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Feasibility Analysis for The Development of Integrated Coconut Industry in Tidore Islands, North Maluku

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***Abstract*—Coconut is the number one commodity in North Maluku. Nevertheless, mostly the coconut farmer is lived in poverty. Therefore The Government of Tidore Islands planned to build an integrated coconut industry in its administration area. This research aimed to analyze the feasibility of integrated coconut industry and to decide the main coconut product of the industry. The analysis consisted of market aspect, raw material availability, technology aspect, financial aspect, applied technic, and the impact on society and environment. The market analysis result showed there were 4 food products and 2 non-food products that were suitable to develop in Tidore Islands. Further analysis, which was financial aspect showed white copra was suitable to be the main product of The Integrated Coconut Industry in Tidore Islands. The production of white copra needed IDR 2.795.000.000 as initial capital investment. It was predicted to make a profit IDR 1.766.520.000 /year, the NPV value was IDR 3.702.044.248,88, the IRR value was 64,899% and the PBP was 2,5 years. Coconut husk and coconut shell will be processed to be coconut fiber and charcoal. Based on the result analysis of all the aspects, Integrated Coconut Industry in Tidore Islands is feasible to be established.**

***Keywords*—feasible analysis, white copra, the integrated coconut industry**

I. INTRODUCTION

Indonesia is an agrarian country, where many Indonesian people depend their life on the agriculture sector. Agriculture is an important sector to preserve food security in Indonesia [1]. In 2021, there was 36.123.820 people worked as farmers of food plants, horticulture, crops, and animal husbandry [2]. Despite agriculture being the main sector to preserve food security and cantilever the economical matter in Indonesia, as many as 46,30% of people who live in poverty is working as a farmer [3].

Coconut is one of the main agricultural commodities in Indonesia. Indonesia is the highest producer of coconut in the world. In 2020, Indonesia produced 2.811.900 tons of coconut. The provinces in Indonesia that had high production of coconut were Riau, North Sulawesi, West Java, North Maluku, and Central Sulawesi [4]. North Maluku as one of the high producers of coconut, had a 202.800 Ha coconut plantation area [5] and it could be produced as much as 220.942-ton coconut in 2020. North Maluku has 10 districts. The top 5 high coconut producers were West Halmahera, Morotai Island, North Halmahera, Sula Islands, and Tidore Islands [6]. Based on the data, in 2020, Tidore Islands had a 12.835 Ha coconut plantation area [7] and produced 12.205-ton coconut [6].

The product made from coconut that people in Tidore Islands mostly produced was black copra. Black copra was made by smoking dried coconut meat. The smoking process made the coconut meat turn black. It also gave a smoke smell to the coconut which covered the original smell. Black copra had 5,80% water content; 54,75% fat; and 1,80% free fatty acid [8]. Black copra had a low price compared to white copra in the market [9]. Black copra was sold for IDR 9900 while white copra was sold IDR 16000 in the market around North Maluku. The buyer was not interested to buy black copra due to its black color and it was dirty [10].

Other than copra, coconut fruit can be processed to be many other products. Example of food product made from coconut is white copra, desiccated coconut, coconut milk, coconut oil, coconut freshwater, VCO, coconut cream, coconut powder, coconut chips, coconut butter, nata de coco, coconut jam, shortening, and margarine. While the example of non-food product made from coconut is soaps, charcoal, coconut fiber, activated carbon, coir pads, and coconut handicrafts [11][22].

The Government of Tidore Islands planned to build an Integrated Coconut Industry in Tidore Islands. The purpose of this project is to increase the selling price of coconut products and develop a new product as the main coconut product. In the end, the long-term purpose of this project is to bring prosperity for the coconut farmer and micro business. This study is the initial step to identify The suitable product as the main product

to be developed in the Integrated Coconut Industry which will be established in Tidore Islands.

II. METHOD

Data used in this research consisted of primary data and secondary data. Primary data was obtained by direct survey and observation in the location. The data was collected in 4 sub-districts in Tidore Islands. It was North Tidore, Oba, Central Oba, and South Oba. The 4 sub-districts was chosen because it produced > 40-ton coconut in a year. Secondary data were obtained from government officials and private companies about the coconut and coconut industry. A feasibility analysis was determined by the analysis of market aspect, raw material availability, technology aspect, financial aspect, applied technic, and the impact on society and environment.

III. RESULT AND DISCUSSION

A. Market Aspect Analysis

The market of coconut commodity and coconut products can be found in the local area or in overseas. Indonesia exported coconut and coconut products to some other countries already. Coconut products that were exported overseas were coconut fruit, desiccated coconut, coconut oil, and copra. Indonesia also exported non-food coconut products such as coconut fiber and charcoal. Importer countries of Indonesia's coconut products were Malaysia, Singapore, Bangladesh, India, China, South Korea, and European countries [12]. There is some company in Indonesia that also potential buyers for coconut products, such as PT Sari Mas Permai, PT. Mangga Dua Coconut Oil Refinery, PT. Krambil Idjo, and PT. Agro Manunggal Cocos. The overseas company that can be potential buyers are Cargill, ADM, Bunge, Unilever Group, Procter & Gamble Co., Henkel AG & Co, Nestle, Mondelez International, and Wilmar International. Based on the data above, the market of coconut products is abundant both in Indonesia and overseas.

The result of the direct survey showed coconut products that potential to be developed in Tidore Islands were coconut oil, coconut powder, VCO, black copra, white copra, coconut fiber, and charcoal. Black copra is the main coconut product produced by people in Tidore Islands for a long time. It is a coconut product that is produced from generation to generation. Black coconut has many minus aspects thus it is not well interested in the market. Tidore Islands needs a new coconut product which is well accepted in the market nowadays. The product must have a good quality to match other coconut products in the market. The Technical Implementation Unit as the administrator of The Integrated Coconut Industry should facilitate it well, hence it can produce a good quality coconut product. The Technical Implementation Unit needs to purvey market segmentation, market competition, product selling price, distribution chain, and promotion aspect.

B. Raw Material Availability Aspect

Raw material availability is one of the important factors for developing a new industry besides funds, human resources, and technology. The raw material is the basic material to produce a product. Raw material availability will affect the production scale [13]. Production scale is connected to consumer demand. The company should be able to fulfill consumer demand. Consumer demand fulfillment depends on product availability. Product availability depends on raw material availability. Therefore, raw material availability is an essential and important matter to support the continuity of industry [14].

Tidore Islands is in the 5th spot as a high producer of coconut in North Maluku. It produced 12.205 tons of coconut in 2020. It has 8 sub-districts and all of its sub-districts produced coconut. The survey result showed sub-districts in Tidore Islands which had high coconut production were Oba, Central Oba, South Oba, and North Tidore. As many as 26 villages produced >40 ton/year coconut. It was divided into 13 villages in Oba, 7 villages in South Oba, 4 villages in Central Oba, and 2 villages in North Tidore. The coconut production number in Tidore Islands was evaluated to be enough to support the integrated coconut industry. The villages with >40 ton/year coconut production will be the main supplier of the raw material.

C. Technology Aspect Analysis

Food products that were evaluated as the suitable product to be developed in Tidore Islands were coconut oil, coconut powder, VCO, black copra, and white copra. Whereas the non-food product that was suitable to develop in Tidore Islands were coconut fiber and charcoal. People in Tidore Islands are used to making black copra as the main product from coconut. They made it using the traditional method. Black copra was made by smoking the coconut meat until it dried. They used coconut husk and shell as the fuel to produce smoke. The smoke from burned coconut husk and shell gradually dried the coconut meat. It needed 1-2 days of the smoking process to dry the coconut meat.

Some coconut farmers and micro-business have produced white copra as an alternative product. White copra can be made by many methods. The first method is using solar drying. Fresh coconut meat is put inside a dome. The dome can be loaded with a variable amount of coconut meat, depending on the dome's size. There are two types of dome, traditional type, and modern type. The traditional dome is made of a plastic hood. The modern hood has an automatic air circle to keep the temperature and humidity inside the dome. There is a risk that coconut meat will be contaminated by mold during the drying process. It can be prevented by the smoke it using burning sulfur or soaking the coconut meat in natrium bisulfite liquid before it is put inside the dome. The drying process lasts for 4 days [15]. Another method to make white copra is using an oven. This method is faster than the solar drying method. It only needs 13 hours of the drying process to dry the coconut meat. The temperature used to dry the coconut meat is 68℃. the process also does not require the preservative agent [8].

People in Tidore Islands also make coconut oil using the traditional method. The oil is used as fried oil. It has a natural coconut smell and clear white-yellow color. The traditional method of how to make oil is started by extracting coconut milk. The coconut milk then is settled for 24 hours. After 24 hours, it will form 2 layers of coconut cream and water. Coconut cream is separated from the water and heated until the oil is extracted. The traditional method of making coconut oil is ineffective and inefficient. Another method to produce

coconut oil is by extracting the oil from copra. One of the tools for pressing copra is a screw oil press machine [16]. The crude oil needs to go through the refinement process before it goes for sale to the market.

Virgin coconut oil (VCO) is coconut oil made from fresh coconut meat using a mechanic processing or natural processing such as fermentation [17] and enzymatic [18] with or without mild heat and without chemical refinement process [19]. VCO is one of the functional food because of its bioactive compounds [20]. There are some micro, small, and medium enterprises (MSMEs) in Tidore Islands that produced VCO with various kinds of methods.

Coconut powder is a coconut product that has not been developed in Tidore Islands yet. No MSMEs and coconut farmers who made coconut powder in Tidore Islands. Coconut powder was made by drying coconut milk. Tween, guar gum, or maltodextrin was added to the coconut milk before it dried using a spray dryer [21].

Coconut meat processing will produce side products such as coconut husk and coconut shell. If it is not well managed, the side product will turn to be waste. Coconut husk is the raw material of coconut fiber. Whereas coconut shells can be processed to be charcoal. All parts of coconut fruit can be the raw material of various products. If it is well utilized, every part of coconut has its economical value.

D. Financial Aspect Analysis

The development of an industry is a long-time project which needs good planning management to reach the main purpose of the company. Problems that may occur during the development are investment matter, new machine or equipment requirement, and replacement of fixed assets which is no longer economic. Investment needs many funds and it will be linked for an extensive time, thus it needs proper and careful planning.

The analysis parameters used in this study consisted of profit/loss analysis, break-even point (BEP), net present value (NPV), internal rate of return (IRR), cash flow, depreciation, payback period (PBP), and earning after tax (EAT). The parameters were analyzed to all the potential products chosen as the candidate of main product for Integrated Coconut Industry in Tidore Islands. Based on the result of profit/loss analysis NPV, IRR, cash flow, EAT, and PBP, white copra was the most suitable product to develop in Tidore Islands (Table 1.).

TABLE I. FINANCE ANALYSIS FOR WHITE COPRA

Analysis	Unit	Value
Total Investment	IDR	2.795.000.000
Profit (per year)	IDR	1.766.520.000
NPV	IDR	3.702.044.248,88
IRR	%	64,889
Cash Flow	IDR	1.683.067.500
EAT	IDR	1.458.484.167
PBP	year	2,5

White copra was decided to be the main product of The Integrated Coconut Industry in Tidore Islands. Black copra which already is the main product made by the farmer and micro business in Tidore Islands will be maintained beside white copra. Most of the coconut will be made as white copra and the rest will be processed as black copra. Waste products of side products such as coconut husk will be turned into coconut fiber, and coconut shell will be turned into charcoal.

E. Technical Planning

Integrated Coconut Industry of Tidore islands will be built in Oba. Oba is the sub-district of Tidore Islands located in Halmahera Island. Next was the technical planning related to the industry:

1. The amount of coconut fruit that will be processed in The Integrated Coconut Industry is around 13.280 drupes. The production planning and product variation was presented in Table 2.

TABLE II. PRODUCT VARIATION PLANNING FOR INTEGRATED COCONUT INDUSTRY IN TIDORE ISLANDS

Raw Material	Product	Percentage of Raw Material (%)	Yield (%)	Total Production (kg/day)
Coconut meat (28%)	White copra	60	50-55	2193-2412
	Black copra	40	50-55	1456-1601
Coconut husk (35%)	Coconut fiber	100	96	5241
Coconut shell (12%)	Charcoal	100	30	562

2. White copra will be produced using the solar drying method. The drying process will be done inside a solar dome. This method was chosen due to its cheap installment and the location of the industry is suitable for applying the solar drying method. The capacity of one dome is 3-5 ton coconut meat/copra.
3. The side product of white copra such as coconut husk and coconut shell will be processed to be coconut fiber and charcoal. This industry will process all parts of the coconut fruit, thus it will not produce any waste. The coconut fiber is made by disentangling the coconut husk using a coir parser machine and a sieve machine. Charcoal is made by burning dried coconut shells using an ignition drum.
4. The production cost of white copra was calculated to be IDR 10.936/kg, coconut fiber and charcoal were IDR 4.166/kg.
5. The selling price of white copra was predicted around IDR 14.217/kg, coconut fiber, and charcoal IDR 5.416/kg.
6. The economic life of this project was predicted to be 20 years.

F. Social and Enviromental Impact Analysis

The construction of The Integrated Coconut Industry was predicted to inflict some impact on the people who live around the construction location. The negative impact that may occur was public anxiety, air pollution, noise pollution because of the land cleaning, construction, and distribution, also water availability. Human resources is another conflict that is predicted to arise. The establishment of this industry will give a new job opportunity for local people, but if the industry also

takes workers from people outside Tidore Islands or North Maluku, it may cause jealousy among the local people.

The positive impact of the industry for local people especially coconut farmers and micro-business is a marketing guarantee. It also will open job opportunities for local people. Inside the area of Integrated Coconut Industry, some stands are prepared as the place for MSMEs in Tidore Islands which produced coconut-based products to promote and sell their product.

IV. Conclusion

Tidore Islands with its high production of coconut is a potential place to build Integrated Coconut Industry. New product development is needed to be done as an attempt to improve the coconut industry in Tidore Islands. The coconut product that was evaluated as a suitable product to be developed in Tidore Islands is white copra. White copra will be the main product, while coconut fiber from coconut husk and charcoal from coconut shell will be the side product. Based on the result of market analysis, raw material availability, technology aspect, financial aspect, technical planning, and social-environmental impact, Integrated Coconut Industry in Tidore Islands was feasible to be established.

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Conflict of Interest

State that the authors have no conflict of interest.

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