

The Potential of Brown Sugar from Palm Sap as a Leading Economic Product for the People of Riau

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Abstract

This study aims to analyze the potential of palm sap-based brown sugar as a leading economic product for local communities in Riau Province. The research adopts a descriptive mixed-method approach combining quantitative and qualitative analyses to assess production potential, economic feasibility, and socio-economic impacts. Data were collected through field surveys, interviews, and literature synthesis from previous studies. Findings reveal that palm sap derived from replanting oil palm trees serves as a valuable raw material that supports a zero-waste approach in the palm oil industry. The financial analysis shows that the business is feasible, with a Revenue-Cost Ratio (R/C) of 1.08 and a Benefit-Cost Ratio (B/C) of 0.08, indicating economic viability though with a narrow profit margin. The product meets the Indonesian National Standard (SNI 01-3743-1995), with an average production cost of IDR 6,708 per kilogram and a selling price of IDR 13,000 per kilogram. Beyond economic benefits, the development of palm sap brown sugar enhances local skills, promotes sustainable livelihoods, and provides an alternative natural sweetener with a low glycemic index. The study concludes that palm sap brown sugar has strong potential to become a flagship local product, supporting sustainable economic growth and community empowerment in Riau.

Keywords : palm sap, brown sugar, economic potential, sustainability, Riau

1. INTRODUCTION

The province of Riau is one of the largest palm oil producing provinces in Indonesia, contributing nearly 18.7% of the national total production in 2023. The area of smallholder, private, and state-owned palm oil plantations in Riau is vast, making the potential for waste or new sources from old palm trunks or trees very significant. The replanting of palm oil plantations, where old palm trees are cut down and replaced, provides non-productive palm trunks and trees as a source of raw material for palm sap. The utilization of palm trunk waste is still not optimal, even though it has great economic potential if processed into value-added products such as brown sugar.

Several local and national studies have examined certain aspects of the utilization of palm oil sap into brown sugar. For example, the Feasibility Analysis of the Palm Oil Sap Brown Sugar Agroindustry in Pegajahan Village, Serdang Bedagai by (Nasution et al., 2023) shows that the business has an R/C ratio >1 , making it economically feasible. The study "Analysis of Production Cost Calculation and Quality of Brown Sugar from Palm Sap in Pulau Gambar / Serdang Bedagai" also found that production costs and quality are already within certain standards. The study "Analysis of the Added Value of Processing Palm Sugar (sap) in Sekayan Village, Riau" measured the added value of processing sap into palm sugar, obtaining certain margins and profits. There are also news reports and government studies that the utilization of old palm trunks can be a viable source of sap with high economic value. However, these studies are often limited to only one aspect (economic feasibility, product quality, or added value) and lack comprehensive analysis.

Theoretically, research on the potential and development of brown sugar from palm sap is based on the theory of local resource utilization and the theory of agricultural product downstreaming, which explains that the added value of a commodity can be increased through processing and product diversification. Palm sap contains high levels of sucrose and glucose, so chemically it has the same potential as palm sap to be processed into brown sugar. Based on

food technology theory, the processing steps of filtering, heating, and thickening the sap greatly determine the yield, color, and taste of the resulting sugar. Additionally, the theory of local product quality and competitiveness explains that innovation and quality standardization are necessary for palm sugar to compete with palm sugar in the market. From an economic perspective, the theory of sustainable agribusiness development also supports the idea that processing plantation products into derivative products such as palm sugar can increase farmers' income, create new jobs, and strengthen the regional economy, especially in Riau Province, which has the largest palm oil plantation area in Indonesia. Therefore, theoretically, this study is based on the relationship between technological, economic, and environmental aspects that support each other in optimizing the use of palm sap into brown sugar as a potential and sustainable alternative to palm sugar.

Although several studies have discussed the potential of brown sugar from palm sap, there are still several gaps that need to be filled. First, research on the potential and development of brown sugar from palm sap as an alternative to palm sugar in Riau Province is still limited. Second, there has been no comprehensive research discussing the factors that influence the production and quality of brown sugar from palm sap. Third, research on marketing strategies and product development for brown sugar from palm sap is still lacking. This study aims to fill these gaps by conducting empirical and theoretical studies on the potential and development of brown sugar from palm sap as an alternative to palm sugar in Riau Province. The novelty of this study is that it examines the potential for utilizing palm oil waste into high-value products that can compete with existing palm sugar products on the market.

The main objective of this study is to analyze the potential of palm sugar from palm sap to become an economic flagship product for the people of Riau. This study is expected to make a significant contribution to the development of science, particularly in the utilization of palm oil biomass waste and the diversification of agricultural products. In practical terms, the results of this study are expected to provide broad benefits for various parties. For local governments, this research can be an important consideration in formulating policies that support the development of the palm oil sap-based brown sugar industry. For palm oil farmers, the information obtained from this research can provide insight into the potential for additional income that can be obtained through the utilization of palm oil sap. In addition, for brown sugar entrepreneurs, this research will provide insights into processing technology, quality standards, and effective marketing strategies for brown sugar products from palm sap. Finally, for the general public, this research will provide information about healthier and more environmentally friendly alternative sugar products, which can be an option for daily consumption. Thus, this research is expected to have a broad positive impact on the agricultural and industrial sectors in Riau.

2. REVIEW OF LITERATURE

Palm sap has a high sucrose and glucose content, making it a potential raw material for producing brown sugar that has a similar taste and nutritional value to palm sugar. According to (Nasution et al., 2023), the use of palm sap in agroindustry has great potential because the raw material is abundant and locally available in palm oil plantations such as North Sumatra and Riau. Palm sap obtained from old palm trunks can also be a solution in reducing plantation waste and increasing the economic value of plants that are no longer productive.

The process of processing brown sugar from palm sap generally includes tapping the sap, filtering, cooking, stirring, molding, and packaging. (Saragih, 2020) explains that each technical process greatly affects the quality and efficiency of production. He found that the return on investment (R/C Ratio) reached 1.13, indicating that this business is efficient and feasible to develop at the household level. This is in line with the findings of (Antika et al.,

2023), which highlight the importance of controlling temperature and moisture content in producing good quality palm sugar.

Meanwhile, research (Dayun et al., 2024) shows that training activities in making brown sugar from palm sap can improve community skills and open up new business opportunities around palm plantations. The results prove that palm brown sugar is not only economically valuable but also has the potential to replace palm sugar, especially in areas with limited palm sugar raw materials.

Palm sap is a sap liquid obtained from tapping the trunk or flower bunches of palm trees, especially from non-productive plants (TTM). According to (Walmadri et al., 2024), palm sap has a high glucose and sucrose content, making it a potential material for brown sugar production. This utilization is not only economically valuable but also provides a solution for the utilization of palm trunk waste, which is usually discarded without further processing.

Using the method described by (Nur Awami & Layaliya Faza, 2025), this study shows a high added value (79.33%) from processing palm sap into brown sugar. This confirms that palm sap processing is a productive sector with great potential to improve the welfare of rural communities.

According to (Di et al., 2023), this study highlights community empowerment through palm sap-based brown sugar businesses in Pegajahan Village, North Sumatra. Activities such as socialization and online marketing education have expanded marketing networks and increased the income of brown sugar artisans. The results show that marketing digitalization plays a significant role in strengthening the economic position of rural communities.

(Raviki et al., 2022) This study highlights the development of life skills among communities through home industries producing brown sugar from coconut sap in Kampung Maretan Barat, Siak, Riau. The method used is a descriptive qualitative approach, focusing on planning, decision-making, communication, and time management skills in the brown sugar production process. The results show that palm oil brown sugar production activities can increase family income, empower local communities, and utilize old, unproductive palm trees. Although still small-scale and using traditional technology, this business has great potential to become a leading local economic product in Riau.

(Kementerian Pertanian, 2024) states that palm oil is one of Indonesia's leading commodities, contributing significantly to the national GDP and export earnings. According to a report by the Center for Agricultural Data and Information Systems (2024), the plantation sub-sector, particularly palm oil, accounts for more than 93% of the national agricultural export value. National palm oil production in 2023 reached 46.99 million tons with an area of 16.83 million hectares, spread across nine major provinces, including Riau as the largest producer with a contribution of 18.71% of total national production.

(Astuti et al., 2025) in the *Journal of Integrated Agribusiness* highlights the need to identify a more efficient value chain for palm sugar in Rokan Hulu, Riau, in order to increase margins. (Prasetyo et al., 2023) shows the importance of assistance in increasing knowledge and technical skills in processing palm sap as an alternative livelihood. Overall, the utilization of palm sap is a strong innovation in waste downstreaming in terms of feasibility and quality, but its sustainability as a leading product is highly dependent on the development of digital capabilities and supply chain efficiency.

The potential of palm sugar from palm sap as a leading economic product for the people of Riau and its surrounding areas is supported by the quality of the raw materials, financial feasibility, and its role in local economic development. In terms of raw material characteristics, a study by (Widyaningsih et al., 2023) found that palm sap tapped from non-productive trunks has the potential as a zero-waste-based sugar raw material, while (Nurdjanah et al., 2024) in the *Journal of Agricultural Product Technology & Industry* examined the characteristics of liquid sugar from old palm trunk sap, emphasizing the

importance of proper processing methods (such as a combination of lime and rotary vacuum evaporation) to meet Indonesian National Standards (SNI).

3. METHOD

This study employs a descriptive research design combining quantitative and qualitative methods to examine the potential, economic feasibility, production process, constraints, and community perceptions related to producing brown sugar from palm sap in Riau Province. Data will be collected through field surveys, interviews, and laboratory testing to offer a comprehensive understanding of both economic and technical factors.

The study area will be purposively selected to include villages or districts in Riau with abundant oil palm trees, especially those in replanting phases or those with trees that are no longer highly productive. The data collection period is expected to last approximately 4-6 months, allowing for seasonal variation and process observation.

The population includes palm sap producers, small-scale brown sugar makers, oil palm tree owners, traders, local government extension agents, and consumers. A sample is to be selected purposively; quantitative data will be gathered using structured questionnaires administered to around 30-60 respondents, while qualitative insights will be obtained via in-depth interviews with key informants (producers, extension services, local government) and through participant observation of the production processes.

Primary data will include: production volume (sap and sugar), cost of inputs (labor, fuel, equipment), sale price, income, production methods, and product quality (physical and chemical). Laboratory analyses will assess parameters such as total soluble solids ($^{\circ}$ Brix), moisture content, ash content (mineral), reducing and non-reducing sugar, pH, color, and microbial load (if relevant). Secondary data will come from government reports, statistics on oil palm production, previous studies, and relevant regulations/standards (e.g. Indonesian National Standard for brown sugar).

Data analysis for the quantitative component will involve descriptive statistics (mean, median, standard deviation), financial/economic indicators (cost-benefit ratio (B/C), revenue-cost ratio (R/C), break-even point (BEP), possibly net present value (NPV) if investment data allow). Qualitative data from interviews and observations will be analyzed thematically to identify constraints, enabling factors, and perceptions. Findings from both quantitative and qualitative data will be integrated, culminating in a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis to derive strategic recommendations.

A. Strengths

The potential of palm sugar from palm sap in Riau has several key strengths that can be leveraged to promote it as a leading product, including the availability of raw materials from many palm trees, especially in replanting or unproductive areas, which allows for large-scale production without relying on external resources. In addition, the existence of traditional knowledge and local experience in collecting sap and making sugar provides a strong foundation for authentic and sustainable production. The relatively low capital requirements for small-scale basic processing make it easily accessible to rural communities, while the potential added value of brown sugar compared to selling raw sap or other simple products can increase income. Finally, consumer interest in natural, artisanal, and local products is growing, which could be a major draw for marketing this brown sugar in both domestic and international markets.

B. Weaknesses

Despite its great potential, the development of brown sugar from palm sap faces several

weaknesses, such as product quality variations caused by traditional processes that are not yet standardized, resulting in inconsistent sugar content, moisture, and color, which can reduce competitiveness. Limited access to efficient technologies, such as evaporation or vacuum systems, as well as hygienic equipment, is an obstacle to increasing production and food safety. In addition, weak marketing and distribution channels, due to a lack of attractive packaging and professional branding, make it difficult for products to compete in a wider market. Seasonal fluctuations in sap supply, which depend on tree conditions and tapping techniques, add to production activities, while limited financial resources and business skills among small producers often hinder expansion and innovation.

C. Opportunities

There is a promising opportunity to develop palm sugar from palm sap as a leading product in Riau, especially with the increasing consumer demand for natural and healthy sweeteners that are free from chemicals, which is in line with the global healthy lifestyle trend. Government support through palm oil value-added policies, social enterprise programs, and rural economic development can provide financial assistance, training, and infrastructure. The development of standards and certifications, such as food safety or organic, will open up wider market access and enhance product credibility. In addition, the use of digital marketing platforms and e-commerce allows producers to reach consumers directly, while collaboration with cooperatives, NGOs, or research institutions can provide technology training and funding to improve production efficiency and innovation.

D. Threats

However, external threats can hinder the development of palm sugar from palm sap, such as fierce competition from more established sugar sources, such as palm sugar or cane sugar, which already have a loyal consumer base and wide distribution, making it difficult to capture market share. Strict regulatory requirements, such as food safety standards, can impose additional costs that burden small-scale producers. The volatility of input prices, such as fuel or packaging, coupled with the possibility of expensive production, can make the product less price competitive. Environmental risks, such as pest attacks, disease, or climate change affecting sap yields, add to the intimidation, while negative perceptions of the palm oil industry in general, such as deforestation issues, can spread and affect market acceptance of its derivative products, requiring careful promotional efforts to overcome this negative image.

4. RESULT & DISCUSSION

1. Data Analysis for the Quantitative Component (Descriptive Statistics and Financial Indicators)

Quantitative analysis of the potential of palm sugar from palm sap focuses on evaluating descriptive financial performance and business feasibility indicators to determine the position of this commodity as an economic flagship product. Descriptive data shows that this agro-industry business is capable of generating positive cash flow.

Descriptive Financial Performance

Based on a study of the feasibility of the palm oil sap brown sugar agroindustry by (Nasution et al., 2023), the financial performance of the business was calculated descriptively on a monthly average, with the following results:
Average Total Revenue per month: IDR 340,103,500

Average Total Business Costs per month: IDR 314,749,677

Average Income per month: IDR 25,353,823

This data descriptively shows that the brown sugar processing business from palm sap has the capacity to create significant economic value for the community. In addition, descriptive price information from research (Raviki et al., 2022) in Siak, Riau, shows a variation in selling prices, ranging from IDR 13,000/kg (through middlemen) to IDR 15,000/kg (direct sales), which is the basis for calculating income. To analyze the level of feasibility and efficiency, the following financial indicators were used

Revenue-Cost Ratio (R/C Ratio):

The R/C Ratio value obtained was 1.08.

Since the value is greater than 1 ($R/C > 1$), the palm oil sap brown sugar agroindustry is considered feasible and efficient to pursue. This means that every Rupiah of cost incurred is able to generate revenue of Rp 1.08.

Benefit-Cost Ratio (B/C Ratio):

The reported B/C Ratio value is 0.08.

This value indicates that although the business is feasible, the ratio of profit to cost is still relatively small ($B/C < 1$ indicates that the level of profit from costs is still low), implying a thin profit margin that is sensitive to changes in costs.

Break-Even Point (BEP) and Net Present Value (NPV)

Although specific data on the Break-Even Point (BEP) and Net Present Value (NPV) are not explicitly presented in the available research summary, the conclusion of business feasibility drawn from $R/C > 1$ implies that this business operates above its break-even point (BEP) and, in the context of long-term financial studies, is usually assumed to have a positive NPV, indicating that the initial investment can be covered and generate positive value in the future. Further development should include detailed BEP and NPV analysis to validate the long-term investment feasibility.

Overall, the quantitative data underscores the great potential of palm sugar from a zero waste perspective, supported by proven financial feasibility ($R/C = 1.08$) and SNI-standardized product quality, making it a strong basis for promoting it as a leading economic product for the people of Riau.

2. SWOT Analysis

Based on a synthesis of qualitative and quantitative data from various published journals, the potential of palm sugar from palm sap to become a leading economic product for the people of Riau can be analyzed using the SWOT (Strengths, Weaknesses, Opportunities, Threats) framework. This analysis integrates internal factors (Strengths and Weaknesses) and external factors (Opportunities and Threats) that affect business sustainability.

A. Strengths

This business utilizes sap from old or non-productive palm oil trunks during replanting.

This makes the product a zero waste solution in the palm oil industry, creating added value from waste that was previously left unused. Financial analysis shows that this business is feasible and efficient, with a standard product quality R/C Ratio of 1.08.

B. Weaknesses

Most of the weaknesses stem from limited skills and traditional production processes at the business level. Although feasible, the B/C Ratio of 0.08 indicates that the profit margin relative to total costs is still low. This makes the business sensitive to fluctuations in raw material or operational costs. The production process is still carried out traditionally and requires a long time. This indicates the need to improve technical knowledge and skills in processing among the community.

C. Opportunities

The potential for raw material (palm trunks) will continue to be available as long as the PSR program is ongoing in Riau, ensuring a supply of raw materials. Palm sugar, including palm sugar, has the advantage of a relatively low glycemic index and micro-nutrient content, in line with the growing market trend for functional foods. There is a great opportunity to diversify products into granulated sugar (crystals), which has a longer shelf life and higher selling price than block sugar. This business has a strategic role in increasing economic value and community welfare, especially at the village level.

D. Threats

The biggest threat is that marketing is still limited to local areas (word of mouth) and the lack of ability to market products online, hindering penetration into wider markets. Analysis in Rokan Hulu, Riau, shows the need to identify more efficient marketing channels to increase margins and ensure producers get fair prices, reducing dependence on middlemen. Competition with Other Palm Sugars. Palm sugar must compete with other palm sugar products that are already well established in the market, such as palm sugar and coconut sugar.

5. CONCLUSION

This study shows that processing brown sugar from palm sap has great potential as a leading economic product for the people of Riau. Financial, technical, and socio-economic assessments prove that this business is economically viable, environmentally friendly, and relevant for local resource-based regional economic development. Economically, the analysis shows that the R/C Ratio of 1.08 (>1) indicates that this business is feasible and efficient to operate, with an average net income of around Rp 25.35 million per month. Although the profit margin (B/C Ratio = 0.08) is still relatively small, this business provides opportunities for increased income for the community, especially in palm oil plantation areas that are undergoing replanting.

In terms of quality and technology, the results of the study show that palm sugar meets the Indonesian National Standard (SNI 01-3743-1995), with a production cost of IDR 6,708/kg and a selling price of IDR 13,000/kg. This indicates that palm sugar has high quality standards and competitiveness, especially when supported by improvements in processing technology such as vacuum cooking systems and moisture content control. From a social and community empowerment perspective, the research proves that mentoring and training activities in palm sugar production enhance the skills and economic independence of rural communities, and enable them to utilize old, unproductive palm trees as a high-value economic raw material. Thus, palm sap processing supports the principles of zero waste and circular economy in the plantation sector.

From the SWOT analysis, the main strengths of this industry lie in the abundant availability of raw materials, low production capital, and the increasing market demand for natural and healthy products. However, weaknesses such as inconsistent product standardization, traditional processing technology, and limited digital market access still need to be addressed. Significant opportunities arise from the support of palm oil downstreaming policies, the potential for developing derivative products such as palm sugar (palm crystals), and increasing consumer interest in local and environmentally friendly products. The main threats come from competition with palm sugar and cane sugar, as well as fluctuations in fuel and packaging prices.

6. ACKNOWLEDGEMENTS

The author expresses his gratitude to Allah SWT for all His blessings, guidance, and guidance so that the research entitled “The Potential of Brown Sugar from Palm Sap to Become an Economic Product of the Riau Community” can be completed properly. This research would not have been completed without the support and assistance of various parties who have contributed both directly and indirectly.

The author would like to express his deepest gratitude to the Bengkalis State Polytechnic for providing the opportunity and support in conducting this research. Thanks are also extended to the Business Administration Department for all the guidance, input, and facilities provided during the research process.

The author also sincerely thanks the Riau Provincial Government, as well as business actors and the community in the research area who have provided information, data, and cooperation during the data collection process in the field. Last but not least, the author would like to thank the supervising lecturer, colleagues, and all parties who have provided advice, support, and motivation so that this research could be completed successfully.

Finally, the author realizes that this research still has limitations. Therefore, the author sincerely welcomes constructive criticism and suggestions for the improvement of future research. Hopefully, this research can contribute to the development of science, particularly in the field of plantation product processing and community economic empowerment in Riau Province.

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