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Assessing the Sustainability of NTFP-Based Community Enterprises: A Viable Business Model for Indonesian Rural Forested Areas

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Abstract: Indonesia's vast forested areas have the potential to serve as a crucial source of livelihood for local communities. However, the current contributions of these forests to community livelihoods are significantly underutilized in comparison to their potential. This study evaluates the financial performance and sustainability of community forest-based businesses operating around the forest management area of the Lakitan-Bukit Cogong forest management unit (LBC FMU). Data were collected through semi-structured and in-depth interviews with the key informants through purposive sampling. Financial viability analysis and a qualitative approach were used to assess the feasibility of the businesses. The findings revealed that all businesses show positive values for all financial indicators. From profit estimation and value-added distribution, all products are shown to be feasible. Concerning the value and supply chain, the rubber-processing industry has a remarkable flow. Moreover, small forest enterprises (SFEs) highlight natural capital optimization through multitudinous derivatives of products that could support a substantial regenerative economy, including citronella essential oil, native honeybees, rubber-based product, biochar, skewers, and liquid smoke. In addition, the multidimensional scaling and rapid appraisal for forest (MDS-RAPForest) approach generates a result based on multiple dimensions (ecology, economics, social and human resources, and institutional and administrative dimensions) showing that overall, SFEs are categorized as sufficient/quite sustainable. Furthermore, mainstreaming adaptable forest-based enterprises, jurisdiction approaches, and cross-production system strategies are also discussed. Our findings suggest that sustainable NTFP-based activities within a community context can be facilitated through interconnected market systems, appropriate price regulations, and support from stakeholders and legal frameworks.

Keywords: non-timber forest products (NTFPs); agroforestry; bioeconomy; financial viability; sustainability index; community forest-based business

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1. Introduction

The challenges faced by forest management in Indonesia have been historically complex due to its intricate connections with local societal factors [1]. The rural economy in Indonesia lacks a robust foundation, leading to high dependence of local residents on natural resources. A total of 31,957 villages have a direct relationship with the forest, with 71.06% of them relying on the forest for their livelihoods [2]. It is believed that forest dwellers have been there for a long time [3]. Forests play a significant role in human livelihood and economic development through both direct and indirect contributions [4]. Improving the livelihoods of local people has received growing attention during the last

two decades and is one of the main goals of watershed management [5]. The sustainability of household livelihoods refers to the capacity of a household to cope with unexpected events and challenges and to preserve or improve its capabilities and resources, without compromising the natural resource base [6].

In this context, community-based forest management is a common approach in several nations [7], such as India [8], Tanzania [9], Bangladesh [10], Ethiopia [11], the Philippines [12], Argentina [13], Kenya [14], Nepal [15], and Vietnam [16]. Community forestry is implemented through a number of strategies that integrate the roles of community, government, and private stakeholders [17,18]. This approach can increase efficiency by engaging locals and promotes knowledge-based and location-specific natural resource management [19,20]. Moreover, community-based forest management systems (CBFMSs) are becoming increasingly popular in developing countries, where 31% of the total forest is either managed or owned by the community [21]. Local communities could, for example, protect their forests, report on deforestation or forest degradation, and then participate in the development of environmentally responsible management practices [22,23]. In addition, the success of rural development efforts is heavily contingent upon the implementation of policies and initiatives that facilitate access to the necessary resources for residents and businesses to drive innovation within their local contexts [24].

In Indonesia, the engagement of communities in forest management has progressed to the third generation [25], with the most recent version being the social forestry initiative [26]. In fact, social forestry can deliver advantages, with a variety of opportunities for active community involvement [27]. Nonetheless, in a number of regions, this program's execution was met with challenges and shortcomings [28–30]. Indonesia's rich forested biodiversity is fundamental to elevating the bioeconomy and NTFP-based community empowerment through the form of enterprises' initiatives. Thus, it is important to manage the forest in a better way. NTFPs hold significant potential for development and are valuable resources that enhance people's livelihoods.

As part of the social forestry program, the forest management unit (FMU) of Lakitan-Bukit Cogong (LBC) has been particularly active in the implementation of the program. A number of programs and strategies have been implemented, including Forest Investment Programs (FIPs) currently being implemented in the LBC FMU. These programs aim to support social forestry initiatives. In the second phase of operationalizing the social forestry policy, efforts are being made to strengthen business capacity. In the initial phase, the number of permits was increased, which enabled the establishment of 10 villages as the focal points for program implementation.

The selection of social forestry businesses in villages within the LBC forest area is based on an assessment of local potential (endemic tree/crop species), community capabilities and skills, and recommendations from a number of privately owned companies in other regions of Indonesia. Currently, there is no financial analysis to serve as a basis for classifying the business undertaken as profitable [31]. However, financial analysis can be utilized as a reference for evaluating positive net cash flows and selecting the forest-based business with the highest rate of return. Additionally, financial analysis can be used to consider multiple management options, to guide government responsibilities in community activities, and as a guide for commercial actors and partners of social forestry programs in the production, sales, and optimization processes.

The growth of SFEs based on non-timber forest products is quite heterogeneous and impacted by a variety of factors [32,33]. Even the COVID-19 epidemic has a definite effect on business continuity [34]. The critical and enabling success factors should be understood by project/program implementation units, SFEs managers, and other stakeholders [35,36]. Therefore, an in-depth and site-specific study is required so that it can serve as a lesson for all parties and be the basis for more successful management.

This research would highlight further the social forestry program example at the forest management unit (FMU) of Lakitan-Bukit Cogong (LBC) in South Sumatera province. Despite the important role that NTFPs play in supporting sustainable local livelihoods

and biodiversity conservation, comprehensive studies on the long-term viability and resilience of NTFP-based enterprises are lacking. Some other research includes that of Pasaribu et al. (2021) [37], who highlighted the general challenges and prospects of four species of NTFPs; Harianja et al. (2023) [38], who underlined only the potential of beekeeping as part of the NTFPs in Indonesia; Sofyan et al. (2021) [39], who investigated potential pine-derived NTFPs in Indonesia; and Simangunsong et al. (2020) [40], who examined the NTFPs in a peatland ecosystem in Indonesia. In other global contexts, Miina et al. (2023) [41] discussed NTFPs and tourism in Brazil; Gasparinetti et al. (2022) [42] analyzed the economic feasibility of restoration of NTFPs in Brazil, Indonesia, Peru, and Cambodia; Peerzada et al. (2021) [43] researched governance transition and NTFP bioeconomy in Himalaya; and Zhu et al. (2021) [44] studied NTFPs' role in livelihood restoration (case in China). Due to the scarcity of research in this area, it is difficult to fully comprehend the factors influencing the sustainability of these enterprises, such as economic viability, social equity, environmental impact, and governance mechanisms. As NTFPs remain important resources for Indonesian communities, further investigations and analyses are required to evaluate and foster the sustainable development of NTFP-based community enterprises.

This study evaluates the practices of small-scale community-based forestry enterprises in order to serve as a resource for various forestry stakeholders, particularly community-based organizations, government officials, extension workers, and researchers, to determine the type of business that is suitable for the physical conditions of tropical forests, local culture, and profitability. This study aims to (1) explore the efforts of FMUs with the support of various stakeholders (particularly FIP 2) for the implementation of forest management development programs; (2) monitor business developments and sustainability triggers; (3) explore the potential and growth of NTFPs on a wider scale; and (4) investigate comprehensively additional (non-financial) enabling aspects for the development of forest-based enterprises.

2. Materials and Methods

2.1. The Study Area

Research was conducted in the forest management area of Region XIII, forest management unit (FMU) of Lakitan-Bukit Cogong (LBC), South Sumatra Province, Indonesia (Figure 1). Geographical location lies between east longitude 102°46′12″ to 103°15′36″ and south latitude 02°45′00″ to 03°16′48″. FMU of LBC covers permanent forest production area (Kungku, North Lakitan I, II, South Lakitan), limited forest production (North Lakitan), and protected forest (Bukit Cogong 1, 2, and 3). The service area includes Musi Rawas Regency, North Musi Rawas Regency, and Lubuk Linggau City, which are administratively located in 15 sub-districts and 69 villages with total population of 411.214 people. Some Indonesian ethnic groups live near LBC FMU. Due to transmigration program, Javanese residents dominate some settlements. Campur Sari Village, for example, has Javanese, Sundanese, and Balinese residents. LBC FMU's territory relies heavily on forests for agriculture and plantations. Monoculture cash-crop proliferation is particularly damaging for Sumatra. Since Dutch colonial times, land tenure policies here have promoted resource exploitation [45]. Tenure insecurity over land and natural resources has adversely impacted livelihoods and perpetuated conflict [3]. Land cover is dominated by mixed upland farms and plantations.

2.2. Samples of Research

The development of community-based businesses commenced in 2018, with a specific emphasis on the production of essential oils, trigona honey, and liquid smoke. Starting from 2019, the FMU of LBC has been receiving support from the Forest Investment Program (FIP) 2 program, which encompasses financial aid, skill-building initiatives, and business assistance. The program has extended its support to various processing-oriented enterprises, including compost production, mellifera honey production, rubber processing, and skewer production. A total of ten SFEs have been successfully established.

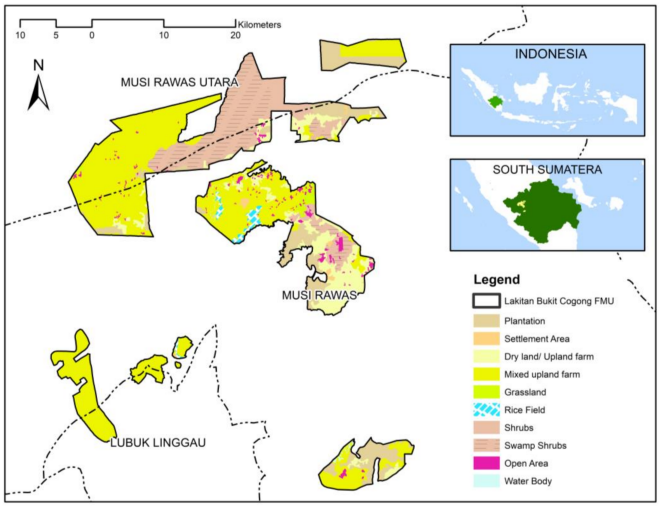

Figure 1. Research Location Map.

The sample was purposively selected based on discussions with key informants such as the head of LBC FMU, forest extension personnel, and other researchers. The selection process also included field observations, a preliminary survey, and reference to the program plan in the RPHJP (*rencana pengelolaan hutan jangka panjang*/long-term forest management plan) document [46]. As a result, from ten SFEs initiated previously, seven small forest enterprises (SFEs) were chosen for further analysis (refer to Table 1). (We use the term SFEs to refer to these samples/objects of research. Legally, SFEs include forest farmer organizations, social forestry business groups, and village forest community institutions.)

Table 1. SFE samples of research.

No.	Type of SFE Activity	Species of Raw Material	Location (Name of the Village)
1	Essential oil production	Lemongrass (*Cymbopogon nardus*)	Megang Sakti 4
2	Honey production	Wild bees (*Apis mellifera)*	Rejosari
3	Honey production	Stingless bees (*Tetragonula leaviceps*)	Mekarsari
4	Saps processing	Rubber (*Hevea brasiliensis*)	Lubuk Rumbai
5	Wood charcoal production	Rubber (*Hevea brasiliensis*)	Jajaran Baru 1
6	Skewer production	Bamboo (*Dendrocalamus asper*)	Marga Puspita
7	Liquid smoke production	Rubber (*Hevea brasiliensis*)	Lubuk Rumbai

2.3. Data Sources and Collection

This research is based on a survey conducted in 2019 and repeated in 2022. As shown in Table 2, we used both primary and secondary data for each analysis goal. Information about farming practices, production facilities, flow and expenses, marketing, supply chain, and qualitative factors (i.e., socioeconomic characteristics of community) was obtained through semi-structured questionnaires and in-depth interviews with key informants (fifteen members of forest-based business group), field inventories, and market assessment. The head and five staff members of LBC FMU were interviewed as key informants using a structured questionnaire to support the community survey. We collected data and information about profile, program, implementation technique and process, and policy on forest area management and community engagement strategy provided by FMU. Furthermore, secondary data were obtained from Central Bureau of Statistics—BPS, village government, and scientific references and activity reports as supporting data and information.

Table 2. Types, sources, techniques, and tools for data analysis.

No.	Goals	Type and Source of Data	Techniques and Tools for Data Analysis
1	Profiling of local business conditions	Primary: semi-structured questionnaires, in-depth interviews, and observation. Secondary: Planning document (RPHJP, RTRW—*Rencana Tata Ruang Wilayah*/Regional spatial plans), report of the FIP 2 project, laws, and regulations.	Tabulation, reduction, and description
2	Wider exploration of potential and growth of NTFPs	Primary: semi-structured questionnaires, in-depth interviews, and observation. Secondary: scientific references and activity reports.	Market and demand (M&D) and financial feasibility
3	Sustainability categorization	Primary: structured questionnaires and in-depth interviews.	MDS-RAPForest

2.4. Estimation of Value Chain, Supply Chain, and Financial Viability

Here, we used a market and demand (M&D) approach, chosen under the assumption that it would provide a more detailed and comprehensive explanation of how each business can perform. The M&D analysis was undertaken by examining a variety of details and information, including farming patterns, value chain, supply chain, and socioeconomic characteristics of the community, among other factors. Furthermore, financial analysis was conducted to assess the feasibility of investment, applying the discounted cash flow method derived from costs and revenues, conducted based on the following assumptions: The value of land is constant and does not vary over time for all land use systems. The tax rate remains unchanging over time. The opportunity cost of labor, in the case of family labor, is calculated based on the current wage rate. The discount rate is 12%, which is the current minimum savings interest rate of the Bank of Indonesia (BI). The study used USD as the currency with an exchange rate of USD 1 = IDR 14,000. However, since the calculations use IDR, exchange rate fluctuations are assumed to have no impact on the research.

Financial analysis was assessed by 3 employed indicators, namely net present value (*NPV*), benefit–cost ratio (*BCR*), and internal rate of return (*IRR*) (Gittinger 1982 [47]; Kadariah and Clive 2001 [48]) as shown in Equation (1).

$$NPV = \sum_{1=t}^{n} \frac{B_t}{(1+r)^t} - \sum_{1=t}^{n} \frac{C_t}{(1+r)^t}$$

$$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2} \times (i_2 - i_1) \quad (1)$$

$$Net\frac{B}{C} = \frac{\sum_{t=0}^{n} \frac{B_t - C_t}{(1+i)^t}}{\sum_{t=0}^{n} \frac{C_t - B_t}{(1+i)^t}}$$

where NPV = net present value (USD/ha); B_t = benefit in year t (USD/ha); C_t = capital outlay and operating cost in year t (USD/ha); n = length of rotation in year; r = annual discount rate (%), t = evaluation time period; B_t = benefit cost (at year t); C_t = cost at year t; $1/(1 + i)^t$ = discounting factor (DF); t = time; i = interest rate; n = economic life value; i_1 = interest rates that produce positive NPV; i_2 = interest rates that produce negative NPV; NPV_1 = NPV positive; NPV_2 = NPV negative.

2.5. Sustainability Index

The enterprises that have been initiated and developed were classified according to their level of sustainability and the factors that affect sustainability, in order to identify the critical success factors for the success of SFEs. To accomplish this, we employed

the Multidimensional Scaling and Rapid Appraisal for Forest (MDS-RAPForest) method, introduced by Tony J. Pitcher in 1999 [49].

MDS-RAPForest, popularly referred to as MDS-Rapfish, which was first applied to research in the field of fisheries to analyze the state of global fisheries [50]. It was introduced in Indonesia by Hartono et al. in 2005 [51] and Fauzi and Anna in the same year [52], and it is now utilized in many multi-aspect [53] and multi-variable development sectors [54]. MDS-RAPForest analysis can yield multiple findings, such as stress values and square correlation (RSQ), sustainability index and status, and leverage of attributes. Table 3 presents a selection of indicators that were considered in this study.

Table 3. MDS-RAPS analysis result indicators.

No.	Indicators	Categories
1	Stress Value	S-Stress Value < 0.25 (the lower, the better)
2	Squared correlation value (RSQ)	RSQ lower than 1
3	Sustainability index and state	0.00–25.00 = bad/not sustainable 25.01–50.00 = low/less sustainable 50.01–75.00 = sufficient/quite sustainable 75.01–100.00 = good/very sustainable

In this MDSForest analysis, Microsoft Office Excel 365 add-ins are utilized [55]. MDS-Forest was selected because it analyzes additional anchors that are not only positive and negative but also have up-and-down menus. By fulfilling this criterion, the anchor will be circular and more stable. Dimensions in MDSRapfish were changed to dimensions suited for the analysis's objective. This study employs four dimensions and sixty attributes, as detailed in Appendix A. The employed attributes were derived from numerous reference sources, such as [56–59] and expert opinion (academics, professionals, and NGOs).

3. Results

3.1. Financial Feasibility and Performance of Small Forest Enterprises

The financial viability of seven SFEs is summarized in Table 4. There are two versions of the shown results obtained. The first version is a calculation using actual financial expectations and independent investment expenses. Conversely, in the second version, investment expenses are not assessed because they are covered by the government through FMU (government) or through the FIP 2 program.

Table 4. Profit estimation and value-added distribution of SFE products.

Product of SFEs	Citronella Oil	Stingless Bee Honey	Wild Bee Honey	Rubber	Wood Charcoal	Skewers	Wood Vinegar
Business feasibility expectations with independent investment costs							
NPV	35,515.88	324.20	2709.63	3185.41	18,208.64	14,777.02	762.70
IRR	43%	13%	13%	12%	45%	49%	29%
Net B/C	(50.62)	(0.10)	(0.89)	(43.57)	(1.23)	71.86	9.66
Feasibility status	*Feasible*	*Feasible*	*Feasible*	*Feasible*	*Feasible*	*Feasible*	*Feasible*
Business feasibility with investment costs resulting from government subsidies and FIP 2 program							
NPV	6733.32	188.76	18,243.93	1383.53	16,201.35	305.59	427.16
IRR	93%	114%	21%	13%	247%	40%	150%
Net B/C	60.81	29.38	0.78	17.48	78.80	14.14	116.26
Feasibility status	*Feasible*	*Feasible*	*Feasible*	*Feasible*	*Feasible*	*Feasible*	*Feasible*

3.2. Value and Supply Chains

An analysis of the value and supply chains of SFEs can provide insight into their current situation and serve as a reference for the development of marketing strategies. Figure 2 displays the value and supply chains of the seven SFEs. These data represent the current state of the citronella oil, honey, wood charcoal, saps, skewer, and wood vinegar enterprises. Figure 2 illustrates that three out of seven developed enterprises are derived from rubber trees (saps and wood), which is likely a result of the prevalence of rubber plants in the region. The saps-processing industry has the longest value and supply chain. This is due to the fact that there are multiple collectors at every level of community groups prior to entering businesses and SFEs. Additionally, honey-producing beekeeping enterprises have the shortest supply and value chains. In reality, SFEs can sell their products directly to end consumers, skipping middlemen and FMUs. Nevertheless, these demands increase effort.

Product of SFEs	**Value and supply chain**					
	Raw material					Finished or semi-finished products
Citronella oil	Citronella farmer	Local middle-man	SFEs	Industrial base	Export	
				Retail base (KPH)	End con-sumer	
Stingless bee and wild bee honey	SFEs	Local middle-man	End consumer			
		KPH	End consumer			
		End consumer				
Saps	Smallholder farmer (Natural rubber)	Local middle-man	District mid-dleman	SFEs	PT BBA	Regional in-dustry
						Export
Wood charcoal	Smallholder farmer (Natural rubber)	SFEs	Regional mid-dleman	Export		
		End consumer				
Skewers	Smallholder farmer (Wild bamboo)	SFEs	End consumer			
			Regional mid-dleman	End con-sumer		
Wood vinegar	Smallholder farmer (Natural rubber)	SFEs	End consumer			

Figure 2. Value and supply chains of SFEs.

3.3. Description of SFE Conditions

3.3.1. Production of Essential Oil

The citronella plant supplies raw material for the manufacturing of essential oils (*Cymbopogon nardus*). Citronella oil, commonly used in perfumes, in aromatherapy, in food flavoring, and as an insect repellent, is extracted using conventional techniques such as distillation and Soxhlet extraction. Initially, the Lena Batu type of citronella was utilized for this purpose. However, due to its low yield (about 0.6%) and poor quality, it was replaced with the Citrona 1 variety, which offers yields between 0.7% and 0.8%. To support the production of citronella oil, the BPHP—Production Forest Management Center of the Ministry of Environment and Forestry of the Republic of Indonesia had provided funding to forest farmer groups to acquire 3 distillation machines (2 with a production capacity of 75 kg/batch and 1 with a production capacity of 1000 kg/batch). Additionally, the government also supported the cost of building a production house and other auxiliary equipment.

The members of the forest farmer group have contributed the property where the distillation equipment (flute machine) is located, thus eliminating the need for rental fees. The local community in Megang Sakti 4 Village legally operates this business as a forest farmer group and village-owned enterprise (locally called *Badan usaha milik desa*—Bumdes). The forest management unit of LBC and Bumdes provide initial capital for processing.

Most processed products are sold in bulk (using jerry cans), but some are selected to be processed into finished products such as aromatherapy massage oil (see Figure 3 right side). The development of this enterprise is constrained by its fluctuating selling prices. Initially, at the end of 2018, bulk products were offered at a price of USD 15.71/kg. However, due to the impact of the COVID-19 pandemic in early 2020, the price dropped dramatically to USD 6.42/kg. Business managers have attempted to innovate by creating air oil products in ready-to-use packaging, but it is challenging to promote products on a large scale, since they lack a commercial license and market capacity is still limited. As a result, production has been discontinued due to selling prices that are not in line with production costs and closed markets, which has hindered business growth.

Figure 3. Citronella oil production plant (**left**) and one of the finished and ready-to-sell products (**right**).

3.3.2. Production of Honey (Wild Bee—*A. mellifera* and Stingless Bee—*T. leaviceps*)

There are numerous honeybee species native to Indonesia, including *Apis dorsata*, *Apis cerana* or *Apis indica*, *Apis mellifera*, and *Trigona* sp. Honey is produced from the nectar of flowers. The source of nectar might be a single type of nectar (monofloral) or multiple types of nectar (multifloral). Honey is a product with hygroscopic properties because it includes naturally high levels of sugar. Due to the high humidity levels in Indonesia, the honey harvest has a relatively high water content. The high water content stimulates the fermentation of microorganisms able to produce new products by chemical metabolism as a single activity or as a form of growth and joint activity. Wild honeybees of *Apis dorsata* and *Apis mellifera*, as well as stingless bees of *Tetragonula leaviceps*, are currently cultivated by the community in and around the forest. However, the *Apis dorsata* wild bee is rarely discussed because cultivation activities are not conducted regularly in this enterprise. The community only harvests, packages, and sells honey, while the other two enterprises engage in intensive bee keeping.

Since 2021, the community of Campur Sari village has been cultivating stingless bees with the support of the FIP 2 program in the form of bee colony containers, feed plant seeds, production houses complete with supporting equipment (for harvesting activities, processing, adjusting water content, packaging, and storage), and additional business help. At first, 300 containers of *Tetragonula leaviceps* bee colonies were utilized in the initial establishment. As illustrated in Figure 4, the cultivation location is situated within an oil palm plantation, and members of the group have also cultivated various flowering plants as food sources (nectar) for trigona bees.

Figure 4. Location of *Tetragonula leaviceps* beekeeping in Campur Sari Village (**left**) and ready-to-sell products of honey (**right**).

The villagers of Rejosari Village have been producing *Apis mellifera* since early 2022. This bee-farming enterprise operates in a mixed oil palm and rubber plantation (as depicted in Figure 5) that is situated adjacent to the production forest area, which is the current area covered by the management permit for industrial Acacia (*Acacia mangium*) forests, owned by PT Paramitra Mulia Langgeng (PML). The location is highly beneficial for bees due to the availability of food sources such as pollen from oil palm and rubber plants and nectar from leaf axils of Acacia. This is one of the factors that has contributed to the rapid growth of apiculture and production.

Figure 5. *Apis mellifera* beekeeping sites (**left**) and ready-to-sell honey products (**right**).

This enterprise was established with the support of the FIP 2 program, which provided bee colony containers, harvesting tools and machinery, and other supports in addition to training and business guidance. Initially, 20 colonies were established. Currently, the firm produces 288 boxes of cultivated colonies and between 200 and 300 kg of honey per month. Honey production conforms to *Standar Nasional Indonesia* (SNI-Indonesian National Standard) 3543:2013 [60], and therefore, its wider distribution is allowed. This business has the greatest quantitative economic feasibility of improvement (see Table 4). SFEs may routinely harvest twice with a yield of approximately 1–1.5 kg/box of colonies, yielding approximately 250–300 kg per month. A relatively low selling price compared to the market price presents opportunities for various supply chains that utilize a distributor or reseller system. In the future, managers can focus on increasing production capacity within a specific market segment. The manufacturing of products based on bees has been shown to provide economic, social, and environmental benefits in other parts of Indonesia [38].

3.3.3. Saps Processing

Natural rubber is one of Indonesia's key commodities and plays a significant role in the country's economy by providing products for foreign exchange and employing a large number of workers in both the upstream and downstream sectors. The upstream natural rubber industry can be divided into two segments: the production of latex in one segment and RSS (Ribbed Smoked Sheet), crepe, crumb rubber, and concentrated latex in the other. About 85 percent of Indonesia's upstream rubber sector business players are farmers. While the downstream rubber business consists of tire production and allied production, completed latex items, and other rubber products, the upstream rubber industry consists predominantly of tire production. Other applications for natural rubber include adhesives, medicinal applications, automotive applications, footwear, foam, and others.

As a result of the latex trading system, which is still based on wet weight, and the lack of suitable incentives for farmers who produce pure latex and utilize superior coagulants, rubber has a very low selling price at the research site. In addition, the value and supply chains are lengthy and closed, resulting in a low price differential between farmers and industry. Therefore, developing a wet-rubber-processing business to produce K3 rubber at the village level is an option that would raise the selling price of farmers (by shortening the supply chain) and open a new business in Lubuk Rumbai Village based on forest farmer groups.

In 2021, Lubuk Rumbai LPHD (Village Forest Management Institution) received support from the FIP 2 program in the form of a production plant with installed rubber-

processing machines (Figure 6). The production machine has a capacity of 1000 kg per unit, and with 2 units in operation, it has the ability to process approximately 2000 kg per production batch. The production procedure has not yet been implemented. There are a number of hurdles, including farmers' commitment to selling wet rubber to collectors and extremely high operational capital needs.

Figure 6. Location of the Lubuk Rumbai Lembaga Pengelola Hutan Desa (LPHD) saps production plant.

Affiliation with a chain of trade systems restricts farmers' ability to negotiate on price determination. This is another difficulty related to starting this rubber-processing enterprise. Efforts to enroll farmers as SFE suppliers are encountering challenges. This situation is illustrated in Figure 2. There are some "middlemen" (locally known as "*Toke*") in the value and supply chain of the rubber industry. *Toke* serve as the link between producers and processors and coordinate the NTFP distribution network. Especially in the weekly traded rubber industry, they gather all production in the village market and pay for it in advance, assuming all risks and transaction expenses. Typically, they establish a two-way commerce by trading food and minor goods (or credit) for rubber products as "payment" or by supplying money (cash) as collateral in addition to initial farmer loans. This forces farmers to sell to chosen middlemen.

The requirement for capital funding to cover operational expenses is significant. According to Table 5, the total monthly operations expenses are USD 23,721.43. The assumption is that production occurs on a daily basis, with a total of 20 production days per month. This amount of capital is difficult for groups to acquire on their own, so investors, including individuals, banks, and other parties, are required.

Table 5. Operational expenses of a rubber-processing company for each production in one month (20 production days per month).

No.	Cost Component	Volume	Unit	Unit Cost (USD)	The Amount of Costs (USD)
1	Buying raw materials	2000	kg	0.57	22,857.14
2	Labor	4	people	7.14	571.43
3	Solar	10	liter	0.71	142.86
4	Electricity	1	day	0.36	7.14
5	Transportation	1	package	7.14	142.86
				Total	23,721.43

3.3.4. Wood Charcoal Production

Wood charcoal is one of the byproducts of burning rubber wood waste. The pyrolysis method is employed to produce the wood charcoal product [61] known as biochar or bio-charcoal, which is one of the carbon-rich products produced from biomass [62,63] by the type of wood charcoal production business conducted in the village of Jajaran Baru 1. The use of traditional brick-and-clay-coated-mud stoves is still prevalent in the production process (see Figure 7). The primary raw material is rubber wood waste (*Hevea brasiliensis*), which is harvested from replanted local gardens in and around the village. The eight-to-nine-day production process consists of the following:

- The one-day process of supplying wood raw materials to the furnace;
- Burning process lasting approximately four days;
- Cooling and packing process for three to four days.

Figure 7. Traditional wood-burning stove (**left**) and charcoal products ready for sale (**right**).

The charcoal is sold to regional collectors, primarily in the Lampung province region, for export, as well as to local users such as restaurants and families for cooking purposes (see Figure 7, right side). Sales are conducted using sacks with 40 kg capacity.

Depending on the number of production days, each stove/furnace should operate approximately three times per month. Five burning stoves are currently owned by LPHD Jajaran Baru 1, according to the funding from the FIP 2 program. Each stove can accommodate and burn 4500 kg of dry wood, outputting approximately 1200 kg. Therefore, the burning process should be repeated 15 times (3 times per stove, 5 stoves available) in order to produce 18,000 kg every month, or 450 sacks. However, to reach these optimum conditions, SFEs face obstacles in the sales funnel. The goal of the production process is to achieve a single burn per stove per month, resulting in an estimated yield of 6000 kg of charcoal or 150 bags per production cycle.

The COVID-19 pandemic has resulted in the closure of export markets, which previously sustained production levels. As a result, after 2020, small-scale community-based forestry enterprises (SFEs) are only able to operate three furnaces per month, with each furnace being operated once per month. This results in a current production of 3600 kg or 90 sacks per cycle, with a selling price of USD 5.36 per bag or USD 0.13 per kg.

3.3.5. Production of Skewers

The LBC forest area has other untapped potentials that have not yet been fully utilized. Some areas of the forest naturally produce NTFPs in the form of bamboo that are only harvested to support people's livelihoods and are not yet used for processing or commerce. The FMU of LBC, along with the community in Marga Puspita Village, took the initiative to improve the selling price of these bamboo resources after identifying their massive potential and limited use. The selling price of bamboo can be increased through the conversion of the raw material into value-added products, such as skewers or sticks, which are currently being explored and produced.

After the construction of the production plant and installation of machinery with the support of the FIP 2 program, this group conducted trial operations in 2021 (as depicted in Figure 8). However, after the trial runs, the daily production capacity was found to be comparatively low, with a maximum output of only 20 kg. In comparison, similar equipment and machinery in other locations have demonstrated a daily production capacity of up to 30 kg. This suggests that the management skills within the group are currently inadequate. Thus, it is necessary to extend production hours in order to maximize capacity. In addition, the operator has been unable to consistently produce goods of acceptable quality that meet market demand. To achieve uniformity in terms of quantity and quality of products, it is essential to improve the standardization of operations, maintain tools and machinery, and enhance the management capabilities of employees.

Figure 8. Skewers production house (**left**) and skewer ready-to-sell products (**right**).

Despite facing challenges such as lack of standardization in their products, limited market absorption capacity, and inconsistent availability of raw materials, SFEs continue to operate. To address these issues, a proposal for training facilitation and the planting of 350 packages of bamboo seedlings with a 2-year plan has been presented. It is projected that harvesting will be possible in 2023.

3.3.6. Production of Liquid Smoke

Liquid smoke, a byproduct of combustion, is generated through the condensation or vaporization of gases produced directly or indirectly from materials high in lignin, cellulose, hemicellulose, and other carbon compounds, via the process of pyrolysis. Pyrolysis, a chemical decomposition method, is executed through the application of heat under reduced oxygen availability, resulting in the breakdown of chemical structures into the gaseous phase [64]. Generally, pyrolysis can occur in 2 to 7 h at temperatures exceeding 300 degrees Celsius. Three products are obtained from the pyrolysis process: gases, pyrolysis oil, and charcoal, the ratio of which is contingent upon the pyrolysis method and the characteristics of the biomass. There are numerous applications for liquid smoke, such as anti-allergy applications, antioxidants, inhibitors, boosting plant growth, deodorant, medicinal applications, anti-fungal and microbiological applications, small animal repellant, and food preservation.

Liquid smoke production occurs in several villages, particularly in Lubuk Rumbai Village. The production process is relatively simple, utilizing a modified drum furnace with a condenser to produce the smoke (as displayed in Figure 9). Old rubber wood waste from replanting is utilized as the raw material. The cooking process typically takes 18 h and results in liquid smoke with grades 1, 2, and 3. The product is sold in large quantities in jerry cans and smaller amounts in 1 L bottles. However, the regular production of liquid smoke has been impacted by the COVID-19 pandemic, as it has become more challenging to sell products on the market. Prior to the pandemic, liquid smoke products were sold in a wide range of markets. For example, toke (middleman) rubber was utilized to eliminate the smell of piles of rubber, rubber farmers used it as a coagulant, and horticultural farmers used it as an insecticide.

Figure 9. Location and apparatus utilized for producing liquid smoke, including the modified drum furnace and condenser (**left**), and liquid smoke products that are for commercialization (**right**).

3.4. Sustainability Status of SFEs

MDS-RAPForest analysis can generate multiple outcomes, such as stress values and square correlation (RSQ), sustainability index and status, and leverage of attributes. The RSQ values on the "RapAnalysis" sheet can show the goodness of fit based on the findings of multidimensional scaling. S-Stress values lower than 0.25 and RSQ values approaching 1 indicate a good model. Considering the results for the stress and RSQ values (see Table 6), all stress and RSQ values indicate that the MDS results in this study are an accurate representation of the situation at hand, forming a good model.

Table 6. S-Stress and RSQ value in each dimension.

Indicators	All Dimensions	Ecology	Economics	Social and Human Resources	Institutional and Administrative
Stress Value	0.12633	0.14051	0.13115	0.16609	0.13747
Squared Correlation (RSQ)	0.95624	0.95228	0.93725	0.94243	0.93851

In addition, the index and sustainability status can be indicated by the results of the RAPForest ordination chart, which describes the location of the object/area we are analyzing (see Figure 10). The circle represents a barrier or anchor. If the resulting value shifts toward the right, it indicates that the value is better, and vice versa. To obtain a more specific number, we can discover the index's value in the "flipped and scaled" menu (presented in Table 6). Overall, based on the sustainability value as presented in Table 7, the SFEs have been classified as sufficient/quite sustainable. One enterprise is classified as very sustainable; that business is the apiculture of mellifera, with an overall sustainability value of 87.53 percent. It is interesting to highlight that this apiculture enterprise holds the top rank in the four assessed dimensions. This indicates that the firm is outstanding in terms of providing benefits, producing no pollutants, being economically profitable, and having proper business attributes. Additionally, the firm has met SNI standards, which makes their products worthy of widespread distribution. Furthermore, the group leaders and members possess strong knowledge, motivation, and commitment, and the enterprise has appropriate institutional and administrative attributes.

Table 7. Sustainability indices of each SFE according to MDS ordination.

No	Type of SFE Activity	Sustainability Index (%)					Category (Based on All Indices)
		A	B	C	D	All	All
1	Essential oil production	75.71	60.34	88.24	43.95	67.94	quite sustainable
2	Production of honey	87.59	53.31	62.92	56.04	63.91	quite sustainable
3	Production of honey	89.84	87.38	88.43	69.60	87.53	very sustainable
4	Rubber processing	62.68	41.54	75.46	40.44	57.64	quite sustainable
5	Wood charcoal production	64.47	45.39	53.88	36.30	53.82	quite sustainable
6	Production of skewer	73.97	47.32	55.37	38.41	51.78	quite sustainable
7	Liquid smoke production	78.25	52.03	60.51	11.31	58.24	quite sustainable

Note: A = Ecology, B = Economics, C = Social and human resources, D = Institutional.

It is noteworthy that the ecological dimension of sustainability has the highest overall average score among the four dimensions assessed, indicating that a majority of SFEs have a positive impact on the environment and generate minimal waste. This is particularly evident in beekeeping, which not only provides economic benefits but also positively contributes to the environment. On the other hand, the institutional and administrative dimension of sustainability has a lower average score compared to the other three dimensions. Furthermore, four SFEs are classified as less sustainable (<score 50%) in terms of economic aspects, with the rubber-processing industry receiving the lowest rating (41.54%).

This is further highlighted by the financial analysis, which shows that a significant amount of capital is required to sustain operations.

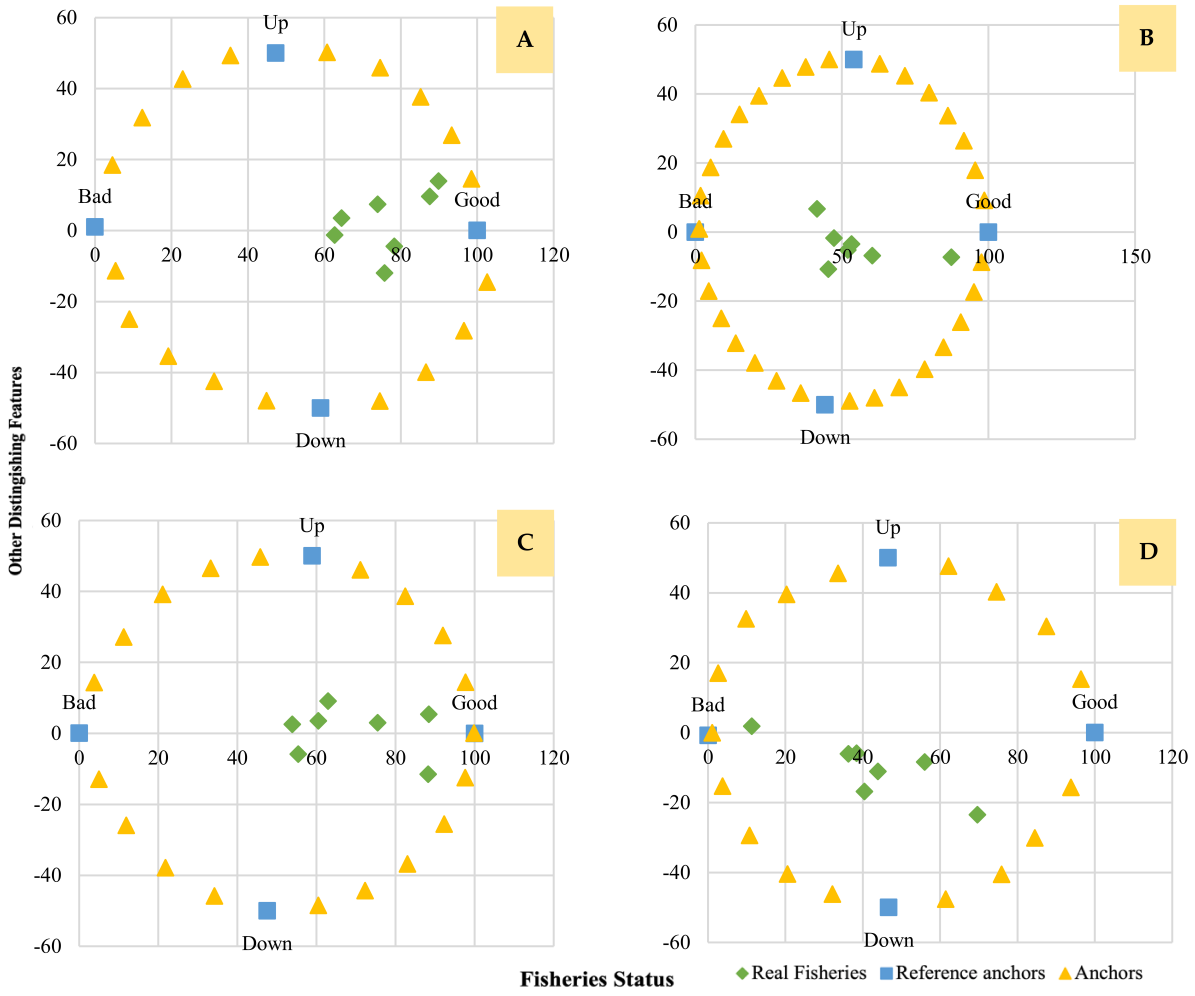

Figure 10. RAPForest ordination plot for each dimension: (**A**) Ecological dimensions; (**B**) Economic dimensions; (**C**) Social and human resources dimensions; (**D**) Institutional and administrative dimensions.

Five SFEs are classified as less sustainable (index 50%) in the institutional and administrative dimensions. Businesses that produce liquid smoke have the lowest sustainability index (11.31%). The results of this assessment of the sustainability index can be utilized by SFEs and other development-supporting institutions, such as KPHs, as evaluation evidence.

Figure 11 illustrates the impact of each dimension group on the assessment of the seven SFEs examined in this study. The results reveal the key variables or attributes that have a significant impact on the evaluation of the seven SFEs being deemed insufficient or inadequate. Should SFEs aim to improve their index value to be considered adequate or good, then these leverage variables can be considered to accelerate the increase.

In ecological dimensions, variables 6 (the presence of raw material fulfillment activities that do not exploit land resources) and 7 (exploitation techniques that are not environmentally friendly) are the two most relevant variables in raising the index. In line with the findings of the sustainability index, SFEs of honey production have the highest sustainability level due to the absence of land exploitation and environmentally damaging exploitation techniques. In contrast, beekeeping involves the protection of land conditions to accommodate bee colonies' growth in a sustainable way.

Figure 11. Leverage attributes in each dimension: (**A**) Ecological dimensions; (**B**) Economic dimensions; (**C**) Social and human resources dimensions; (**D**) Institutional and administrative dimensions.

In the economic dimension, variables 8 (market reach) and 10 (yield/salary/wages) have the most impact. Some SFEs have reached regional and national market penetration. Nonetheless, there are several SFEs with only local market presence. The honey-producing business is capable of generating items that may be sold in retail chains. Moreover, the utilization of marketplaces and online sales provides this enterprise with obvious and tangible benefits, allowing it to reach a larger and more accessible market. In addition, unlike the other enterprises, only SFE mellifera honey and citronella oil processing may provide members or managers with regular returns/salaries/wages, on a timely basis.

The social and human resource dimensions significantly impact variables 9 (quality of IT and marketing ability) and 3 (commitment and motivation of chairpersons and members). The reality on the ground shows that these two variables represent crucial criteria for establishing SFEs. It is essential to note that some SFEs are slowly improving, if at all, due to the chairperson and members' lack of commitment and motivation in operating their enterprise. This is in contrast to the condition of SFEs such as the production of mellifera honey, which appears to be cohesive and motivated. All Standard Operating Procedures (SOP) manuals and group agreements can be implemented effectively. Additionally, marketing capabilities impact sales volume. Almost all SFEs have been able to create products but should restrict production due to lack of market demand. Similar to Vietnam, knowledge

of forestry economic policies and participation in technical training have variable effects on the expansion of SFEs [65].

In the institutional and administrative dimensions, variable 5 (village/regional regulations that govern operations) and variable 7 (the existence of assistants) are the most influential variables. These two variables contribute significantly to the formation of SFEs. The attention of villages and regions, as well as assistants, is able to create group dynamics; village and business governance systems can be governed.

4. Discussion

4.1. Promoting Adaptable Forest-Based Enterprises and Jurisdiction Approach

Small forest enterprises (SFEs) constitute a significant portion of opportunities for individuals living in poverty within the forest harvesting, wood, and non-timber-forest-product-processing sectors. However, these enterprises often encounter various obstacles, and their access to existing support structures is limited. As a result, self-supporting alternatives play a crucial role in addressing these challenges. The government (FMU) and the FIP 2 program have proven, with the support of external parties, that a community can develop when provided with resources, such as tools, machinery, knowledge, and skills. The utilization of the processing sector, specifically non-timber forest products (NTFPs) and environmental services, can be an effective strategy for reducing dependence on wood from forested areas among communities. This approach can not only contribute to the sustainability of forest resources but also provide economic benefits for local communities through the development of new income streams.

A case study of seven SFEs in the LBC forest showed that the community has much potential for establishing forest-product-based enterprises. Innovative products can be developed in accordance with the specific biophysical and sociocultural characteristics of the region. It is crucial to conduct thorough financial analysis to determine the feasibility of an enterprise. As a solution, to improve public relations with the private sector, government relationships and strategy implementation must be strengthened. Theoretically, this endeavor may be accomplished by a jurisdictional strategy. The jurisdictional approach is a prime example of integrated landscape management. It is essential to note that the landscape is defined by constraints that are pertinent to policy and the underlying strategy aims to achieve a significant level of government involvement [66]. The jurisdiction approach promotes multi-stakeholder collaboration to accomplish sustainable development objectives across administrative areas [67,68]. Similarly, in other locations in Indonesia and Cameroon, efforts to empower communities surrounding forested areas have the potential to encourage collaboration between governments and businesses and support local and global markets [32,69,70]. Key landscape actors can participate in these efforts. The ultimate goal is to create sustainable landscapes, improve local livelihoods, and protect forests and other natural ecosystems through the implementation of coordinated, cross-sectoral strategies such as deforestation-free commodity production (minimal exploitation) that is economically viable.

A jurisdictional approach would involve government agencies defining and enforcing land use policies and executing them across jurisdictions [71]. The territorial strategy also necessitates the participation of regional leaders. To play an active role at the research site, the head of the FMU and the head of the forest farmer group/social forestry business group are required. This has had a significant impact on small-scale forest enterprises, resulting in the current level of company growth being in line with expectations.

4.2. Cross-Production System: Facilitate the Ability of Individuals with Public and Private Goals to Work Together

The wood-oriented paradigm has already long been transformed by a resource-oriented paradigm so that the benefits of forests are derived not only from wood but also from the non-destructive utilization of other resources, such as non-timber forest products, tourism, and environmental services [72]. Permits for forest areas are not confined

to a single type of business. Like in United States (U.S.) forests [73], the government's job creation statute currently allows forest owners to utilize their land for several forestry-related enterprises (multipurpose forest use). It is anticipated that the implementation of this strategy will result in an enhancement in the value of a forested area.

Expanding enterprise varieties from industrial forest plantation permits (HTI) and oil palm plantation business permits is one of the ideas that emerged from research and field application. HTI and plantations can generate revenue by utilizing byproducts from trees with mellifera and trigona beekeeping, as it has been proven to be a potentially viable business that does not disturb the primary stand forests.

Multi-business forestry can also be executed by planting multi-purpose tree species (MPTS) and integrating them with existing forestry/plantation plants. Calliandra, a pioneer plant that is tolerant of frequent cutting and poor, acidic soils [74–76], is one of the most rapidly growing species. The utilization of Calliandra trees as a raw material for the production of charcoal briquettes and liquid smoke presents a viable alternative, given the limited availability of traditional sources such as old rubber trees. *Calliandra calothyrsus* nectar is a source of nectar for honeybees, and its year-round flowering makes it appropriate for *Apis mellifera* beekeeping. In addition, the leaves are ideal for use as animal feed (for poultry, goats, and cows) due to very high protein content. LBC is the ideal site in terms of climate because it has the appropriate temperature and humidity [77]. The permit-holding company can collaborate with the surrounding forest community at the level of social institutions. Strong connections between the community and the company will result in a multiplier effect. In addition to enhancing the community's income, forest security is provided, and frequently occurring conflicts can be alleviated.

5. Conclusions

Based on the research results, seven community businesses based on forest product processing have proven financially feasible when supported with equipment, machines, production facilities, and training. However, during the follow-up process, it is vital to strengthen the marketing sector so that the resulting items may be offered while the production sector continues to undergo improvements and innovations.

Based on the sustainability analysis, the SFE with the highest level of sustainability is the Mellifera bees' honey enterprise. The least sustainable aspects are the institutional and administrative ones. For the development of SFEs to be sustainable, several factors need to be considered. These include activities that provide raw materials without exploiting land resources; exploitation practices that are not beneficial to the environment; market reach; yield/salary/wages; level of mastery of IT and marketing; commitment and motivation of the chairpersons and members; village/regional regulations that govern operations; and the presence of assistants.

The key recommendations of this study are as follows: (1) Insufficient infrastructure and community skill hinder marketing in rural areas. Therefore, intermediary traders play a crucial role in the majority of commodity value chains. However, measures should be implemented to ensure fairness in price determination. This can be achieved through the establishment of price regulators, supply chain management, and knowledge management through a jurisdictional approach. (2) Efforts to utilize forest byproducts and downstream processing should be developed in order to capitalize on opportunities arising from recent government policies on multi-business forestry. The analysis findings from this study provide a basis for offering policy recommendations to the government, with the aim of supporting the development of current small forest enterprises (SFEs) or replicating their success in different geographical locations. It is crucial to carefully consider the influencing variables that have been identified and diligently pursue proposed solutions that demonstrate effectiveness. By doing so, policymakers can make informed decisions and implement strategies that foster the growth and sustainability of SFEs, contributing to the overall advancement of the forestry sector.

Nevertheless, it is crucial to provide support for marketing these products throughout their development stages, particularly for those with limited market segmentation, such as essential oils, wood charcoal (biochar), trigona honey, and liquid smoke. This responsibility can be assigned to local collectors, village governments, the government (FMU), or other relevant entities. To ensure efficiency and sustainability, active participation in the marketing process by these stakeholders is essential to maximize profit margins. In practice, the involvement of third-party intermediaries, commonly known as "brokers," in the sales process should be regulated to prevent the occurrence of price imbalances that could lead to significant disparities in profit margins along the supply chain. Furthermore, the government should reinforce its role in maintaining market equilibrium through supply–demand mechanisms. By addressing these considerations, the marketing aspect of the SFEs can be effectively managed, supporting their long-term viability and success.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Dimensions and Attributes Used for RAPForest Analysis.

No.	Attributes	Scoring	Bad	Good	Notes
		Ecological dimension			
1	Liquid and solid waste products	0; 1; 2; 3; 4	0	4	Waste (solid and liquid) by process and ability to handle: much and not handled (0); little and unaddressed (1); much and can be handled (2); little and manageable (3); none (4)
2	The result of pollution, carbon, and harmful substances	0; 1; 2; 3; 4	0	4	Water and water emissions by process and ability to handle: many and not handled (0); few and unaddressed (1); many and can be handled (2); few and manageable (3); none (4)
3	The production process produces odors	0; 1; 2; 3; 4	0	4	Many and unaddressed (0); few and unaddressed (1); many and can be handled (2); few and manageable (3); none (4)
4	Land carrying capacity	0; 1; 2; 3	0	3	Very critical (0); critical (1); prone (2); safe (3)
5	Energy use	0; 1; 2; 3	0	3	Energy use in business (production and others): none (0); low (1); high and conventional (2); high and renewable (3)
6	Exploitation of resources and land	0; 1; 2	0	2	The need for raw materials/business processes that require the exploitation of SD and land: none (0); low (1); high (2)
7	Exploitation practices that are not environmentally friendly	0; 1; 2	0	2	Land burning, excessive logging, etc.: none (0); low (1); high (2)
8	Positive influence on the environment	0; 1; 2	0	2	Assisting with land rehabilitation, ecological cycles, etc.: none (0); low (1); high (2)
9	The level of dependence on environmental quality	0; 1; 2	0	2	Business dependency on raw materials, resources, land, environmental quality, weather/climate, etc.: none (0); low (1); high (2)
10	Compatibility of business with natural factors	0; 1; 2	0	2	Natural factors such as weather, climate, soil fertility, altitude: none (0); low (1); high (2)
11	Chemical use	0; 1; 2	0	2	None (0); low (1); high (2)
		Economic/business dimension			
1	Product legality	0; 1; 2	0	2	Requirements for marketing the product legally: none (0); exists but incomplete (1); complete (2)
2	Sustainability of raw material availability	0; 1; 2	0	2	Difficult (0); available, but limited (1); available all year round (2)
3	Processing technology capability	0; 1; 2; 3	0	3	All conventional (0); semi-automated (1); limited/less automation (2); sufficient machines (3)
4	Production capacity				Stopped (0), by order (1), sideline (2), routine (3)
5	Supply chain/product chain	0; 1; 2; 3	0	3	long and hidden (0); long and open (1); short and hidden (2); short and open (3)
6	Presale processing	0; 1; 2	0	2	E.g., packaging: none (0); some (1); much (2)
7	Information and communication technology (ICT)	0; 1; 2	0	2	Use of ICT in business, e.g., online sales, marketing, payments, digital advertisements, online stores, and virtual communities: none (0); some (1); much (2)

Table A1. *Cont.*

No.	Attributes	Scoring	Bad	Good	Notes
8	Market reach	0; 1; 2	0	2	Current market: local/national (0); national/regional (1); international/export (2)
9	Marketing	0; 1; 2	0	2	Extent of marketing activities carried out, e.g., promotion, branding, positioning: none (0); low (1); high (2)
10	Yield/salary/wages	0; 1; 2; 3	0	3	None (0); low (1); sufficient (2); appropriate (3)
11	Financial management	0; 1; 2	0	2	Division of tasks, financial accounting: none (0); some (1); much (2)
12	Ability to access capital	0; 1; 2	0	2	Adequacy of requirements and knowledge for access to capital, ex-investors, cooperatives, banking: cannot (0); maybe (1); very likely (2)
13	Government subsidies and assistance	0; 1; 2	0	2	Subsidies and assistance from the government, e.g., district government, FMU: none (0); some (1); substantial (2)
14	Subsidies and assistance from donors/external parties	0; 1; 2	0	2	Subsidies and assistance from donors/other external parties, e.g., investors, cooperatives, banks, NGOs, local private companies: none (0); some (1); substantial (2)
15	Financial feasibility	0; 1; 2	0	2	Profitability indicators, e.g., NPV, Net B/C, IRR: not feasible (0); feasible with notes (1); feasible (2)
16	Selling price				(0) Much below average; (1) below average; (2) same; (3) above average; (4) well above average
			Social, human dimension		
1	Conflict between communities	0; 1; 2	0	2	Revealed (0); latent (1); none (2)
2	Team cohesiveness	0; 1; 2; 3	0	3	None (0); low (1); sufficient (2); much (3)
3	Leader and member commitment and motivation	0; 1; 2	0	2	Commitment shown by the leader and members to implement the project efficiently and effectively: none (0); some (1); high (2)
4	Understanding of the leader and members of the vision, mission, goals, rules, and group management	0; 1; 2; 3	0	3	No (0); low (1); sufficient (2); much (3)
5	Participatory project implementation	0; 1; 2	0	2	Implementing activities with active community participation: none (0); some (1); high (2)
6	Formal education	0; 1; 2; 3	0	3	Dominant formal education level of group members: no school (0); elementary (1); junior high school (2); higher education/graduate (3)
7	Environmental knowledge	0; 1; 2	0	2	Level of knowledge about environmental and forestry issues: none (0); some (1); much (2)
8	Technical knowledge	0; 1; 2	0	2	Level of knowledge about technical (processing), entrepreneurial, and innovation competence issues: none (0); some (1); much (2)
9	IT and marketing knowledge	0; 1; 2	0	2	Level of knowledge about IT and online and offline marketing (promotion and sales) issues: none (0); some (1); much (2)

Table A1. *Cont.*

No.	Attributes	Scoring	Bad	Good	Notes
10	Organizational capacities	0; 1; 2	0	2	Group ability to organize members, e.g., minimizing internal conflict, leadership, and empowering members: none (0); some (1); high (2)
11	Leadership ability	0; 1; 2	0	2	Chairperson's ability to lead and manage the business: none (0); some (1); high (2)
12	Access to information and knowledge	0; 1; 2; 3	0	3	Information on innovation (science and technology development), cooperation and market opportunities, assistance and subsidies, product prices, value chains: none (0); low (1); enough (2); high (3)
		Institutional and administrative dimensions			
1	Supporting local regulations (regional/village/group regulations)	0; 1; 2	0	2	Village/group regulations governing businesses: none (0); existing but not implemented (1); exists and is applied (2)
2	The concern and contribution of the village government for and to businesses/groups	0; 1; 2; 3	0	3	Assistance activities/funds, facilitation and motivation, monitoring and evaluation, etc.; none (0); low (1); enough (2); high (3)
3	Communities bargaining power in decision making	0; 1; 2; 3	0	3	None (0); low (1); enough (2); lots (3)
4	Clarity of business planning and development	0; 1; 2; 3	0	3	Existence and implementation level of business work plan: none (0); there is no implementation (1); exists but is not referenced (2); exists and is referred to (3)
5	Rules of the village/region that govern operations	0; 1; 2	0	2	Village/regional regulations governing business management: none (0); incomplete (1); there are (2)
6	Business/group/organization legality	0; 1; 2	0	2	Requirements to operate legally: none yet (0); incomplete (1); complete (2)
7	Existence of professional assistants	0; 1; 2	0	2	Persons who intensively monitor: none (0); there but not intensive (1); existing and intensive (2)
8	SOP (Standard operational and procedures)	0; 1; 2; 3	0	3	Availability and application of SOP: not available (0); available but not applied (1); available and minimal implementation (2); available and maximum applicability (3)
9	Existence of business administration	0; 1; 2	0	2	Financial books (assets, cash flow, debts), secretariat, etc.: none (0); enough (1); complete (2)

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