Designing business models for rural agroindustry to increase the added value of coconut

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Abstract. Indonesia is the world's largest coconut producer, where smallholder plantations play a significant role. Income-generating from coconut farming currently very low because there is no by-products processing. The integrated coconut industry is a strategy to produce processed products with added value by utilizing all product components. However, implementing a rural-based integrated coconut industry faced several constraints. This paper aims to analyze the constraints of increasing coconut added value and identify the integrated coconut industry's business model, followed by a support system analysis. The constraints faced include raw material, processing, human resource capacity, and support system. These constraints are not only related to technical problems but also managerial aspects. Therefore, the required approach must be system-based, where the development of a business model with its supporting system is a strategic step to overcome. Three business model patterns can be built, distinguished by business model structure, role sharing, and risk management. The development of a business model requires an innovation system that allows the transfer of knowledge and technology. It focuses on capacity building, technology transfer, market access, and financial support. The system will involve small-medium enterprises, local government, research institutes, coconut associations, and financial institutions.

1. Introduction

Indonesia is the world's largest coconut producer dominated by smallholder (99.04%). The total area of coconut in 2018 reached 3,417,951 hectares, and producing ca. 14.3 billion nuts or ca. 2.84 million MT copra per year [1]. The coconut export includes the primary form, coconut and copra, manufactured product, and derivative product. The Indonesian coconut export value in the 2010-2019 period tended to increase with an average growth of 16.74% per year [2]. Coconut is considered a healthy food, and therefore there is a high demand to shift the market towards value-added products [3]. Increasing the added value of coconut can be done through the implementation of the integrated coconut industry. It is an industry that applies the coconut processing method by utilizing all product components in the form of coir, meat, shell, and coconut water in one industry. In large-scale commercial use, the products must be produced, packaged, and delivered to the market in a form that meets the consumer requirements [3]. However, copra and whole coconuts are significant product sales and income-generating from coconut farming currently very low because there is no by-products process from coconut trees [4]. This paper aims to analyze the constraints of increasing coconut added value and identify the business model for coconut rural agroindustry development followed by a support system analysis for implementing the business models.
2. Research methods

2.1. Research approach
This study used a qualitative approach. The analysis includes mapping the integrated coconut industry, analyzing constraints of integrated coconut industry development, and developing the integrated coconut industry's business models. The analysis was carried out by conducting field observation and in-depth interviews. Developing the business model is based on an analysis of existing opportunities and constraints.

2.2. Location and time of research
The study was conducted in North Minahasa Regency as one of the coconut developments in North Sulawesi Province. Field observation was carried out in 2017, followed by secondary data analysis in 2020. Sources of information are farmer groups and coconut processing companies that have exported processed coconut products.

2.3. Analysis method
The analysis used the Analytical Hierarchy Process (AHP) method, which is applied in analyzing the constraints faced in developing the integrated coconut industry. AHP steps consist of (1) defining the problem and setting goals, (2) arranging the problem into a hierarchy, (3) calculating the comparison value for each element in the hierarchy generated from the pairwise comparison matrix, and (4) calculating a consistency level [5]. The scale used in pairwise comparisons is "1" means the two elements have the same importance value, "3" means one element is a little more important, "5" means one element is more important, "7" means one element is very important, and "9" means one of the more important absolute elements. The values "2", "4", "6", and "8" are the values in between, while the reciprocal value shows the opposite value. The data was processed using the Expert Choice program.

3. Result and discussion

3.1. Integrated coconut industry development
Through agro-enterprise development, supporting rural areas is a strategic way of dealing with shortages of resources and assets and significant changes in the agricultural sector caused by globalization and market integration [6]. The development of rural agroindustry will increase rural agricultural products' added value to increase farmers' income. Besides that, regional development will ultimately increase local labor, regional income, and exports [7]. Through agro-industrial development, benefits will be obtained in the form of job creation, reduction of post-harvest losses, foreign exchange from exports, and extension of product shelf life, as well as ensuring food availability through product diversity and distribution facilities [8].

The establishment of agribusiness enterprises throughout the value chain will create additional employment, enhance the linkage from the production side to the consumption side, and reduce the production chain's length [9]. This process requires production enhancement, promotion of producers organization, partnership, and profitability through market linkages [9]. Raw material price and other input price are determinants of value-added amounts because the two variables lead directly to an increase in production cost [10].

The relationship between agriculture and industry looks promising, although still very weak. Enhancing this relationship can be done by commercializing the rural and market orientations of agricultural and farmer households, creating non-agricultural employment, waste reduction practices, trade relations, and policies related to partner countries and traded products [11]. More specifically, the development of agricultural entrepreneurship appears as a way forward for rural communities to improve their standard of living [6].

Added value can be built through increased quality, functionality, form, place, time, and ease of ownership [12]. Value creation can be constructed through technology delivery, product delivery,
economics, finance, and customer delivery processes [13]. The strategies related to added value development are value capturing and value-creating. Capturing value usually means capturing some of the added value by processing and marketing. On the other hand, a created-value strategy relies on products or services unique or different from the mainstream equivalent [8].

The opportunity for developing the coconut agroindustry to increase added value is enormous. Processed coconut products are not only in the form of food products but also in non-food products such as activated carbon, shell powder, fibre, charcoal, handicrafts, furniture, and roofs [3]. Besides, coconut can be a source of fuel for rural and industrial areas. Added value-oriented and health-oriented products would dominate the future market of coconut. The main commercial products marketed in the global market were originally copra, but it has shifted to processed products [14]. It is such as coconut milk, coconut cream, coconut vinegar [3], coconut water, Virgin Coconut Oil (VCO), coconut sugar, and others [14].

Processed product include VCO, Oleochemical (OC), Desiccated Coconut (DC), Coconut Milk/Cream (CM/CC), Coconut Charcoal, Activated Carbon (AC), Brown Sugar (BS), Coconut Fiber (CF), and Cocon Wood (CW), which are developed partially or in an integrated production system [15]. Specifically, in Indonesia, the product alternatives considered to have good prospects for development are coconut oil, coconut milk, coconut sugar, nata de coco, handicraft industry, copra, VCO, and coconut fibre, desiccated coconut, and shell charcoal [16].

3.2. The constraints of integrated coconut industry development

The integrated coconut industry is one of the strategies to produce processed products with added value. It applies coconut processing methods by utilizing all product components in coir, meat, shell, and coconut water in one industry. About 87 industries in Indonesia consist of coconut oil, integrated industries, desiccated coconut, and carbon industries, recorded in The Ministry of Industry. These industries are medium and big industries located in Sumatera, Java, Sulawesi, and Kalimantan. The development of a rural-based integrated coconut industry on a small scale has not yet been optimally developed that caused by various obstacles faced in its development.

Studies show that coconut farming constraints are the low time allocation for plant maintenance and the old plants' age [17, 18, 19]. The coconut industry development in the Philippines is marked by several obstacles such as limited information flow in the supply chain resulting in high marketing costs and low million entrepreneurial skills of farmers, and technical problems in managing coconut plantations [20].

The lack of raw materials for VCO production was the primary constraint to operational efficiency [21]. Four factors that impacted the smallholder agro-processing industry's growth are manufacturing equipment, manufacturing skills training, access to automated functions, and management skills training [22]. Some of the obstacles in the processing of coconut by-products are the availability of raw materials, unsuitable types of agro-industry, low quality of products produced by rural agro-industries, lack of hygienic production process implementation, and limited infrastructure. [23].

North Minahasa Regency is one of the potential regions in developing an integrated coconut industry, seen from existing coconut plantations and coconut processing industries, besides the potential export market. The dominant plantation crop in North Minahasa Regency is the coconut. The total area of coconut plantations in North Minahasa Regency in 2019 is 36,643 hectares, with the largest area in Dimenbe, Kauditan and Talawaan Districts. The production was 36,228 tons [24].

In general, the obstacles to implementing the rural-based integrated coconut industry are listed below:

1. The raw material. It consists of (1.1) insufficient supply of raw materials, (1.2) delivery of raw materials is not continuous due to seasonal characteristics, (1.3) low quality of raw material supply, and (1.3) the sources of raw materials are scattered and relatively far from the factory.

2. Processing. It consists of (2.1) traditional processing equipment and machines, (2.2) lack of proper hygiene and sanitation practices, (2.3) product quality that does not meet the required standards, and (2.4) high production cost due to economies of scale.
(3) Human resources capacity. It consists of (3.1) limited manufacturing skills and (3.2) limited management skills.

(4) Support System. It consists of (4.1) lack of technical support for the agro-industrial sector and (4.2) lack of financial support.

The analysis shows that the elements of raw material (0.260), processing (0.295), human resource capacity (0.202) and support system (0.242) have adjacent values (figure 1).

Figure 1. Hierarchy structure of the constraint in integrated coconut industry development.

The result shows that these four elements need to be handled simultaneously. The constraints are not only related to technical problems but also managerial aspects. Therefore, the required approach must be system-based, where the development of a business model with a supporting system is one of them.

3.3. The business model of the integrated coconut industry

The development of the rural-based integrated coconut industry will be closely related to the business model. The strategy has a significant influence on developing a business model, and elements of the strategy are often mentioned in the context of a business model [25]. One of the efforts to improve the rural-based integrated coconut industry is developing a business model appropriate to existing conditions. A business model describes an organization's value to create and capture customer value represented by a set of interrelated elements consisting of customers, value propositions, organizational structure, and economic dimensions [26]. The business model pillars make it possible to express what is offered, the consumer target, how to realize it, and how much can be earned [27].

The rural-based integrated coconut industry is a strategic model for increasing the added value and competitiveness of coconut. Many farmers sell coconuts in the form of coconut or copra grains. The integrated coconut industry enables the coconut processing industry to produce coconut oil and the coconut by-product processing industry in the form of shells, coir fibre, and coconut water. Based on mastery of technology and availability of resources, villages in coconut development centers can build an integrated coconut industry with a capacity of 1000-10,000 coconut/day [28].

The coconut oil processing industry can take traditional coconut oil, Refined Bleached Deodorized (RBD) coconut oil, and VCO. VCO is produced by squeezing fresh coconut fruit to get the oil without cooking, while RBD coconut oils are processed and refined using heating and chemicals. In contrast, virgin coconut oils are not exposed to such processes.

One of the shell-based products is shell charcoal, which is the raw material for charcoal briquettes, which can be processed into activated charcoal. The primary products of coconut coir processing consist of fibres (long fibres), bristles (fine and short fibres), and abrasive dust. Fibres can be processed into rubberized fibres, mats, geotextiles, or carpets. Compost, cocopeat, and particleboard can be produced from coir dust. Coconut water produces several products such as soft drinks, vinegar, and nata de coco.
Several product combinations in the integrated coconut industry are (1) VCO, vinegar, coir fibre, and shell charcoal, (2) VCO, nata de coco, coir fibre, and shell charcoal. With a 1500 coconut/day capacity, the industry development will have a B/C ratio of 2.18 and 2.25 [28]. There is also an integrated coconut industry with expanded products. Coconut meat is processed into DC (50%), coconut powder (30%) and coconut oil (20%), coconut coir produces coir fibre, coconut shell produces charcoal briquettes (75%) and liquid smoke (25%), and water coconut produces nata de coco. Financial analysis showed that investment capital is IDR 13.43 billion and working capital is IDR 2.96 billion and get a B/C ratio of 1.26 [29].

Three business model patterns can be built, distinguished by business model structure, role sharing, and risk management. The actors involved are farmers, farmer groups or cooperatives, and small-medium enterprises. In model 1 (figure 2), the role sharing is as follows: cultivation activities to produce coconuts are carried out by farmers, farmer groups, or cooperatives carry out raw materials collecting. Small-medium enterprise carries out all production units in the processing industry, consisting of coconut oil processing, fibre processing, husk processing, shell processing, and coconut water processing (nata de coco production). Small-medium industries carry out all products produced by industry. Model 1 is applied to conditions where farmers' and farmer groups' technical aspects and aspects are still low. Improvement activities at the farmer level focus on intensifying coconut plantations to continuously improve raw materials' quality and supply. In model 1, the risk-sharing is divided into three parts. The farmers accept the risk of cultivation, small-medium industries carry the risk of agroindustry, and small-medium industries take marketing risk.

![Figure 2. Business model 1.](image-url)

In model 2 (figure 3), the role sharing is carried out by considering coconut processing by individual and farmers group. Small-medium enterprise carries out the production units for fibre processing, husk processing shell processing, and coconut water processing. Model 2 is applied to conditions where farmers' ability is adequate, and farmer groups have experience processing coconut oil but have limited capital to develop fibre processing, husk processing, shell processing, and coconut water processing units. In model 2, the farmer accepts the risk of cultivation and agroindustry risk for coconut oil processing. The agroindustry risk for processing fibre, husk, shell, and coconut water, also marketing risk is handled by small-medium enterprises.
In model 3 (figure 4), the role sharing is based on the assumption that the farmers have been optimal in doing the plantation business to produce good quality copra. Farmers are also involved in processing coconut oil and coconut water in home industries, farmer groups, and cooperatives. The small-medium enterprises carry out the production units for fibre, husk, and shell processing. Model 3 is applied to conditions where farmers and farmer groups can experience processing coconut oil and coconut water but have limited capital to develop fibre, husk, and shell processing units. Hence, the small-medium enterprise carries them out. In model 3, the farmer accepts the risk of cultivation and agroindustry for processing coconut oil and coconut water. The agroindustry risk for fibre, husk, and shell processing, also marketing risk is taken by small-medium enterprises.

3.4. **Innovation system model for supporting integrated coconut industry development**

The development of a business model in the integrated coconut industry also requires an innovation system that allows the transfer of knowledge and technology. The innovation system elements include knowledge and education domains, business and company domains, and bridging institutions that connect the two domains [30]. In the agriculture innovation system, agricultural producers are the main actors in the value chain [28]. Agricultural research and education systems, through bridging institutions, provide support to build the capacity of agricultural producers. Besides, other value chain actors such as seed producers and agro-input suppliers offer technical assistance to improve production.
efficiency. On the other hand, retailers provide information and guidance to achieve Good Agricultural Practice standards and product quality requirements.

The objectives of the innovation system model for supporting integrated coconut industry development are to overcome the obstacles faced by farmers and to ensure its sustainability. The system will involve small-medium enterprises, local government, research institutes, coconut associations, and financial institutions with different roles (table 1).

**Table 1.** Innovation system model for integrated coconut industry development

| Aspect                | SME                          | Local Government | Research Institute | Coconut Association | Financial Institution |
|-----------------------|------------------------------|------------------|---------------------|---------------------|------------------------|
| Capacity Building     | Human resources training     | Agricultural extension and assistance | Community agriculture school | Provision of production and marketing data and information |
| Technology Transfer   | Total Quality Management implementation | Demonstration plot and agro-processing unit pilot development | Rural-based technology development | Best practice benchmarking |
| Market Access         | Product certification        |                  |                     | Organizing business meetings |
| Financial Support     | Credit collateral            | Incentives for financial institutions |                      | Business Credit |

The innovation system focuses on capacity-building activities, technology transfer, market access, and financial support, which in implementation will involve cross-institutions. Capacity building program will be included human resources training activities, agricultural extension and assistance, community agriculture school, and production and marketing data or information provision. The program is designed for coconut smallholders and farmer groups as the leading players in the rural coconut agroindustry. Small-medium enterprises, local government, research institutes, and coconut associations will support intensively.

Technology transfer aims to increase added value, product quality, and industrial competitiveness through cost advantages. The activities consist of total quality management implementation, demonstration plot and agro-processing unit pilot development, rural-based technology development, best practice benchmarking. Technology transfer activities will involve small-medium enterprises, local government, research institutes, and coconut associations. Market access is a strategy to build market assurance to manage price fluctuations and competition. It is achieved through the development of a certification system and arrange regular business meetings.

One of the crucial obstacles in developing an integrated coconut industry is capital and credit access. Through financial support, the credit will be available and accessed by smallholders and rural agroindustry units. The strategies or programs taken include collateral credit by business partners, government incentives, and access to agricultural business credit services.

4. **Conclusion**

Integrated coconut industry development is a strategy to increase added value, farmers income, and regional competitiveness. The dominance of smallholder plantations and processing industries that have
not been integrated affects coconut agribusiness development’s performance. Integrated coconut industry development provides opportunities to use all parts of coconut as commercial products. It also delivers chances for collaboration among actors in mutually beneficial relationships.

Three business model patterns can be built, distinguished by business model structure, role sharing, and risk management. The actors involved are farmers, farmer groups or cooperatives, and small-medium enterprises. The development of business models in the integrated coconut industry should be followed by developing an innovation system model that focuses on capacity building, technology transfer, market access, and financial support. The system will involve small-medium enterprises, local government, research institutes, coconut associations, and financial institutions with different roles.

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