun-dried in current sunlight. From the above data collection, the production amount of snake-head fish was approximately 1,500,000 kilograms per year and can be processed about 1% or approximately 15,000 kilograms
per year. Processing using making single sun-dried snake-head fish at present, snakehead fish was naturally dried using solar energy. It was applied to dry naturally by using a net in a cage built to prevent insects as shown in Figure 1.

![Image of sun-dried snake-head fish]

**Figure 1 the current location of single sun-dried snake-head fish and the current product before upgrading.**

From Figure 1, it was found that in the current sun drying, the temperature in the sun can not be controlled, resulting in the drying time and the moisture content in the single sun-dried snake-head fish inconsistent and affecting the storage time. The humidity required for making single sun-dried snake-head fish was approximately 65%. At present, the group had used the experience to estimate the time of the sun exposure, resulting in different humidity for each time of the sun exposure.

2. The Ang thong Fisheries and Processing Cooperative Group needed processing to meet the GMP principles and meet the community product standard for single sun-dried snake-head fish (TCPS.298/2549), and can produce single sun-dried snake-head fish every time because the single sun-dried snake-head fish product can be produced relying on sunlight and producing only in the sun. According to the preliminary survey, the Ang Thong Fisheries and Processing Cooperative Group had a gas-powered dryer, but it was not used due to difficulty and had to watch and open the top and bottom lids according to different temperatures, making it inconvenient to use, difficult to use, and use as most of them were elderly villagers who were inconvenient to work. From collecting the data from the literature review and combining it with the needs of the said Ang Thong Fisheries and Processing Cooperatives Group, the researcher was used as the basis for the research and can be used as preliminary information, which can be summarized as follows.

1. The Ang Thong Fisheries and Processing Cooperative Group wanted to process it to meet the GMP primary and meet the community product standard for single sun-dried snake-head fish (TCPS. 298/2549).

2. Ang Thong Fisheries and Processing Cooperatives Group wants to work without sunlight.

3. Ang Thong Fisheries and Processing Cooperative Group needed tools that could be used and used by all genders and ages.

4. The Ang Thong Fisheries Cooperative and Processing Group needed a dryer that can be processed in bulk, approximately 50 kilograms per time.

5. The Ang Thong Fisheries and Processing Cooperative Group needed a dryer that was easy and harmless.

From the preliminary data, the researcher had summarized the requirement that the single sun-dried snake-head fish should be used as heat pump drying to use electricity in the community. The material to be used must be food grade, with simple buttons, easy to use, programmable timer, and can put 50 kilograms of fish at a time (fresh fish with only meat leftovers).
3. From the information on the preliminary requirements for upgrading the processing of single sun-dried snake-head fish to meet the GMP primary and meet the community product standard as well as add value, the researcher with the Ang Thong Fisheries and Processing Cooperative Group agreed initially was to develop a dryer to be able to dry single sun-dried snake-head fish by GMP standards. The single-strand dryer used a heat pump system with a capacity of 50 kilograms per cycle by using a heat pump system that can control temperature and time. The design process was a heating system in the middle of the dryer and hot air flows to the left and right to suit the amount of single sun-dried snake-head fish used for drying. The rack design emphasizes ease of use and hot air distribution. The rack was a food-grade stainless steel mesh basket and the rim was food-grade stainless steel so that moisture can evaporate to the top of the unit. The heat pump used was approximately 38000 BTU for heating, as shown in Figure 2.

![Figure 2 Design of a heat pump dryer for drying single sun-dried snake-head fish.](image)

From Figure 2, the heat pump drying machine for drying single sun-dried snake-head fish had the following working steps:

1. The airflow in the system started from the motor power blower to distribute the hot air to the layers so that the fish get the same heat. The hot air from the pump system was distributed along the side edge of the machine and was distributed into each layer of the fish in each tray.

2. The hot air passing through the fish meat in each layer would carry moisture into the inside edge of the cabinet, the center of the machine, and down the bottom of the machine.

3. The humid hot air entered the bottom of the unit through the lower cooling coil to draw the water away from the hot air so that the hot air had reduced water vapor and passed into the outdoor unit.

4. The hot air that had been pre-circulated through the indoor unit will flow through the outdoor unit with a heat pump system to bring the hot air to the desired temperature to flow to the system. In this heat pump system, the heat was also added from the outside air by connecting another set of cooling coils so that the heat can be improved better and the cool air can be used to benefit the needs of the community. For example, if the dryer was installed in the processing room, it will be able to cool around 25-30 degrees Celsius so that the processor can use energy efficiently, which was the highlight of the machine that the researcher had developed as shown in Figure 3.
Figure 3 The heat pump dryer for drying single sun-dried snake-head fish.

4. The study of the appropriate method of drying snake-head fish was a comparative study of 2 methods, namely: 1) Natural drying method using natural sunlight that temperature was about 55 degrees Celsius. 2) Drying method by using a heat pump dryer for drying snake-head fish at a temperature of 60 degrees Celsius for 6, 9, 13, 15 hours. It was found that the longer the drying time, the darker the product was from the 6 hour baking value. This drying gave the color brighter than the drying at 9, 13, 15 hours, respectively. Drying at 15 hours gave the product the darkest color. The natural sun drying method using sunlight at a temperature of approximately 55 degrees Celsius at 6, 9, 13, 15 hours was found to have the same effect as the drying with a heat pump dryer for drying fish with a single suntan. With a longer drying time, the darker color of the product was from the 6 hour drying value to the color that was brighter than the drying at 9, 13 hours, and at 15 hours the product was the darkest. By comparing the color of the products from the two baking methods, it was found that the product color obtained from the heat pump dryer for drying fish had a reddish-brown color and was more appetizing than the products from the natural sun drying method using sunlight.

The natural sun drying method using sunlight was found to have the same effect as drying with a drying oven. When it took longer to dry in the sun, the remaining moisture content decreased. Drying was at 55 degrees Celsius with the time of 6, 9, 13, 15 hours and residual moisture values of 64.05 ± 0.30, 61.58 ± 0.64, 53.48 ± 0.68, and 52.42 ± 0.36, respectively. The method of drying with a heat pump dryer for drying single sun-dried snake-head fish was found that the longer the drying time, the moisture content of the product decreased. Drying was at 60 °C, time 6, 9, 13, 15 hours with residual moisture values of 59.57 ± 0.45, 52.38 ± 0.32, 47.09 ± 0.30, and 42.42 ± 0.36, respectively. The moisture effect was consistent with the Community Product Standard for single sun-dried snake-head fish (TCPS 298/2549), indicating that the moisture content of single sun-dried snake-head fish products must not exceed 65% by weight.

The single sun-dried snake-head fish products that used the natural sun drying method, use sunlight, the moisture would decrease rapidly in the outer skin, but the inner meat still had moisture. Single sun-dried snake-head fish had a strong color, musty, putrid smell. However, drying with a heat pump dryer for drying of single sun-dried snake-head fish can maintain the color and moisturized quality better than natural drying and the product was more consistent. This was consistent with the Community Product Standard for single sun-dried snake-head fish (TCPS 298/2549). The smell was the naturally good of single sun-dried snake-head fish and free from any
unpleasant smells such as musty, foul, and spoilage. The resulting texture characteristics were firm, and not hard or soft as shown in Table 1.

Table 1 Results of comparing the moisture content of the natural sun drying method using sunlight and heat pump drying machine for drying of single sun-dried snake-head fish.

<table>
<thead>
<tr>
<th>Temperature (degrees Celsius)</th>
<th>Time (hours)</th>
<th>Humidity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying with a heat pump dryer for drying single sun-dried snake-head fish (60 °C)</td>
<td>6</td>
<td>59.57±0.45</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>52.38±0.32</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>47.09±0.30</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>42.42±0.36</td>
</tr>
<tr>
<td>Natural sun drying method used sunlight (55 °C)</td>
<td>6</td>
<td>64.05±0.30</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>61.58±0.64</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>53.48±0.68</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>52.05±0.57</td>
</tr>
</tbody>
</table>

**Note:** ± means the experimental standard deviation.

From Table 1, the researcher and Ang Thong Fisheries and Processing Cooperative Group brainstormed and summarized to select the drying of snakehead fish with a heat pump dryer for single sun-dried snake-head fish at a temperature of 60 degrees Celsius and the drying time of 6 hours with a humidity of 59.57 ± 0.45% due to the beautiful color of single sun-dried snake-head fish and the humidity passed the community product standard for single sun-dried snake-head fish (TCPS 298/2549).

Enhancement by designing suitable brands, labels, and packaging according to food standards with appropriate community participation. In the design, Ang Thong Fisheries and Processing Cooperative Group, Huai Khan Lan Subdistrict, Wiset Chai Chan District, Ang Thong Province, the community participated in the label design, which trained the label and packaging knowledge to the group and Brainstorming in groups to get labels that meet customer needs. The design was prioritized according to research by Sritong and Sritong [14] that brought customer needs to develop products. By developing packaging after a meeting with the group, it was found that the packaging must contain details consisting of: 1) Name of food 2) Food system number 3) Name and address of the manufacturer 4) The amount of food 5) Key components 6) Date of manufacture / expiration / consumption 7) Storage methods to meet community product standards. The community had modified the colors and patterns according to the needs of the community to make them stand out. When the packaging was attached to the product, it made the product more attractive, cleaner, and more appetizing as shown in Figure 4.
5. Enhanced results to increase the value of the snakehead product by developing a standardized and branded product, labeling, and appropriate packaging can increase the value of the single sun-dried snake-head fish. At present, the single sun-dried snake-head fish costs 250 baht per kilogram. The average cost of single sun-dried snake-head fish production was 217.70 baht per kg. Therefore, the profit was about 32.30 baht per kilogram. If it was upgraded with a dryer and had packaging that was hygienic and can be stored for longer and more beautiful colors, it can be sold for about 350 baht per kilogram. The cost will increase from 228.05 baht per kg. Therefore, profits were about 121.95 baht per kilogram, or if selling single sun-dried snake-head fish processed with a dryer and with hygienic packaging, can increase the profit more than selling traditional single sun-dried snake-head fish with an average of 89.65 baht per kilogram. With the aim of 1% processing of 1.5 million kilograms of fresh fish (the whole group of fish), 15,000 kilograms of fish can be processed, and it will be able to increase the profit from the sale of processed single dried cobra fish and standardized production and had a more hygienic packaging than the traditional sales of snakehead fish in the amount of 1,344,750 baht. Therefore, from research funding, the amount was 656,500 baht. The break-even point for producing dehydrated single sun-dried snake-head fish with hygienic packaging was 7,323 kg. The payback period was approximately 179 days, so the investment can be returned. The data showing production costs were shown in Table 2.

Table 2  The cost of production of single sun-dried snake-head fish in the original and the improvement (depreciation type).

<table>
<thead>
<tr>
<th>Sun dried cost per kilogram</th>
<th>Baht</th>
<th>Incubator cost per kilogram (depreciation type)</th>
<th>Baht</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 kilograms of sunfish require fresh fish at a price of 8,000 Baht (at the price of fish 100 baht per bag)</td>
<td>160</td>
<td>50 kilograms of Sun-dried fish require fresh fish at price of 8,000 Baht (at the price of fish 100 baht per kilogram)</td>
<td>160</td>
</tr>
<tr>
<td>Fish lock ice cost is 80 baht per 50 kilogram.</td>
<td>1.6</td>
<td>Fish lock ice cost is 80 baht per 50 kilogram</td>
<td>1.6</td>
</tr>
<tr>
<td>Seal bag costs, approximately 150 bags per 50 kilograms, 5 baht per bag</td>
<td>15</td>
<td>Seal bag costs, approximately 150 bags per 50 kilograms, 5 baht per bag</td>
<td>15</td>
</tr>
<tr>
<td>Label fee, 150 pieces per 50 kilogram piece, 4.2 baht per piece</td>
<td>12.6</td>
<td>Label fee 150 pieces per 50 kg piece 4.2 baht per piece.</td>
<td>12.6</td>
</tr>
<tr>
<td>Labors cost for 3 persons, 300 baht per person, and can produce 50 kilograms.</td>
<td>18</td>
<td>Sauce costs 0.9 baht, sugar 1.25 baht, fish sauce 1.25 baht, salt 0.25 baht can be used to marinate fresh fish 50 kilograms.</td>
<td>0.07</td>
</tr>
<tr>
<td>The cost of table salt for fermentation of 50 kg of fresh fish uses 1 kilogram of table salt at 25 baht</td>
<td>0.5</td>
<td>Labor cost for 3 persons, 300 baht per person, and can produce 50 kilograms.</td>
<td>18</td>
</tr>
<tr>
<td>Use of sunlight energy</td>
<td>0</td>
<td>Electricity cost is 4.22 baht per unit, requiring 4 units per hour, baking for 6 hours each time, 50 kilograms.</td>
<td>2.03</td>
</tr>
<tr>
<td>Overhead expenses is 500 baht per 50 kilograms.</td>
<td>10</td>
<td>Machine depreciation is 437,50 baht per 50 kilograms, 8.75</td>
<td></td>
</tr>
<tr>
<td>Total cost per kilogram</td>
<td>217.7</td>
<td>Overhead expenses is 500 baht per 50 kilogram.</td>
<td>10</td>
</tr>
<tr>
<td>Selling price per kilogram</td>
<td>250</td>
<td>Total cost per kilogram</td>
<td>228.05</td>
</tr>
<tr>
<td>Profit per kilogram</td>
<td>32.3</td>
<td>Selling price per kilogram</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Profit per kilogram</td>
<td>121.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Profit increased by</td>
<td>89.65</td>
</tr>
</tbody>
</table>

Estimation of cost prices in the event of changes. Because at present, the price of fresh snake-head fish has changed seasonally between the price of 60 baht–150 baht per kilogram and

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the selling price can be changed to stimulate the market, organize various promotions and the price can be changed between the price of 250 baht-350 baht per kilogram. Costs and profits for the change were shown in Table 3.

Table 3 Profits from changing prices of fresh snake-head fish in the range of 60 baht–150 baht (depreciated)

<table>
<thead>
<tr>
<th>Price of fresh fish (baht per kilogram)</th>
<th>Production cost (baht per kilogram)</th>
<th>Profit (baht per kilogram at a selling price of 350 baht per kilogram)</th>
<th>Profit (baht per kilogram at a price of 300 baht per kilogram)</th>
<th>Profit (baht per kilogram at the selling price 250 baht per kilogram)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>164.05</td>
<td>185.95</td>
<td>135.95</td>
<td>85.95</td>
</tr>
<tr>
<td>70</td>
<td>180.05</td>
<td>169.95</td>
<td>119.95</td>
<td>69.95</td>
</tr>
<tr>
<td>80</td>
<td>196.05</td>
<td>153.95</td>
<td>103.95</td>
<td>53.95</td>
</tr>
<tr>
<td>90</td>
<td>212.05</td>
<td>137.95</td>
<td>87.95</td>
<td>37.95</td>
</tr>
<tr>
<td>100</td>
<td>228.05</td>
<td>121.95</td>
<td>71.95</td>
<td>21.95</td>
</tr>
<tr>
<td>110</td>
<td>244.05</td>
<td>105.95</td>
<td>55.95</td>
<td>5.95</td>
</tr>
<tr>
<td>120</td>
<td>260.05</td>
<td>89.95</td>
<td>39.95</td>
<td>-10.05</td>
</tr>
<tr>
<td>130</td>
<td>276.05</td>
<td>73.95</td>
<td>23.95</td>
<td>-26.05</td>
</tr>
<tr>
<td>140</td>
<td>292.05</td>
<td>57.95</td>
<td>7.95</td>
<td>-42.05</td>
</tr>
<tr>
<td>150</td>
<td>308.05</td>
<td>41.95</td>
<td>-8.05</td>
<td>-58.05</td>
</tr>
</tbody>
</table>

From Table 3, it was found that if selling single sun-dried snake-head fish at 350 baht per kilogram, there would be no loss, but if selling single sun snakehead fish at 300 baht per kilogram, it would start to lose when the price of fresh snake-head fish cost 150 baht per kilogram. If selling single sun-dried snake-head fish at 250 baht per kilogram, it would start to lose when the price of fresh snake-head fish cost 120 baht per kilogram.

VI. DISCUSSIONS

The research on An Enhancement of Community Product: A case study of single sun-dried snake-head Fish was an upgrade of the single sun-dried snake-head fish product of Ang Thong Fisheries and Processing Cooperative Group, Huai Kan Lan Subdistrict, Wiset Chai Chan District, Ang Thong Province. The objective of the research was to raise the level of sunfish products to meet the community product standard for single sun-dried snake-head fish (TCPS. 298/2549). The results of the study were to raise the level of the production process to the standard, to study the needs of the development group, and to improve the production process to meet the standard. The improvement and development results were the development of the natural sun drying process of snake-head fish, which was unsuitable, unhygienic, and the temperature cannot be controlled, resulting in substandard products and rapid spoilage. After brainstorming and figuring out solutions, the researcher and the group were able to find a way to improve the sun exposure by developing a heat pump dryer for drying the single sun-dried snake-head fish so that it can dry at the desired temperature and Hygienic because the dryer was made of all food-grade stainless steel and was able to develop the optimal temperature for drying single sun-dried snake-head fish at 60 °C in 6 hours. This gave the single sun-dried snake-head fish a bright color and the moisture content of the single sun-dried snake-head fish was approximately 59.57 ± 0.45%.

The development of a heat pump drying machine for drying fish from the sun was the use of a heat pump drying system, a system that provided uniform heating and continuous heating. The heat pump drying system provided additional heat by allowing the moisture in the fish meat to gradually evaporate from the fish meat. The front surface of the snake-head fish would not dry out and block the evaporation of water inside. Unlike natural sun drying, this method was heated at

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high temperatures, drying the surface of the snake-head fish and blocking the evaporation of water in the fish meat, causing the outside but moist inside, resulting in rapid spoilage. This was consistent with research from research [7-10] that introduced heat pump drying systems to develop food dehumidification that was suitable for use in the community because it was a simple technology and the community was easy to maintain. Most of the temperature used for baking food was about 50-60 Celsius because it will produce food that was colorful and had a standard moisture content.

Adding the value of the single sun-dried snake-head fish product by enhancing the brand, label, and packaging was to develop a branded packaging and had a correct label that complied with the food standard, which included the food name, food system number, manufacturer’s name, and address, the quantity of food, key ingredients, date of manufacture/expiration / recommended consumption, and storage methods to build trust in customers. Developing a branded and labeled packaging can add value to the single sun-dried snake-head fish, increase customer confidence in consuming it, and can be stored for a longer period. This was consistent with research from [13] that had raised the quality of the well-known souvenir pork cabbage in Chiang Mai province to be higher quality and consistent with the research of [11] upgrading fresh cherry tomatoes and saffron tomatoes. It was dried to become a more quality product and was an outstanding product of Nakhon Pathom province and can be exported abroad.

CONCLUSION

The research on An Enhancement of Community Product: A case study of single sun-dried snake-head Fish was an upgrade of a single sun-dried snake-head fish product of the Ang Thong Fisheries and Processing Cooperative Group, Huai Kan Lan Subdistrict, Wiset Chai Chan District, Ang Thong Province. The objective of the research was to raise the level of sunfish products to meet the community product standard for single sun-dried snake-head fish (TCPS. 298/2549). Effect of upgrading to increase the value of snake-head fish products by developing standardized and branded products, labels, and the right packaging can increase the value of snakehead fish as follows: At present, the sun dried snakehead fish costs 250 baht per kilogram. The average cost of single sun-dried snake-head fish production was 217.70 baht per kg. Therefore the profit was about 32.30 baht per kilogram. If it was upgraded with a dryer, had hygienic packaging, can be stored for longer, and was more colorful, it can be sold for around 350 baht per kilogram. The cost increased from 228.05 baht per kg. Therefore, the profit was approximately 121.95 baht per kilogram. If selling single sun-dried snake-head fish processed in a dryer and a hygienic packaging, it can increase profits more than selling traditional single sun-dried snake-head fish with an average of 89.65 baht per kilogram. By setting a goal of processing 1% from 1.5 million kilograms of fresh fish (the whole group of fish), 15,000 kilograms of fish can be processed and will be able to increase the profit from the sale of processed single sun-dried snake-head fish and standardized production and had a more hygienic packaging than the traditional sales of single sun-dried snake-head fish for 1,344,750 baht. Therefore, the research funding was 656,500 baht. The break-even point for producing dehydrated single-skinned snakehead fish with hygienic packaging was 7,323 kg. The payback period was approximately 179 days, so the investment can be returned as in Figure 5.
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