

Optimizing the feasibility and marketing of siwalan fruit peel waste products as an environmentally friendly innovation in tuban regency

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Abstract

Nearly all parts of the siwalan plant possess considerable utility value. The leaves of the siwalan plant, for instance, can be utilized for weaving materials, while its trunk can serve as a strong construction material. The flowers contain liquid commonly known as legen, which is believed to provide health benefits, and the fruit can be consumed by local communities after being processed into sweets. However, one part that has little commercial value is the siwalan fruit peel. This peel waste, which has generally been regarded as useless waste, actually has potential to be processed into raw materials for environmentally friendly products, including dishwashing utensils. By conducting technical, economic, and marketing feasibility assessments, this research examines the possibility of transforming this waste into value-added products that can support local economic development while minimizing adverse environmental effects. The results are expected to offer recommendations for developing products made from siwalan fruit peel waste that are both environmentally sustainable and economically viable. In addition, this research seeks to increase community awareness regarding the importance of recycling and maximizing waste utilization as part of efforts to promote sustainable development.

Keywords:

Feasibility Study; Marketing; Product Development

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INTRODUCTION

Tuban Regency, located in the northern coastal region of East Java, is largely composed of dryland areas. This geographical condition supports the extensive cultivation of siwalan (sugar palm), making the plant one of the commonly grown commodities in the region. (*Siti et al., 2021*). Valued for its utility as food, a beverage source, and an industrial raw material, the siwalan fruit has long been an important local commodity. However, the outer skin of the siwalan fruit remains underutilized, as it is commonly used only as animal feed or discarded as waste. This limited utilization can result in the accumulation of siwalan fruit skin waste, which could potentially be processed into more valuable and useful products (*Fariha et al., 2020*). Although siwalan fruit fibers are known for their considerable strength and durability, their potential has not been fully utilized. The increasing amount of siwalan fiber waste presents an opportunity to further process and develop these materials into useful products with greater practical and economic value (*Jin et al., 2018*) utilizing siwalan fruit skin waste as a raw material for eco-friendly products offers an innovative solution that not only reduces waste but also boosts the local economy and supports environmental sustainability.

Siwalan fruit husks have distinctive characteristics, such as water resistance, strong fiber structure, and environmentally friendly properties. These characteristics enable them to be utilized in producing various value added products, including handicrafts, household equipment, and natural cleaning agents. One potential application of this waste is the development of siwalan husk scrubbers, an environmentally friendly cleaning tool that can serve as an alternative to harmful chemicals and disposable plastic products. Nevertheless, despite their considerable potential, the processing and commercialization of siwalan husk-based products continue to encounter several challenges. Therefore, comprehensive research on their technical and economic feasibility, along with suitable marketing strategies, is essential to promote wider market acceptance.

Product quality refers to the overall capability of a product or service to perform its intended functions and meet consumer expectations. It includes several important attributes, such as reliability, durability, ease of use, functionality, and other characteristics that contribute to the product's value. In contrast, the outer skin of the siwalan fruit remains relatively underutilized, as it is generally used only as animal feed or discarded as waste. The limited use of this material may contribute to the increasing accumulation of siwalan fruit skin waste. Therefore, its availability presents an opportunity for further utilization and development into innovative products that are more useful and have greater practical and economic value (*Kamil et al., 2022*) From a technical perspective, processing siwalan (sugar palm) fruit husks into high-quality

products requires appropriate technologies such as drying, fiber separation, and final product manufacturing that are efficient and do not compromise the quality of the raw material. Economic feasibility is equally important, production costs including raw materials, labor, and production facilities must be carefully carefully calculated. The product should be offered at a competitive price while maintaining sufficient profitability for local businesses. In addition, determining the appropriate target market for siwalan husk-based products, whether at the local, national, or international level, is essential. From an environmental perspective, the utilization of siwalan husks as raw materials for environmentally friendly products can significantly contribute to waste reduction and the sustainable management of natural resources. This innovation is also consistent with global efforts to reduce carbon footprints and decrease dependence on non-biodegradable materials, particularly plastic.

Marketing products derived from siwalan (sugar palm) fruit peel waste requires a strategic approach to reach environmentally conscious consumers who prioritize eco-friendly products. One applicable marketing strategy involves educational and sustainability campaigns that highlight the benefits of siwalan peel-based products as alternatives to synthetic or plastic-based goods. In the fashion industry, Instagram has become an effective digital platform for visual communication and marketing. Through its visual-based features, Instagram enables fashion businesses to present and promote their products while providing consumers with information about the latest fashion trends, styles, and product offerings. This platform also facilitates more engaging communication between brands and consumers, making it an important medium for reaching and attracting potential customers (*Maharani et al. 2021*). Beyond the consumer market, these waste-derived products can also be marketed through collaborations with other sectors such as handicrafts, home industries, and tourism where they can serve as local souvenirs that embody added cultural and environmental value.

This study seeks to comprehensively evaluate the technical and economic feasibility of products derived from siwalan fruit peel waste, while also developing effective marketing strategies to strengthen their competitiveness and potential in the market. Furthermore, the research is expected to provide insights into marketing management specifically regarding brand image and product quality (Asri et al., 2022) and to contribute positively to the economy of Tuban Regency by creating jobs and fostering local economic empowerment. Thus, optimizing the use of siwalan fruit peel waste for eco-friendly products not only benefits the environment but also represents a sustainable innovation that supports the economic well-being of the Tuban Regency community.

LITERATURE REVIEW

Potential Viability of Siwalan Products

Waste from Siwalan fruit husks can be utilized in various product forms, such as dishwashing tools, raw materials for handicrafts, or even as a base ingredient for food products. Utilizing this waste not only reduces environmental pollution but also generates economic value for the community. A feasibility study is an important assessment used to determine the viability of a proposed business idea or project. It provides a comprehensive basis for decision-making by evaluating whether the planned business or project is feasible to implement, considering various relevant aspects before a final decision is made to proceed with or reject the proposed plan (Putri et al., 2020). Previous studies have shown that effective environmental education plays an important role in increasing consumers' awareness and understanding of the environmental impacts associated with the products they purchase and use. By providing relevant information about environmental issues, such education can encourage consumers to make more responsible purchasing decisions and increase their willingness to choose products that are environmentally friendly and sustainable (Ahmadi, 2024). Through appropriate educational approaches, strategic partnerships, and effective marketing, this waste can be converted into a valuable community resource while contributing to the achievement of sustainable development goals. Existing initiatives indicate that the community in Tuban has demonstrated its readiness to adapt, develop innovations, and improve practices in waste management.

The Influence of Geographical Resources on Marketing Strategy

The increasingly intense competition within the marketing environment has created greater challenges for e-commerce platforms in attracting and retaining consumers. In response to this competitive situation, e-commerce businesses are required to enhance the attractiveness and competitiveness of their products through effective marketing strategies. These efforts are intended to capture consumers' attention, strengthen their interest in the products offered, and ultimately encourage them to make purchasing decisions (Marcella et al., 2023). Promotion is a planned marketing activity that involves communicating relevant information about products, services, or ideas to consumers. It aims not only to provide consumers with information but also to influence their perceptions, generate interest, and encourage them to consider and respond positively to the products or services being offered (Tamsir et al., 2022). A product can be regarded as superior when it generates substantial added value across the entire value chain and provides a meaningful contribution to the regional economy. Superior marketing commodities generally consist of high-quality products originating from particular regions with unique characteristics that strengthen their competitiveness. These

competitive advantages may be supported by favorable climatic conditions, fertile land, competent human resources, effective management, and appropriate technological applications. Collectively, these factors create comparative advantages that enhance added value throughout the value chain and make a significant contribution to regional economic development.

Development of Unique Packaging to Increase Consumer Buying Interest

The appropriateness of packaging for dishwashing products produced from sugar palm bark fiber waste plays an important role in attracting consumer interest and strengthening the effectiveness of product marketing strategies. Product innovation adds value to the product (*Hauli et al., 2022*) reflecting an eco-friendly identity such as through the use of biodegradable or recycled packaging materials allows the product to more easily attract consumers who care about sustainability. The use of natural colors, such as brown and green, along with a minimalist design, strengthens the product's natural and functional identity, allowing it to gain greater visibility in the market. In addition, packaging that explicitly emphasizes product advantages, including durability and natural ingredients, can increase product value and strengthen consumer trust. The packaging should also be designed to be compact and functional to reduce unnecessary waste, while allowing consumers to recognize the benefits of a product that is not only effective but also promotes an environmentally conscious lifestyle.

RESEARCH METHOD

The method employed in this study is descriptive analysis. According to (Kinter & Sherman, 2023), The descriptive method refers to a research approach designed to describe independent variables, whether involving a single variable or multiple variables, without comparing them or investigating their relationships with other variables. Descriptive research involves gathering data related to factors that support the research object and subsequently analyzing these factors to identify their respective roles. Data collection is conducted to obtain relevant, accurate, and reliable information through observation and interviews. The research participation was voluntary, with siwalan producers, village officials, and siwalan sellers expressing their willingness to participate as informants. In addition, consumers who had previously used the product were included as supporting informants to provide complementary information for the study.

FINDINGS AND DISCUSSION

The research findings present a detailed descriptive analysis of the marketing and feasibility of dishwashing products produced from siwalan peel fiber waste, which previously had limited economic value in Tuban Regency. The data collected through interviews are systematically presented in the form of tables, graphs, and diagrams to provide a clearer understanding of the

analytical results. These visual presentations are intended to facilitate the interpretation of the findings and provide a comprehensive overview of the information obtained from the interview process. Accordingly, the following interview data are presented:

Effect of siwalan fruit supply on production stability

The availability of siwalan fruit is essential for maintaining production stability in Tuban Regency, particularly for industries that utilize this commodity to produce various products, including siwalan sugar, sap, and other local specialties. A consistent supply enables production activities to operate efficiently, fulfill market demand, and contribute to the welfare of farmers and business operators. However, the availability of siwalan fruit is influenced by several factors, including harvesting periods, weather conditions, cultivation practices, and fluctuations in market demand. Disruptions in supply, caused by prolonged dry seasons or inadequate cultivation practices, may affect production levels and subsequently decrease the income and economic resilience of communities dependent on this commodity. Therefore, maintaining a stable supply of siwalan fruit is crucial for ensuring the sustainability of local industries in Tuban Regency.

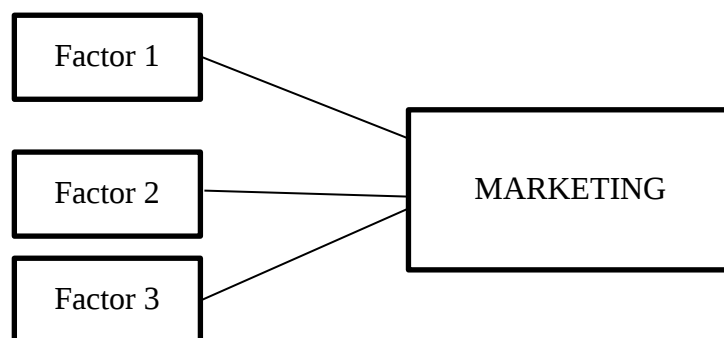
Maximize human resources for the production process by utilizing local government realtions

The utilization of policies and programs implemented by the local government can contribute significantly to workforce development. The Tuban Regency Government has undertaken various efforts to improve workforce quality through skills training and the development of vocational education programs that are aligned with the requirements of local industries. Through collaboration among the local government, companies, and educational institutions, business operators can access a skilled workforce that is adequately prepared and understands the demands of the local market. These initiatives not only contribute to increasing business productivity but also support local employment opportunities and strengthen regional economic development.

The effect of environmentally friendly products on consumer purchasing power

These products appeal to environmentally conscious consumers, particularly younger generations who tend to demonstrate greater awareness of sustainability and environmental concerns. Although environmentally friendly products generally have higher prices, consumers are increasingly willing to pay a premium because they recognize the additional value associated with environmental sustainability and social responsibility. This makes green products attractive in the market and increases consumer purchasing power for products that support environmental sustainability.

Figure 1.
Research Marketing



Source: Processed by researchers

This study is important because identifying the annual supply of siwalan fruit supports the production of environmentally friendly dishwashing tools and the feasibility assessment of siwalan fiber waste utilization. Sustainable packaging is also needed to maintain competitive prices and consumer interest. Furthermore, collaboration with siwalan suppliers in Tuban Regency can strengthen marketing, distribution, and product commercialization.

Table 1.
According to the Central Bureau of Statistics of Tuban Regency

Type of Plantation Crop	2019/pound	2018/pound
Siwalan	116,92	119,64

Source: Author(s) work

Table 2.
Product Feasibility Analysis

Aspects	Product Feasibility	Product Marketing
Definition	Assessment of whether the product meets market needs	The process of introducing and selling products to consumers
Destination	Determine the potential success of the product in the market	Build brand awareness and increase sales
Key Factors	Market research, competitor analysis, consumer feedback	4P strategy (Product, Price, Place, Promotion)
Consumer Research	Understand consumer needs, preferences, and behavior	Identifying target markets and creating the right message
Product Launch	Launch planning and management	Communication strategy to attract consumer attention
Performance Evaluation	Measuring market response to the product	Analyze the effectiveness of marketing campaigns

Source: Author(s) work

Table 3.
Strategy marketing

Factor	Description	Influence on Purchasing Power
Environmental Awareness	The level of consumer understanding of environmental issues and the importance of green products.	Significantly increase purchase intention for green products
Product Knowledge	Information that consumers have about the benefits and features of green products.	Consumers are more likely to buy if knowledge is high.
Price Perception	Consumers' views on the price of green products compared to conventional products.	Willingness to pay more if they believe in the benefits
Perceived Consumer Effectiveness (PCE)	Consumers' belief that their actions can contribute to environmental improvement.	High PCE drives green product purchase intention.
Attitude towards Green Products	A positive view of the sustainability and social impact of green products.	Positive attitude increases purchase intention.
Consumer Engagement	The level of consumer participation in finding and choosing environmentally friendly products.	High engagement is associated with greater purchase intention.

Source: Author(s) work

CONCLUSIONS

Optimizing the feasibility and marketing potential of processed siwalan fruit peel waste as an environmentally friendly innovation in Tuban Regency offers significant opportunities to promote environmental sustainability and regional economic development. Based on the analysis, the utilization of siwalan fruit peel waste can help reduce pollution and waste accumulation while generating added value through products such as biodegradable packaging, natural fibers, and environmentally friendly health products. From an economic perspective, processing this waste requires relatively low production costs and has the potential to create employment opportunities for local communities while contributing to regional economic growth. In terms of market potential, the increasing demand for sustainable products creates opportunities for siwalan-based products to gain wider acceptance, particularly among environmentally conscious consumers. Nevertheless, several challenges remain, including limited public awareness of the potential value of siwalan waste, inadequate processing technology, and weaknesses in supply chain management. Therefore, collaboration among government institutions,

business actors, and non-governmental organizations is necessary to strengthen training programs, provide technological support, and develop effective marketing strategies. With appropriate and integrated approaches, products derived from siwalan fruit peel waste can serve as a sustainable model of environmentally friendly innovation while generating long-term economic benefits for Tuban Regency.

LIMITATION & FURTHER RESEARCH

Although this study provides an overview of the potential utilization of siwalan fruit peel waste as an environmentally friendly product, several limitations should be acknowledged. One limitation concerns the availability of data regarding the quantity and distribution of siwalan peel waste in Tuban Regency, which may influence the assessment of production feasibility and supply chain conditions. Furthermore, the development of efficient and environmentally sustainable processing technologies remains a challenge, as the utilization of this raw material is still relatively innovative and requires further investigation. This study also does not comprehensively evaluate product competitiveness in the market, particularly regarding consumer behavior and preferences toward products derived from agricultural waste. Therefore, future research should investigate more advanced processing technologies, conduct comprehensive market analyses, and assess the long-term social and economic impacts of this initiative. Further studies may also focus on developing inclusive and sustainable business models that encourage the active involvement of local communities and relevant stakeholders throughout the siwalan product value chain.

AUTHOR CONTRIBUTION

Author: Conducted fieldwork in Tuban Regency, including gathering data related to the feasibility of utilizing siwalan fruit peel waste. Led the evaluation of environmental impacts and explored opportunities for efficient waste management. Contributed to developing marketing strategies for the proposed products, particularly by examining consumer acceptance, market opportunities, and sustainability aspects. Assisted with the preparation of the manuscript. Conducted economic feasibility evaluations, covering cost-benefit analysis and opportunities for integration into the local market. Contributed to writing the results section and completing the final manuscript.

Declaration of interest

The authors hereby declare that there are no competing interests or conflicts of interest related to the research, authorship, and publication of this article. The study was carried out independently and without financial assistance, grants, sponsorship, or other forms of funding from external organizations, institutions, or parties. The authors further declare that they have no personal,

professional, institutional, or financial conflicts of interest that could directly or indirectly affect the research process, the findings obtained, or the interpretation of the results. Accordingly, the authors affirm that this study was conducted objectively and independently, and that the conclusions presented in this article are derived exclusively from the results and analyses of the research.

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