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Agroindustry Transformation: Down-streaming and Diversification Strategies for Oyster Mushroom Products to Improve Economic Independence at Fostered Partners Malaysian Institute of Sustainable Agriculture

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Abstract

This research and community service aim to analyze the impact of diversifying oyster mushroom processed products on increasing economic added value for partners fostered by the Malaysian Institute of Sustainable Agriculture (MISA). Through an Asset-Based Community Development (ABCD) approach, this program provides interventions in the form of food processing technology transfer and business management. The results show that the transformation from fresh mushroom sales to processed products (downstream), such as nuggets, chips, and sausages, can significantly increase economic value. Specifically, processing into mushroom nuggets provides an added value increase of up to 80% compared to sales of fresh mushrooms. This program concludes that product diversification is a strategic key in overcoming the risk of post-harvest damage and market price fluctuations.

Keywords: Product Diversification; Downstream Processing; Oyster Mushrooms; Added Value

1. Introduction

The agriculture and horticulture sectors play a vital role in the economic structure of Southeast Asia, including Malaysia and Indonesia, as a pillar of food security and a source of livelihoods for rural communities. However, the traditional agricultural paradigm, which focuses solely on on-farm cultivation without adequate post-harvest strategies, often places farmers in a weak bargaining position in the global supply chain. Farmers are often trapped in the role of raw material providers with very thin profit margins, while the greatest added value is enjoyed by downstream industry players who process these raw materials into finished products.

Oyster mushrooms (Pleurotus ostreatus) are a leading commodity with high economic potential. This mushroom is popular for its meat-like texture, high nutritional content, and relatively short cultivation cycle. For partner communities of the Malaysian Institute of Sustainable Agriculture (MISA), oyster mushroom cultivation has become a promising alternative livelihood. MISA, as an institution focused on sustainable agriculture, has successfully fostered communities to produce high-quality mushrooms.

However, an analysis of the situation on the ground reveals a significant gap between production potential and the economic well-being of partners. The fundamental problem faced is partners' dependence on fresh mushroom sales. The highly perishable nature of oyster mushrooms, with their high-water content, results in a very short shelf life, ranging from 1 to 2 days at room temperature. This perishability creates psychological and economic pressure for farmers to sell their harvest quickly, often at prices pressured by middlemen or an oversupplied market.

When the main harvest arrives, fresh mushroom prices tend to plummet. The risk of losses due to unsold and rotting produce poses a real threat, eroding business capital. Furthermore, the lack of product differentiation makes

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competition among farmers highly competitive and focused solely on price wars. This phenomenon confirms that relying on raw commodity sales is no longer relevant to ensuring long-term economic sustainability.

Therefore, strategic intervention is needed in the form of transforming the business model from mere raw material traders to agro-industrial producers. The concept of downstreaming agricultural products through diversified food processing is the most rational and urgent solution. Product diversification is not simply an effort to increase sales variants, but rather a risk management strategy to extend the product life cycle, expand market reach, and create significant added value.

This activity report details the implementation of a community service program aimed at empowering MISA's partners through the transfer of oyster mushroom processing technology. The main focus of the activity is to provide technical skills (hard skills) in processing mushrooms into various derivative products, such as chips, nuggets, meatballs, and sausages, as well as managerial skills (soft skills) related to branding and digital marketing. Through this program, it is hoped that a resilient business ecosystem will be created, where partners are no longer dictated by fluctuations in fresh market prices, but are instead able to become price makers through processed products with high sales value. This article will discuss in depth the urgency, methodology, and analysis of the economic impact of this downstreaming program.

2. Literature Review

To understand the theoretical framework of this empowerment program, a review of relevant literature on mushroom cultivation, diversification strategies, small business management, and community empowerment is necessary. Characteristics and Potential of Oyster Mushrooms: Sánchez (2010), in his study on the cultivation of Pleurotus ostreatus, emphasized that oyster mushrooms are saprophytic organisms capable of converting lignocellulosic waste into high-protein food [1]. Royse, Baars, and Tan (2017) added that, in addition to their nutritional value, adaptive mushroom cultivation technology makes them an ideal commodity for community economic empowerment [2]. However, the main challenge of this commodity is its highly perishable nature. Without post-harvest technology, the economic value of mushrooms will be completely lost within a short time after harvest. This requires technological processing interventions to maintain the intrinsic value of this raw material.

Oyster mushrooms are a type of edible mushroom widely cultivated due to their adaptability to various environmental conditions and growing substrates. They are saprophytic fungi capable of degrading complex organic matter, particularly lignocellulose, through enzymatic activity such as cellulase, hemicellulase, and ligninase. This ability makes oyster mushrooms play a crucial role in the recycling of organic matter and act as agents for the bioconversion of agricultural waste into economically valuable food sources [1,3].

Nutritionally, oyster mushrooms are known to possess a fairly comprehensive nutritional profile, including protein, carbohydrates, dietary fiber, vitamins, and minerals. Oyster mushroom protein content ranges from 15–30% of dry weight, with a relatively balanced composition of essential amino acids. Furthermore, oyster mushrooms contain dietary fiber and β-glucan, which play a role in maintaining digestive health and lowering cholesterol levels. Their low-fat content makes them suitable as a healthy food and an alternative source of plant-based protein [4,5].

In addition to their nutritional value, oyster mushrooms also possess important bioactive potential for health. Various studies have reported that Pleurotus spp. contain phenolic compounds, flavonoids, and bioactive polysaccharides that possess antioxidant, antimicrobial, antidiabetic, and immunomodulatory activities. The β-glucan compound found in oyster mushroom cell walls is known to enhance the immune system's response and has the potential to act as a preventative against degenerative diseases. Therefore, oyster mushrooms serve not only as a food ingredient but also have the potential to be developed as functional foods and raw materials for the health industry [6,7].

The Concept of Product Diversification and Added Value: Product diversification is a crucial business development strategy. Razak (2022) explains that diversification is an effort to vary product types to expand the market and minimize business risks [8]. In the context of agribusiness, diversification is often associated with the concept of the value chain. UNIDO (2009) defines the development of an agro-industrial value chain as a series of activities that add value to agricultural products from the production stage to final consumption [9]. The transformation of fresh mushrooms into processed products (such as nuggets or chips) is a concrete form of added value creation, where technological and labor inputs change the physical form of the product so that it has higher utility and selling price.

Competitive Advantage and Marketing: Porter's (1985) theory of competitive advantage states that to win the competition, a business entity must have differentiation or cost advantages [10]. In the case of MISA partners, product

differentiation is key. Pratama, Evien, & Tarunay (2024) found that product diversification supported by strong brand equity significantly influences consumer purchasing decisions [11]. This is in line with Scarborough & Cornwell's (2016) view on entrepreneurship, which emphasizes the importance of innovation and marketing management in the success of small businesses [12]. Digital marketing and attractive packaging are integral supporting elements of a physical product diversification strategy.

Community Empowerment: The empowerment approach in this activity draws on Rappaport's (1987) theory, which defines empowerment as a process by which individuals, organizations, and communities gain control over their lives. [13]. In this context, this control is realized through the transfer of knowledge and skills that enable partners to become economically independent, free from dependence on collectors or fluctuations in the raw commodity market.

3. Material and methods

This activity was implemented using a participatory Asset-Based Community Development (ABCD) approach, which prioritizes the utilization of existing assets and potential within the Malaysian Institute of Sustainable Agriculture (MISA) partner communities. The implementation stages are as follows:

- Initial Observation and Analysis: Mapping problems, potential raw materials for oyster mushrooms, and human resource readiness among the partners being mentored.
- Program Socialization: Aligning perceptions regarding the urgency of processing downstream products from oyster mushrooms for the sustainability of business potential that can be developed sustainably.

Proposed concept for intensive technical training related to the oyster mushroom production process produced by MISA's mentored partners. The intensive training will focus on the production of various oyster mushroom products, including:

- Dry Food/Snacks: Mushroom chips and crispy mushrooms.
- Frozen Food: Mushroom nuggets, mushroom meatballs, and mushroom sausage.
- Seasoning: Instant mushroom broth. This training covers recipe formulation, hygienic processing techniques (Good Manufacturing Practices/GMP), and the use of appropriate production equipment.

Business Management Assistance:

- Developing a proposed SOP (Standard Operating Procedure) for diversifying oyster mushroom processing production.
- Proposed concepts and examples for calculating the Cost of Goods Sold (COGS) and determining the selling price of processed oyster mushroom products.
- Proposed packaging design (branding) and digital marketing (e-commerce) concepts.

Monitoring and Evaluation: Measuring program success through indicators of increased product variety and analyzing partner revenue increases.

4. Results and discussion

This section outlines the results of the program implementation and an in-depth analysis of the economic and social impacts of the product diversification strategy.

4.1. Product Transformation and Quality Improvement

Prior to the program intervention, MISA's partners relied entirely on fresh mushroom sales. Observations revealed a high level of product waste, especially when market demand declined. Through technical training, partners successfully developed a new product line that transforms fresh mushrooms into products with a much longer shelf life. The resulting processed products are divided into two main categories based on their shelf life:

Dried Products (Chips and Broth): Have a shelf life of 3-6 months with proper packaging. These products target the souvenir and healthy snack markets.

Frozen Products (Nuggets, Meatballs, Sausages): Have a shelf life of 1-3 months when frozen. These products target the household segment requiring practical and healthy side dishes.

Strict implementation of SOPs during the training has successfully standardized product taste and quality. Partners now understand that consistency is key in the processed food business. In addition, the introduction of packaging technology (such as vacuum sealers for frozen food and aluminum foil standing pouches for chips) has improved product aesthetics, making them competitive in both modern and e-commerce markets.

4.2. Economic Value

4.3. Value Added Analysis

The most significant impact of this program is seen in the economic analysis. Comparing the sale of raw materials with the sale of processed products shows a striking disparity in profits. The following is a calculation simulation based on real-world data for 10 kg of oyster mushrooms:

- Scenario A: Fresh Sales: If a partner sells 10 kg of fresh mushrooms, the average market price ranges from the local market standard. The estimated total gross revenue is IDR 120,000 to IDR 150,000. After deducting simple harvesting and transportation costs, the net profit margin is very slim, and the risk of unsold goods is very high.
- Scenario B: Processing into Mushroom Nuggets: When 10 kg of oyster mushrooms are processed into nuggets, the final product volume increases due to the addition of supporting ingredients (flour, eggs, spices, etc.). However, the most crucial factor is the increase in the selling price. Based on the analysis of production costs and market selling prices:

The cost of raw mushrooms and additional ingredients is factored into the Cost of Goods Sold (COGS).

Nugget production output from 10 kg of mushroom raw materials can generate significantly higher sales revenue (turnover).

The analysis shows that the net profit from processing 10 kg of mushrooms into nuggets reaches around IDR 270,000.

Comparative Discussion: Comparing Scenario A (maximum IDR 150,000) and Scenario B (IDR 270,000), there is a significant difference in income. Diversification into nugget products can increase economic added value by more than 80%. This figure does not include non-material benefits such as the creation of new jobs for partner family members to assist with production, packaging, and marketing.

In addition to nuggets, mushroom chips also show a positive trend, with an increase in net economic value of between 20% and 50%. This variation depends on the efficiency of cooking oil use and the oil-spinning technique. This analysis quantitatively proves that downstreaming is an effective mechanism for multiplying farmers' incomes without the need for expansion of cultivation areas (post-harvest intensification).

4.4. Marketing Strategy and Business Sustainability

Production success will have no impact if it is not absorbed by the market. Therefore, discussions regarding results also include a transformation of marketing strategy. MISA's mentored partners are encouraged to move away from the mindset of "selling what is harvested" and toward "producing what the market wants."

Current market trends indicate a strong consumer preference for healthy food and convenience foods. Processed oyster mushroom products address both of these needs: healthy (plant-based, low-cholesterol) and convenient (simply fry/eat). Armed with new branding and digital promotional materials developed during the mentoring program, partners have begun expanding their reach online through social media and marketplaces. This cuts dependence on geographically limited local physical markets.

The sustainability of this program is ensured through the formation of joint business groups under the auspices of MISA. These groups serve as a forum for resource sharing (for example, purchasing supporting materials in bulk for lower prices) and collective quality control. This system minimizes the risk of individual business failure.

5. Conclusion

Based on the results of program implementation and data analysis, it can be concluded that:

1. Diversification Effectiveness: The oyster mushroom processed product diversification program for MISA's fostered partners has successfully transformed their mindset and business model from mere sellers of raw materials to producers of processed food. The resulting variety of products (nuggets, chips, sausages, meatballs) boasts high quality and a longer shelf life.
2. Significant Economic Improvement: Product down-streaming has been empirically proven to drastically increase economic added value. Processed mushroom nuggets recorded the highest economic value increase, reaching over 80% compared to selling fresh mushrooms. Meanwhile, chips generated a 20-50% increase.
3. Business Resilience: By having long-lasting processed products, partners have a stronger bargaining position and are no longer vulnerable to losses due to crop spoilage or sharp fluctuations in fresh mushroom prices.
4. Recommendation: To ensure sustainability, it is recommended that MISA continue to assist in obtaining distribution permits (PIRT/Halal) to expand market access to modern retail, as well as continue to innovate flavor variants to follow dynamic culinary trends

Compliance with ethical standards

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Disclosure of conflict of interest

The authors of this manuscript declare no conflict of interest.

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