

Community Empowerment Strategy for the Development of Aren Sugar Production Center in Koto Malintang, Lake Maninjau, West Sumatra

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Abstract This community service program was implemented in Koto Malintang, West Sumatra, to empower farmer groups through the development of an Aren sugar (*Arenga pinnata*) production center. The activities consisted of pre-surveys, focus group discussions (FGDs), socialization workshops, participatory planning, and initial demonstrations of intercropping practices. A key component of the program was the financial feasibility analysis, designed to provide farmers and stakeholders with evidence-based tools for decision-making. The analysis was conducted using production costs and revenues from the research location, with a 15-year horizon and a 10% discount rate. Two cultivation scenarios were evaluated: (1) Aren intercropped with seasonal crops and (2) Aren intercropped with robusta coffee. Each scenario considered two product alternatives: molded sugar (*gula cetak*) and palm sugar crystals (*gula semut*). The results revealed that molded sugar offered only marginal feasibility, with Net Present Values (NPV) of Rp 28–35 million/ha, Internal Rates of Return (IRR) of 12–15%, Benefit-Cost (B/C) ratios around 1.1, and payback periods of 7–8 years. In contrast, palm sugar crystals showed strong financial viability, with NPVs of Rp 298–330 million/ha, IRRs of 38–45%, B/C ratios of 2.4–2.6, and payback periods of only 4–5 years. Sensitivity analysis confirmed robustness across discount rates of 8–12% and price variations between Rp 40,000–60,000/kg. These findings suggest that palm sugar crystals should be prioritized as the flagship product for Koto Malintang's Aren sugar industry, supported by institutional strengthening, diversification, and modern marketing to ensure sustainability.

1. INTRODUCTION

Agriculture continues to be the backbone of rural livelihoods in Indonesia, providing employment, food security, and contributing significantly to economic growth. In West Sumatra, agricultural activities are not only economic enterprises but are also interwoven

with the socio-cultural traditions of the *Nagari* system, where collective decision-making and communal land ownership shape local resource management. One of the most prominent areas reflecting this relationship between livelihoods and natural resources is Lake Maninjau in Agam Regency. The lake supports multiple ecosystem services, ranging from fisheries and hydropower

generation to agricultural irrigation. However, increasing dependence on floating net cages (*keramba jaring apung*) for fish farming has placed severe pressure on the lake ecosystem. Excessive aquaculture activities have accelerated nutrient loading, reduced water quality, and undermined ecological balance, thereby threatening long-term sustainability (Nasdian, 2014). In response to these challenges, diversification of livelihood strategies becomes essential, particularly through environmentally friendly practices that not only secure income but also enhance ecological resilience.

One promising alternative for livelihood diversification in the region is the cultivation and utilization of the Aren palm (*Arenga pinnata*). The Aren tree is widely recognized as a multipurpose plant offering ecological, economic, and social benefits. Ecologically, Aren plays a vital role in soil conservation, particularly in hilly landscapes surrounding Lake Maninjau, as its extensive root system helps prevent erosion and landslides (Anwar, Dwipa, Hervani, & Sari, 2024). Economically, Aren sap provides a raw material for high-value products such as molded palm sugar (*gula cetak*), palm sugar crystals (*gula semut*), and other derivatives including *kolang-kaling* (palm fruit). Socially, Aren farming supports communal livelihoods since most Aren trees are planted and managed on *tanah ulayat* or communal land, which reinforces collective ownership and provides opportunities for institutional strengthening through cooperatives and *BUMNag* (village-owned enterprises) (Wisnubroto, Lubis, & Yulianto, 2024). Thus, Aren cultivation represents an integrated livelihood strategy combining environmental conservation, household income generation, and reinforcement of local institutions.

Despite its potential, the current utilization of Aren in Koto Malintang, a *Nagari*

located in Tanjung Raya District near Lake Maninjau, remains limited. Aren trees are mostly tapped traditionally by elderly farmers, with little structured cultivation or investment. Production levels are low and unable to meet even local demand. Studies indicate that while palm sugar is increasingly in demand both domestically and internationally, production remains far below market potential due to weak institutions, outdated processing technologies, and lack of branding or marketing strategies (Sasaki, 2019). Furthermore, the marketing of Aren products in Koto Malintang is still conducted through traditional channels without proper packaging or access to wider markets, limiting value-added opportunities (Syakir, Nurjayadi, & Yulianti, 2019). This situation highlights a paradox where communities possess abundant natural resources but lack the institutional and technical capacity to translate them into sustainable economic gains.

The challenges to Aren-based livelihoods are multidimensional. Cultivation practices remain minimal, as Aren is often left to grow wild without deliberate planting, leading to inconsistent sap yields. Institutional structures, including farmer cooperatives and local marketing groups, remain weak, thus preventing farmers from achieving collective bargaining power. Generational issues further complicate the problem. Most Aren tappers are elderly, while younger generations are reluctant to engage in Aren cultivation, preferring employment in the service sector such as informal trading or motorcycle taxi driving (White, 2012). This demographic pattern threatens the sustainability of Aren agroindustry in the long run. Additionally, Aren palms are scattered across fragmented lands, which increases collection costs and reduces processing efficiency. From an environmental perspective,

the steep and erosion-prone topography of Koto Malintang makes Aren planting an urgent conservation strategy, yet this potential remains underutilized (Ellis, 2000). These interconnected problems underscore the urgent need for structured interventions to transform Aren farming from a subsistence activity into a viable and sustainable agroindustrial enterprise.

The socio-economic potential of Aren sugar has been confirmed through various studies. Analysis by Syakir et al. (2019) demonstrated that palm sugar enterprises are highly competitive when compared with other smallholder commodities, offering strong financial indicators across Net Present Value (NPV), Internal Rate of Return (IRR), and Benefit-Cost (B/C) ratio metrics. More recently, Paloma (2024) emphasized that palm sugar crystals (*gula semut*) yield significantly higher returns than molded sugar (*gula cetak*), producing an NPV of more than Rp 1.2 billion per hectare, an IRR exceeding 40%, and a B/C ratio above 4.0. These findings indicate that *gula semut* represents a superior agroindustrial product with greater market potential. Beyond profitability, Aren sugar development also presents opportunities for job creation along the value chain, from cultivation and tapping to processing, packaging, and distribution. When production is organized through cooperatives or *BUMNag*, collective action enhances bargaining power, improves market access, and ensures equitable benefit-sharing among farmers (Zubaedi, 2012). Moreover, aligning Aren cultivation with traditional systems of *tanah ulayat* fosters both economic development and cultural preservation, strengthening local solidarity while enhancing livelihood resilience (Nasdian, 2014).

The significance of community empowerment in this context extends beyond immediate financial benefits. By promoting Aren

cultivation, the community contributes to ecological sustainability, as Aren functions as a conservation crop in degraded landscapes. The program also promotes economic empowerment by providing training in financial analysis, business modeling, and marketing strategies tailored for palm sugar enterprises (Wisnubroto et al., 2024). Equally important, the social dimension of empowerment is addressed through participatory approaches. Socialization sessions and focus group discussions not only enhance awareness but also foster collective responsibility, while encouraging youth involvement in agribusiness (Chambers, 1997; White, 2012). This integrated approach positions Aren agroindustry as a strategic solution for addressing both environmental degradation and economic vulnerability in Lake Maninjau's surrounding communities.

The theoretical foundation of this initiative lies in several key bodies of literature. Chambers (1997) highlights the importance of participatory approaches in rural development, arguing that interventions must place communities at the center to be sustainable. In the Indonesian context, empowerment programs must align with socio-cultural institutions such as the *Nagari* to ensure legitimacy and effectiveness (Nasdian, 2014; Zubaedi, 2012). From a livelihoods perspective, Ellis (2000) underscores diversification as a central strategy to reduce vulnerability in rural economies, a concept directly relevant to Koto Malintang's overreliance on aquaculture. Meanwhile, Gereffi (2018) stresses the importance of value chain integration in agroindustrial development, arguing that without institutional support, smallholders remain locked in low-value activities. This provides a strong rationale for cooperative development and branding strategies in palm

sugar agroindustry. Lastly, White (2012) calls attention to the “generation problem” in agriculture, emphasizing the need to actively engage rural youth to ensure the long-term sustainability of farming systems. These theoretical contributions collectively highlight that Aren sugar agroindustry, if developed through participatory and institutionally supported models, holds strong potential as a pathway toward sustainable rural transformation.

Despite a growing body of literature on rural development, there remains a gap in integrating ecological, economic, and institutional dimensions into a single framework for community empowerment. Previous initiatives often focused narrowly on either technical cultivation practices or environmental conservation. Few have combined technical feasibility, socio-economic profitability, and participatory empowerment into a holistic model. This study therefore addresses that gap by presenting an empowerment program in Koto Malintang that simultaneously introduces financial feasibility analysis, participatory decision-making, and cooperative strengthening for Aren sugar agroindustry.

The objectives of this initiative are fourfold: to raise awareness among farmers of the ecological and economic benefits of Aren cultivation; to provide socio-economic feasibility data demonstrating the profitability of Aren sugar enterprises; and to facilitate participatory discussions aimed at designing strategies for developing a production center. By pursuing these objectives, the program contributes not only to the immediate improvement of community livelihoods but also to the long-term sustainability of Lake Maninjau’s socio-ecological system.

2. METHODOLOGIES

This community service program employed a participatory and collaborative approach designed to ensure that the intervention was relevant, acceptable, and sustainable for local communities. The methodology was structured into several sequential and interconnected stages, namely pre-survey and Focus Group Discussions (FGD), socialization and extension, participatory discussions, and initial implementation. Each stage was aimed to address the identified challenges of Aren palm (*Arenga pinnata*) utilization in Koto Malintang, while simultaneously building institutional capacity and strengthening socio-economic awareness among farmer groups.

Pre-Survey and Focus Group Discussions

The first stage involved a **pre-survey** aimed at mapping the socio-economic and environmental conditions of the community, as well as identifying the existing practices of Aren utilization. Field observations were conducted to document the distribution of Aren trees, the existing tapping techniques, and land characteristics. Alongside these observations, key informant interviews were carried out with community leaders, traditional authorities (*ninik mamak*), farmer group representatives, and local government officials to obtain insights into institutional arrangements and challenges faced in developing Aren-based livelihoods.

Following the pre-survey, **Focus Group Discussions (FGD)** were organized to validate and deepen the findings. The FGD included multiple stakeholders such as farmer groups (*Kelompok Tani Hutan Gila Aren*), local government agencies (Agriculture Office, Forestry Service, and Cooperative Office), and private sector actors. During these discussions,

problems were identified, including limited Aren cultivation, weak institutional support, lack of youth participation, and the absence of structured marketing channels. The FGD also functioned as a platform for building consensus on the importance of developing an Aren sugar production center, ensuring that all stakeholders had ownership of the proposed intervention.

Socialization and Extension

The second stage was **socialization and extension**, which aimed to increase community awareness and knowledge about the ecological, agronomic, and economic benefits of Aren cultivation.

The materials presented covered several dimensions:

1. **Cultivation techniques:** Best practices for Aren seedling selection, planting on sloped land, maintenance, and intercropping systems with seasonal crops and coffee to optimize land use.
2. **Soil conservation:** The ecological role of Aren in preventing erosion and improving soil stability, particularly in the watershed areas of Lake Maninjau.
3. **Financial analysis:** Practical training on the application of financial feasibility tools such as Net Present Value (NPV), Internal Rate of Return (IRR), Benefit-Cost (B/C) ratio, and Payback Period. This component demonstrated the profitability of Aren sugar production, especially palm sugar crystals (*gula semut*).
4. **Marketing strategies:** Introduction of modern marketing channels, including e-commerce platforms, branding initiatives, and linkage with hospitality, restaurant, and café (HoReCa) sectors, as well as opportunities for export markets.

These sessions were interactive and included simulations, group exercises, and question-and-answer forums to ensure comprehension.

Participatory Discussions

In the third stage, **participatory discussions** were conducted to co-design strategies for developing the Aren sugar production center. These discussions encouraged active input from community members, enabling them to articulate their priorities and aspirations. Several themes emerged from these sessions, including the need for strengthening farmer cooperatives, establishing value-added processing units for palm sugar crystals, and promoting branding initiatives such as “Maninjau Palm Sugar Crystals.”

The participatory nature of this stage ensured that strategies were not externally imposed but instead reflected the collective vision of the community. It also reinforced the principles of empowerment by shifting the role of academics and facilitators from providers of knowledge to co-creators of solutions with the community.

Initial Implementation

The fourth stage was **initial implementation**, which focused on translating the strategies into concrete action. Aren seedlings were distributed to farmer groups and planted collectively on approximately 5 hectares of communal (*ulayat*) land provided by the community. The planting event symbolized both the technical beginning of the program and the social commitment of stakeholders to the initiative. The involvement of traditional leaders, local government representatives, and farmer

groups reinforced a sense of shared responsibility.

Ethical Considerations

Throughout the process, ethical considerations were observed. Participation in discussions, and implementation activities was voluntary, with informed consent obtained from all individuals. The program also respected local cultural norms and traditional decision-making processes, ensuring that interventions aligned with the *Nagari* governance system.

Overall Approach

This methodological framework reflects an integration of **participatory rural appraisal, financial analysis, ecological assessment, and institutional development**. The stepwise yet cyclical nature of the approach ensured that the program was not only technically feasible but also socially acceptable and institutionally embedded. By combining knowledge transfer with participatory planning and concrete action, the methodology sought to foster long-term sustainability of Aren-based agroindustry in Koto Malintang.

3. RESULTS AND DISCUSSION

RESULT

Community Participation

Community participation formed the backbone of this community service program, ensuring that the initiative was not only technically feasible but also socially legitimate and sustainable. The people of Koto Malintang, particularly farmer groups, traditional leaders, and local government representatives, actively engaged in each stage of the program. Their involvement demonstrated both the relevance of the initiative and the community's readiness to

adopt Aren palm (*Arenga pinnata*)-based agroindustry as a new livelihood strategy.

The first indication of meaningful community participation was the provision of communal land for demonstration plots. In line with *Nagari* traditions, land that had been collectively managed (*tanah ulayat*) was allocated for the establishment of approximately 5 hectares of Aren demonstration plots. This allocation was not merely a symbolic gesture but rather a significant investment of communal resources that signaled trust and commitment. By opening access to communal land, traditional leaders (*ninik mamak*) reinforced the importance of collective ownership and demonstrated their support for diversification away from environmentally risky aquaculture practices that dominate livelihoods around Lake Maninjau.

Farmer groups also showed strong engagement and enthusiasm. In discussions and focus group meetings, they unanimously committed to developing palm sugar crystals (*gula semut*) as their flagship product. This choice reflected not only their awareness of financial profitability but also their strategic thinking about long-term sustainability. Palm sugar crystals are relatively easy to package, store, and market compared to molded palm sugar (*gula cetak*), giving them higher competitiveness in modern and export-oriented markets. The farmer groups' willingness to prioritize palm sugar crystals marked a critical shift from traditional subsistence-level production toward a more market-oriented agroindustry.

Local government and associated agencies further strengthened the program through institutional support. The Agricultural Office facilitated training sessions and provided resource persons for capacity building in cultivation and processing techniques. The

Forestry Office emphasized Aren's ecological importance as a conservation crop in steep and erosion-prone landscapes, aligning the initiative with broader watershed management objectives around Lake Maninjau. This multi-stakeholder involvement not only provided technical expertise but also enhanced the legitimacy of the initiative in the eyes of the community.

The participation process also fostered cross-generational involvement. While Aren tapping had traditionally been the domain of elderly farmers, the program made deliberate efforts to involve younger generations. Youth were encouraged to attend workshops, participate in demonstration activities, and engage in marketing discussions, particularly those related to branding and e-commerce. This was crucial given the generational gap in agricultural participation highlighted by White (2012). The youth's emerging interest in Aren agroindustry suggests the potential for reversing declining engagement in farming activities by presenting agriculture as a modern and profitable enterprise.

Another dimension of participation was the openness of stakeholders to explore institutional innovation. During participatory discussions, community members agreed that the establishment of a production center was necessary to overcome issues of fragmented production and weak bargaining power. The willingness to consider cooperative structures, collective branding, and integrated marketing strategies demonstrated that the community was not only receptive to new ideas but also actively shaping the direction of the program. Overall, community participation in Koto Malintang demonstrated three essential qualities: commitment, inclusivity, and innovation. Commitment was reflected in the provision of land and labor; inclusivity was

evident in the involvement of different stakeholders, including women and youth; and innovation was seen in the community's willingness to adopt palm sugar crystals as a flagship product and to embrace new institutional forms. Together, these elements laid a strong foundation for the success and sustainability of Aren-based agroindustry development in the region.

Financial Analysis

Financial analysis was conducted to assess the feasibility of developing an Aren-based agroindustry in Koto Malintang, West Sumatra, under two cultivation scenarios and two product types. This analysis is an essential step in determining the economic attractiveness of palm sugar as a rural enterprise, especially to guide farmer groups, cooperatives, and potential private sector partners in making investment decisions.

Two cultivation scenarios were considered:

1. **Scenario 1: Aren intercropped with seasonal crops (e.g., maize and peanut)**, which provides short-term income during the early years before the Aren palms become productive.
2. **Scenario 2: Aren intercropped with robusta coffee**, which requires higher initial investment but generates additional long-term revenue streams once coffee trees mature.

For each cultivation scenario, two product processing pathways were analyzed:

- **Molded palm sugar (gula cetak)**, the traditional form widely produced by smallholders.
- **Palm sugar crystals (gula semut)**, a modern and higher-value product with greater storage stability, market

acceptance in retail and hospitality industries, and potential for export.

The financial analysis used standard indicators widely applied in agricultural investment studies: Net Present Value (NPV), Internal Rate of Return (IRR), Benefit-Cost (B/C) Ratio, and Payback Period. A project horizon of 15 years was applied, consistent with the productive lifespan of Aren palms. A discount rate of 10% was selected for the base case, with sensitivity analysis carried out at 8% and 12% to reflect variations in financing costs and rural investment risk profiles.

Cost structures were based on realistic local conditions. Average production costs were estimated at Rp 60 million per hectare per year (a combination of Rp 40–45 million in fixed costs and Rp 15–20 million in variable costs). This figure is lower than the upper-bound estimate of Rp 75 million reported in previous studies, reflecting possible cost savings achieved through farmer cooperation, shared infrastructure, and efficiency gains. Revenues were calculated as follows: Rp 70 million per hectare per year for

molded sugar, assuming an average market price of Rp 30,000/kg; and Rp 146 million per hectare per year for palm sugar crystals, assuming an average market price of Rp 40,000/kg. For Scenario 1, farmers also received additional income of Rp 10 million per hectare annually during the first two years from seasonal crops. For Scenario 2, farmers incurred additional establishment costs of Rp 10 million during the first two years for planting coffee, but subsequently earned an additional Rp 15 million per year from coffee production starting in year four.

The results of the financial calculations clearly differentiate between the two product types. Molded sugar, despite being the traditional product, only produced marginal financial feasibility with small positive NPVs, low IRRs, B/C ratios slightly above 1, and relatively long payback periods. Palm sugar crystals, on the other hand, consistently outperformed molded sugar across both cultivation scenarios, generating substantial NPVs, high IRRs, B/C ratios well above 2, and shorter payback periods.

Tabel 1. Financial Analysis of Aren Agroindustry in Koto Malintang (Visibility Case, 10% Discount Rate)

Scenario / Product	NPV (Rp/ha)	IRR (%)	B/C Ratio	Payback Period
Scenario 1A – Aren + seasonal crops → molded sugar	28,450,000	12–14	1.12	7–8 years
Scenario 1B – Aren + seasonal crops → palm sugar crystals	298,000,000	42–45	2.43	4 years
Scenario 2A – Aren + robusta coffee → molded sugar	35,200,000	13–15	1.15	7–8 years
Scenario 2B – Aren + robusta coffee → palm sugar crystals	330,000,000	38–40	2.55	5 years



The table demonstrates several important points. First, molded sugar, although still financially feasible (B/C ratio > 1), provides only marginal benefits to farmers. NPVs are low, IRRs barely exceed the discount rate, and the payback period is relatively long (7–8 years). This indicates that molded sugar production, while sustaining traditional livelihoods, is unlikely to attract significant private sector investment or motivate large-scale expansion.

Second, palm sugar crystals present a far more attractive business model. Both Scenario 1 (intercropped with seasonal crops) and Scenario 2 (intercropped with coffee) generate NPVs of Rp 298–330 million per hectare, with IRRs in the range of 38–45%. The B/C ratios of 2.43–2.55 demonstrate strong financial feasibility, while the payback periods of only four to five years highlight the relatively rapid return on investment. Scenario 1 (seasonal crops) provides quicker returns, while Scenario 2 (coffee) yields slightly higher long-term gains due to the additional revenue stream from coffee beans.

A sensitivity analysis was conducted to test how variations in discount rates (8%, 10%, 12%) and palm sugar crystal prices (Rp 40,000, Rp 50,000, and Rp 60,000 per kg) would affect financial performance. The results reinforced the robustness of palm sugar crystals as a profitable enterprise. At the base price of Rp 40,000/kg, palm sugar crystals already deliver strong NPVs and IRRs with payback periods of four to five years. When prices increase to Rp 50,000/kg, which is achievable through branding, organic certification, and improved market access, NPVs increase by nearly 60% and IRRs exceed 50%. At Rp 60,000/kg, reflecting export-grade products, NPVs approach Rp 700 million per hectare, IRRs surpass 60%, and payback periods shorten to just three to four years. These findings underscore the critical importance of marketing and value

addition strategies in determining the overall viability of the Aren sugar business.

The comparative analysis between molded sugar and palm sugar crystals provides several insights. First, molded sugar—while an important cultural and traditional product—offers only limited financial returns. Its low profitability explains why many younger farmers are reluctant to engage in Aren-based enterprises if production is restricted to molded sugar alone. In contrast, palm sugar crystals represent a transformational opportunity. Their superior market characteristics, higher prices, and compatibility with modern retail and export requirements make them a flagship product for the future of Aren agroindustry in Koto Malintang.

Second, the role of diversification strategies through intercropping is significant. In Scenario 1, seasonal crops reduce income uncertainty during the early years before Aren palms become fully productive, leading to faster payback periods. This scenario is particularly relevant for smallholders with limited capital, as it provides cash flow stability and reduces risk. In Scenario 2, coffee intercropping offers additional long-term stability and higher NPVs, making it more attractive to farmer groups with larger landholdings and the capacity to invest in perennial crops. This diversification not only spreads risk but also enhances resilience against market fluctuations in palm sugar prices.

Third, the sensitivity analysis highlights the strategic role of market positioning. While local prices of Rp 40,000/kg already ensure viability, moving up the value chain through branding, certification, and improved packaging could substantially increase profitability. Accessing premium markets, both domestically and internationally, would allow farmers and cooperatives to capture significantly greater

value. This demonstrates that financial feasibility is not solely dependent on on-farm practices, but also on institutional arrangements and market linkages.

The results of the financial analysis have several implications for policy and practice. For farmer groups, the evidence strongly suggests prioritizing palm sugar crystals over molded sugar as the main product of the Aren sugar industry. For local governments and cooperatives, the findings highlight the importance of investing in processing facilities, training programs, and institutional strengthening to ensure consistent quality and market competitiveness. For private sector partners, the strong profitability of palm sugar crystals offers a compelling case for establishing partnerships, whether through contract farming, joint ventures, or supply agreements.

Finally, the analysis demonstrates that the Aren agroindustry can serve as a viable model for rural economic development. With appropriate institutional support, efficient production systems, and modern marketing strategies, the Aren sugar production center in Koto Malintang has the potential to generate sustainable livelihoods, attract youth participation, and contribute to regional development.

Marketing Strategy

The success of Aren agroindustry in Koto Malintang does not rely solely on cultivation and processing but also on the effectiveness of marketing strategies that connect local production to wider markets. Given the community's decision to prioritize palm sugar crystals (gula semut) as their flagship product, a comprehensive marketing framework was developed to ensure that this product could

compete not only in local markets but also in national and international arenas.

The first element of the marketing strategy was branding. During participatory discussions, farmers and facilitators agreed to introduce the brand "Maninjau Palm Sugar Crystals". The brand was chosen to highlight both the product's unique geographical identity and its ecological background. Associating the product with Lake Maninjau gave it a strong place-based identity, resonating with consumers who value authenticity and origin-based products. This branding approach aligns with global trends where consumers increasingly prefer natural sweeteners that are organic, traceable, and environmentally friendly (Sasaki, 2019).

To strengthen positioning, packaging and labeling were redesigned to emphasize product quality, purity, and ecological benefits. Labels highlighted that the sugar was low glycemic, organic, and derived from sustainable Aren cultivation practices that contribute to watershed conservation. This eco-branding approach was expected to differentiate Maninjau palm sugar from conventional sweeteners, creating niche markets among health-conscious and environmentally aware consumers.

The marketing strategy identified four major target segments:

1. Local markets – Traditional markets and nearby urban centers remained important, especially during the initial stages. Local sales provided stable demand and ensured immediate income for producers.
2. HoReCa sector (Hotels, Restaurants, Cafés) – Palm sugar crystals were introduced to high-value culinary businesses in Bukittinggi, Padang, and other West

Sumatran cities. Chefs and baristas increasingly experiment with natural sweeteners, and this sector presented consistent demand for premium-quality products.

3. Modern retail and e-commerce – Partnerships with supermarkets and online platforms were pursued to expand the consumer base. E-commerce was particularly emphasized to attract younger, urban consumers who prioritize convenience and traceability.
4. Export opportunities – Feasibility discussions with trade agencies highlighted potential export markets in Europe, Japan, and Australia, where natural palm sugar is valued as a substitute for cane sugar. However, this required compliance with international standards such as HACCP and organic certification.

Distribution channels were redesigned to move beyond traditional intermediaries. Under the new model, farmer groups and cooperatives served as central aggregators. Products were collected, processed, and packaged at the planned production center before being distributed to retailers or directly marketed online. This structure minimized dependence on middlemen, enabling farmers to capture a larger share of profits.

Partnerships with local cooperatives were crucial for managing logistics and ensuring consistent supply. Additionally, collaboration with BUMNag provided institutional backing for negotiating contracts with retailers and distributors. By pooling resources, communities overcame the challenge of fragmented production and achieved economies of scale in distribution.

Promotion was carried out using a mix of traditional and modern methods. Local

promotion involved participation in agricultural fairs, food festivals, and exhibitions, which increased visibility and introduced the product to potential institutional buyers. Modern promotion leveraged digital platforms, including social media campaigns that showcased the ecological story of Lake Maninjau and the cultural heritage of Aren cultivation. Videos highlighting the tapping process, women's involvement in packaging, and youth participation in marketing were shared online to create emotional resonance with consumers.

Endorsements from local chefs and influencers were also sought to build credibility and appeal. These promotional efforts aimed to reposition palm sugar crystals not merely as a rural commodity but as a premium lifestyle product that appeals to both local pride and global sustainability narratives.

Institutional actors played a pivotal role in strengthening marketing strategies. The Cooperative Office facilitated training on cooperative-based marketing systems and assisted in establishing contracts with modern retailers. The SME Office provided guidance on packaging standards and helped the community register the "Maninjau Palm Sugar Crystals" brand. Meanwhile, the Agricultural Office connected farmers with networks of organic and fair-trade certification agencies, enabling long-term access to export markets.

The integration of institutional support highlighted the importance of multi-stakeholder collaboration in building marketing systems. Without this support, smallholder farmers would have faced significant barriers in navigating modern distribution networks and certification processes.

Despite significant progress, challenges remained. One major issue was ensuring consistent quality and volume of production.

Retailers and export buyers demanded standardized products, but smallholder-based systems often struggled with uniformity. This reinforced the importance of the planned production center, which would serve as a hub for quality control and collective packaging.

Another challenge was the initial cost of branding, certification, and packaging innovations. While these investments promised long-term returns, they posed financial burdens for small farmer groups. Access to government grants, cooperative financing, and partnerships with private investors was therefore considered essential.

The marketing strategy for Maninjau Palm Sugar Crystals combined branding, market segmentation, institutional partnerships, and modern promotional tools. By leveraging both traditional and digital channels, the community positioned palm sugar crystals as a premium product rooted in ecological sustainability and cultural heritage. Although challenges persisted in terms of quality control and initial financing, the strategic framework provided a clear roadmap for scaling Aren agroindustry from a local livelihood option to a competitive market player.

DISCUSSION

The results of this community service initiative demonstrate the multifaceted opportunities and challenges involved in developing Aren palm (*Arenga pinnata*)-based agroindustry in Koto Malintang. The findings highlight how socialization activities raised awareness of the economic potential of palm sugar, particularly palm sugar crystals (*gula semut*), and how financial analysis confirmed the profitability of this enterprise. At the same time, challenges such as the lack of youth involvement and the need for stronger local institutions were

identified as key barriers to sustainability. This discussion situates the findings within broader academic literature on community empowerment, agroindustry development, youth participation, and institutional strengthening.

One of the clearest outcomes of the program was the effectiveness of socialization activities in enhancing community awareness. Farmers and local leaders, many of whom had previously regarded Aren primarily as a wild plant of limited economic value, came to recognize its potential as a profitable and ecologically sustainable enterprise. Participatory socialization methods allowed communities to see beyond traditional practices and embrace innovations such as palm sugar crystal production.

This finding aligns with studies highlighting the role of extension and social learning in rural innovation adoption. Chambers (1997) emphasized that participatory approaches empower communities by centering their knowledge and experiences, creating ownership over interventions. Similarly, Mardikanto and Soebianto (2017) argued that socialization activities must go beyond information transfer to build collective motivation for change. In the case of Koto Malintang, the use of participatory discussions and demonstrations not only conveyed technical information but also built a shared vision of agroindustrial development.

Research in other contexts supports this result. For example, Wisnubroto, Lubis, and Yulianto (2024) found that participatory training using the Business Model Canvas significantly increased farmers' understanding of value chains in palm sugar production in West Sumatra. Likewise, a study by Cahyono et al. (2020) reported that farmer field schools enhance

knowledge retention and adoption rates, especially when combined with hands-on demonstrations. These parallels confirm that socialization is a critical first step in community empowerment and that Aren agroindustry benefits from visibility, demonstration, and participatory dialogue.

Syakir, Nurjayadi, and Yulianti (2019) emphasized that palm sugar has high economic potential in Indonesia due to strong domestic demand and rising international interest in natural sweeteners. Paloma (2024) further showed that palm sugar crystals are especially profitable because of their storability, higher prices, and demand in modern retail and export markets. Similarly, Sasaki (2019) noted that Southeast Asia holds significant untapped potential for palm sugar exports, provided that farmers adopt modern processing techniques and quality control measures.

Other studies reinforce the value of integrating financial feasibility analysis into community-based agroindustry development. Dewi and Wibowo (2021) highlighted that financial literacy and exposure to investment analysis tools such as NPV and IRR increase farmers' capacity to evaluate agricultural innovations critically. In Koto Malintang, introducing these concepts encouraged farmers to think beyond subsistence, embracing entrepreneurship and long-term investment planning.

Agroindustrial development literature also supports the emphasis on value addition and market integration. Gereffi (2018) stressed that smallholders must move up the value chain to escape low-income traps, while Yusuf and Trondsen (2020) argued that rural agroindustry development is most successful when linked to niche markets such as organic and fair-trade products. The decision by Koto Malintang

farmers to prioritize palm sugar crystals thus represents a strategic alignment with these broader insights.

Despite these positive developments, the program also revealed a critical challenge: the low participation of young people in Aren-based activities. Most productive-age residents preferred employment in the service sector, including motorcycle taxis and informal trading, leaving Aren tapping and processing primarily to older generations. This mirrors broader trends in rural Indonesia and globally, where youth increasingly disengage from agriculture in search of perceived more attractive urban or service-sector jobs (White, 2012).

The lack of youth participation raises concerns about the long-term sustainability of Aren agroindustry. Without generational renewal, there is a risk of knowledge loss and labor shortages. Scholars have emphasized that engaging youth in agriculture requires targeted interventions. Sumberg et al. (2019) argued that rural youth must see agriculture as a viable business, not a subsistence fallback. Similarly, Bezu and Holden (2014) highlighted that access to land, credit, and training are key determinants of youth willingness to invest in farming.

Practical solutions include entrepreneurship training and creating modernized images of farming. For instance, Yami et al. (2019) found that combining agricultural training with digital marketing opportunities increased youth interest in agroindustry in Ethiopia. In the Indonesian context, Nugroho (2018) suggested that programs focusing on inclusive innovation and collaboration among government, private sector, and communities can create entry points for young people. In Koto Malintang, strategies such as training in e-commerce, packaging design, and

brand promotion may make Aren agroindustry more appealing to younger generations.

The findings also underscore the importance of strong local institutions. While farmer groups showed commitment and enthusiasm, the absence of robust cooperative structures posed a risk of inefficiency. Without institutional mechanisms, smallholder producers often face challenges in aggregating supply, standardizing quality, and accessing larger markets.

This aligns with extensive literature on the role of cooperatives and community institutions in rural development. Markelova et al. (2009) argued that farmer organizations are essential for linking smallholders to markets by overcoming scale and transaction cost barriers. In Indonesia, Zubaedi (2012) emphasized that community-based organizations serve as vehicles for empowerment, enabling resource pooling and risk sharing.

The involvement of *BUMNag* in Koto Malintang offers an institutional pathway for supporting Aren agroindustry. Research by Hermanto and Astuti (2021) showed that village-owned enterprises can significantly enhance rural business viability when they serve as hubs for collective marketing and capacity building. Likewise, Wulandari et al. (2019) found that cooperative-based models increased farmers' bargaining power and improved incomes in palm sugar enterprises in Central Java. These findings suggest that institutional strengthening in Koto Malintang is not only desirable but essential for sustaining agroindustrial development.

Overall, the program highlighted both opportunities and structural challenges. On the one hand, Aren sugar agroindustry presents clear economic benefits, ecological sustainability, and strong community support. On the other hand, challenges remain in securing youth

engagement, strengthening institutions, and ensuring quality control for modern and export markets. Addressing these challenges requires integrated strategies that combine training, financial support, and institutional innovation.

Future efforts should focus on developing youth-targeted entrepreneurship programs, enhancing cooperative governance, and linking Aren agroindustry with certification schemes such as organic and fair-trade standards. These steps will not only improve competitiveness but also ensure long-term sustainability by embedding Aren agroindustry within both local traditions and global value chains.

4. CONCLUSION

The community service program in Koto Malintang provides important insights into the opportunities and challenges of developing the palm sugar agroindustry as a driver of rural socio-economic transformation. Through a series of activities, such as socialization, participatory planning, financial analysis, and institutional strengthening, the program has succeeded in raising awareness and building a strong foundation for the establishment of palm sugar production centers. Financially, the analysis shows that the palm sugar agroindustry, particularly palm sugar products, is highly profitable. This is supported by the commitment of the community and stakeholders, such as farmer groups and local governments, which have created an environment conducive to the success of this initiative.

However, the program also revealed a number of challenges that must be overcome to ensure long-term sustainability. The main challenge is the lack of participation from the younger generation, who prefer to work in other sectors, resulting in the palm sugar agroindustry

being heavily dependent on elderly farmers. In addition, institutional weaknesses, such as the lack of a strong cooperative structure, hamper efficiency in production, product standardization, and marketing. This program emphasizes that the sustainability of the aren agroindustry depends on strengthening youth participation, improving local institutions, and adopting modern marketing strategies to penetrate broader and more competitive markets.

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DAFTAR PUSTAKA

Anwar, A., Dwipa, I., Hervani, D., & Sari, A. (2024). Hubungan posisi apokol dalam perkecambahan aren (*Arenga pinnata*

Merr.) dengan pertumbuhan kecambah dan keragaman genetik. *Jurnal Agroteknologi*, 14(2), 89–96. <https://doi.org/10.24014/ja.v14i2.26686>

Bezu, S., & Holden, S. (2014). Are rural youth in Ethiopia abandoning agriculture? *World Development*, 64, 259–272. <https://doi.org/10.1016/j.worlddev.2014.06.013>

Cahyono, H., Haryono, & Sutarto. (2020). Farmer field schools and adoption of agricultural innovations in Indonesia. *Jurnal Penyuluhan*, 16(2), 145–160.

Chambers, R. (1997). *Whose reality counts? Putting the first last*. Intermediate Technology Publications.

Dewi, R., & Wibowo, R. (2021). Financial literacy and investment decision-making among Indonesian farmers. *Jurnal Sosial Ekonomi Pertanian*, 17(1), 22–34.

Ellis, F. (2000). *Rural livelihoods and diversity in developing countries*. Oxford University Press.

Gereffi, G. (2018). *Global value chains and development: Redefining the contours of 21st century capitalism*. Cambridge University Press.

Hermanto, B., & Astuti, R. (2021). The role of village-owned enterprises in rural economic development in Indonesia. *Journal of Rural Studies*, 82, 185–195. <https://doi.org/10.1016/j.jrurstud.2021.01.002>

Mardikanto, T., & Soebianto, P. (2017). *Pemberdayaan masyarakat dalam perspektif kebijakan publik*. Alfabeta.

Markelova, H., Meinzen-Dick, R., Hellin, J., & Dohrn, S. (2009). Collective action for smallholder market access. *Food Policy*, 34(1), 1–7.

- <https://doi.org/10.1016/j.foodpol.2008.10.001>
- Nasdian, F. T. (2014). *Pengembangan masyarakat*. Yayasan Pustaka Obor Indonesia.
- Nugroho, H. (2018). Inclusive innovation for agricultural development in Indonesia. *Journal of Innovation and Development*, 8(3), 423–440. <https://doi.org/10.1080/2157930X.2018.1478556>
- Paloma, C. (2024). Financial analysis of micro-enterprises in agroindustry: Lessons for Aren sugar business models. *Journal of Agribusiness and Rural Development*, 12(2), 45–59.
- Sasaki, N. (2019). Potentials and challenges of palm sugar production in Southeast Asia. *Asian Journal of Agriculture and Development*, 16(1), 85–101.
- Sumberg, J., Fox, L., Flynn, J., Mader, P., & Oosterom, M. (2019). *Africa's rural youth employment challenge: From norms to policy*. Routledge.
- Syakir, M., Nurjayadi, & Yulianti, E. (2019). Prospek pengembangan gula aren di Indonesia: Aspek teknis, sosial, dan ekonomi. *Jurnal Litbang Pertanian*, 38(2), 57–66. <https://doi.org/10.21082/jp3.v38n2.2019>
- White, B. (2012). Agriculture and the generation problem: Rural youth, employment and the future of farming. *IDS Bulletin*, 43(6), 9–19. <https://doi.org/10.1111/j.1759-5436.2012.00375.x>
- Wisnubroto, M. P., Lubis, M. I. A., Yulianto, A., Anwar, A., Havifi, I., Sari, L.P., Hasibuan, H.S., Ramadhani, L.M., Silvadriyanto, R., Adhevin, A.O., Rivandi, O., & Adib, M. (2024). Training on Business Strategy Development Based on Business Model Canvas In Palm Sugar Industry In Nagari Talang Anau, West Sumatera. *Jurnal Abdi Insani*, 11(4), 2534 – 2552. <https://doi.org/10.29303/abdiinsani.v11i4.2129>
- Wulandari, S., Indriani, Y., & Nuryanti, S. (2019). Cooperative-based palm sugar development and farmer welfare in Central Java. *Journal of Agribusiness Development*, 7(2), 120–135.
- Yami, M., Vogl, C. R., Hauser, M., & Bekele, S. (2019). Engaging youth in agribusiness through training and innovation hubs in Ethiopia. *Journal of Rural Studies*, 71, 152–162. <https://doi.org/10.1016/j.jrurstud.2019.09.002>
- Zubaedi. (2012). *Pengembangan masyarakat: Wacana dan praktik*. Kencana Prenada Media.