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# Utilization of Fishery Waste Product: The Case of MSMEs (In Central Java, Indonesia)

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## Abstract

Resource management encompasses not only fishing and aquaculture activities but also the management of fishery waste, classified as animal by-products. Effective management of fishery waste, including heads, bones, scales, offal, and shells—which constitute approximately 30-40% of total fishery products—provides opportunities to mitigate pollution and boost the income of traditional coastal communities. In 2014, the FAO highlighted Indonesia's significant fishery commodities, particularly mollusks and sea shells, which hold substantial export potential. Utilizing every part of the fish promotes environmental sustainability and creates economic benefits. This reflects a growing recognition of sustainable practices in enhancing local economies and ecological health. Indonesia's waters are divided into nine fisheries management areas (WPP). Research on Sustainability Practices in Micro, Small, and Medium Enterprises (MSMEs) indicates that MSMEs are pivotal to Indonesia's economic development and are increasingly adopting Green Supply Chain Management (GSCM) practices to improve sustainability. In Central Java, fisheries are a key economic activity, with fish farming and processing supporting local diets and incomes. The region's economy is diverse, with the processing industry leading, contributing 34.99% in the first quarter of 2024. Regulations for MSMEs in Central Java aim to foster growth and sustainability by providing legal protections, financial aid, and infrastructure support, enhancing the resilience and competitiveness of MSMEs, including those in fisheries. Ongoing efforts are essential to overcome implementation challenges and ensure these regulations benefit all stakeholders. This article explores the utilization of fish waste management in MSMEs.

**Keywords:** Fish waste: Fishery management: Fisheries: MSMEs: Central Java.

## Introduction

Indonesia ranks as the second largest fish producer globally, with an estimated production of 21.8 million metric tons according to the World Population Review (WPR, 2022). In 2022, the fisheries sector contributed approximately 2.6 percent to Indonesia's gross domestic product (GDP) (Monica, 2024). The fisheries industry is pivotal not only to Indonesia's economy but also to nutrition, job creation, and income generation, as highlighted by the International Institute for

Sustainable Development (IISD, 2021). Central Java is recognized as the largest province supplying Indonesian fishers to both domestic and foreign-flagged fishing vessels (Nababan et al., 2020). According to a 2022 report from the Provincial Marine Affairs and Fisheries Office of Central Java, the province hosts over 150,000 fishers and 27,488 fishing vessels, with total fish production reaching 318 million tons, valued at more than IDR 4.2 billion.

Large-scale fish production generates significant amounts of waste, which, if not properly managed, can lead to environmental issues such as pollution and damage to marine ecosystems. To address this, the Ministry of Maritime Affairs and Fisheries (MMAF) advocates for a zero-waste approach within the fisheries sector (Azura, 2023). Transforming fish waste into valuable products presents a significant opportunity for Micro, Small, and Medium Enterprises (MSMEs) in Central Java. By adopting sustainable practices and exploring community initiatives, these enterprises can enhance their economic potential while contributing to environmental sustainability.

In recent years, over half of Indonesia's total fisheries production has come from aquaculture, with key species including shrimp, tilapia, catfish, and seaweed cultivated across the archipelago. Conversely, Indonesia's capture fisheries are primarily marine-based, with tuna fisheries playing a crucial role due to their substantial catch volume, high economic value, and significant presence in international trade. While industrial fisheries significantly contribute to export production, domestic fish consumption relies mainly on small-scale fisheries, which account for over 90 percent of the fishing workforce. Despite the substantial involvement of fisherwomen, their contributions remain largely unrecognized, limiting their access to official government support such as subsidies and insurance. Consequently, women are primarily engaged in informal, downstream activities like post-harvest handling, selling, processing, storage, packaging, and marketing, often without formal contracts. Additionally, fishing establishments in Indonesia typically employ more men than women.

## Fish Waste Management in Central Java

Capture fisheries in Central Java Province include marine capture and public waters capture fisheries, both with significant development potential. The potential annual performance of marine capture fisheries in Central Java waters is around 1,873,530 tons, including approximately 796,640 tons/year from the Java Sea and 1,076,890 tons/year from the Indonesian Ocean (Naya, Wijayanto & Sardiyatmo, 2017). Given its extensive coastal areas, fisheries are a crucial economic activity in Central Java. Fish farming and processing support local diets and incomes, thereby sustaining numerous MSMEs involved in fish processing, particularly in pindang fish production, which is highly demanded locally. The growth of MSMEs engaged in fish processing is noteworthy. For instance, in North Cicinde, Karawang, approximately 926 MSMEs are involved in producing pindang fish (a traditional Indonesian dish), collectively generating substantial monthly production (Suhada, 2024).

In countries like England, Ireland, and Scotland, strict regulations govern the management of residual waste from animal production to safeguard human and animal health

and the environment. These regulations cover all aspects, including collection, storage, processing, disposal, as well as the marketing and export of processed waste. Animal product waste is categorized into three risk levels: Category 1 (very high risk), Category 2 (high risk), and Category 3 (low risk). Category 3 includes waste from fisheries, marine animals, and shells. Shellfish waste, as an animal by-product, must be treated according to the same stringent standards, and waste handling must be conducted through licensed facilities. In Central Java, Indonesia, fish waste management employs various strategies aimed at minimizing environmental impact and maximizing resource utilization.

## Fish Species Found Across Central Java

Central Java, Indonesia, boasts a diverse range of fish species in both freshwater and marine environments. A study of the Klawing River identified 18 fish species from 11 families. The Cyprinidae family exhibited the highest diversity with six species, followed by Bagridae and Cichlidae with two species each. Other families included Mastacembelidae, Anabantidae, and Channidae, reflecting the river's varied environmental conditions from upstream to downstream (Suryaningsih et al., 2018). Recently, researchers discovered the rare freshwater fish Lobocheilos falcifer, or Mangut, in Central Java's Wadaslintang Reservoir. Previously thought to be restricted to West Java, this discovery significantly extends the known range of the species (Hasan et al., 2019).

The Bengawan Solo River is another critical habitat for various fish species. Research indicates that native species like Pangasius polyuranodon (Jendil) and Cyclocheilichthys enoplos (Seren) thrive in this river despite challenges posed by pollution and habitat modification. The river experiences mass fish deaths due to organic pollution, which adversely affects biodiversity (Aida, 2022). While specific marine species in Central Java's coastal areas were not detailed, these regions are known for commercially important fish such as snapper, grouper, and mackerel. These species are integral to local fisheries and significantly contribute to the region's economy.

## Fish Waste Management in Central Java

The pindang fish industry is particularly vibrant in North Cicinde, Banyusari sub-district, Karawang district, West Java. A total of 926 fish processing MSMEs operate in this area, organized into 42 groups, with a combined monthly output of 565 tons. The distribution network involves several stages, beginning with producers who sell to collectors or traders. These traders then pass the products on to smaller vendors, who ultimately deliver them to consumers. This multi-layered system enables extensive distribution of pindang fish products across various areas, such as Karawang, Purwakarta, Subang, Cikarang, and Bekasi (Suhada, 2024). Central Java's biodiversity supports active fish production and processing. Consequently, MSMEs in Central Java are innovatively transforming fish waste into a variety of valuable products. This strategy not only addresses waste management issues but also enhances economic prospects in the region.

Key innovations include producing Fish Protein Hydrolysate (FPH) from low-value fish, which serves as a nutritional supplement for animal feed and aquaculture, providing a sustainable

protein source and helping to combat malnutrition and stunting. Fish offal and wash water are processed into liquid organic fertilizer enriched with nitrogen, phosphorus, and potassium, enhancing plant growth and reducing environmental pollution. Fish bones and heads are converted into nutritious snacks, offering a healthier alternative to traditional snack foods. Collagen extracted from fish skins and bones is used in the pharmaceutical industry, contributing to health sector advancements while promoting sustainable fishing practices. Additionally, fish entrails and other by-products are turned into high-protein animal feed, providing a cost-effective feed option and minimizing the environmental impact of waste.

## The Zero Waste Initiative

The Zero Waste initiative is a prominent strategy being implemented by companies like Aruna. This program aims to minimize fishery waste by utilizing every part of the fish. Fish flesh is transformed into fillets and steaks, while bones and heads are converted into snacks or pharmaceutical ingredients. Entrails are often used as livestock feed (Aruna, 2023). The initiative promotes selective fishing, efficient processing, and creative waste utilization to reduce overall waste generated from fishery activities.

## MSMEs in Central Java

Fishing is a major source of employment in Indonesia, particularly on the smaller islands within the archipelago. As of March 2020, the Satu Data database recorded 1,459,874 fishers, representing about 1.2 percent of the total population. The identification of active fishers has become more accurate, with 719,309 registered with Marine and Fisheries Business Actor Cards (Kusuka). Most fishers operate on a small scale, using vessels under 10 GT (gross tonnage). Of the 768,972 boats in the fishing fleet, only 36 percent are motorized, while the rest use portable engines or are non-motorized (Badan Pusat Statistik, 2020). Fishers typically reside in coastal villages characterized by low-income, overcrowded, and poor living conditions (Badan Pusat Statistik, 2019).

## Regulations Governing Micro, Small, And Medium Enterprises (MSMEs) in Central Java

Government Regulation No. 7 was issued on February 2, 2021, primarily focusing on facilities, protection, and empowerment for cooperatives and MSMEs as part of the broader Job Creation Law (Law No. 11 of 2020). It establishes a framework for business certainty and development for MSMEs, mandates the creation of a single database for MSMEs to improve data accuracy and accessibility, and allocates 30 percent of public infrastructure areas for MSME use, aiming to enhance their competitiveness. Law Number 23 of 2014 provides the legal basis for regional governments to empower MSMEs through various support mechanisms, including legal protection for MSMEs in business operations, assistance in production processes, marketing strategies, and access to capital. The Central Java Provincial Office of Cooperatives and SMEs plays an essential role in implementing these provisions.

The Debt Relief Regulations (Government Regulation No. 47/2024), recently signed by President Prabowo Subianto, offer debt cancellation for individuals and MSMEs in agriculture, fisheries, and plantations. This aims to improve access to new loans and support businesses affected by natural disasters or economic crises like COVID-19. The regulation specifically applies to debts from state-owned banks. Provincial Regulation Number 12 of 2022 outlines capital assistance provisions for MSMEs in Central Java, facilitating investment activities and business licensing requirements. Any person wishing to engage in business must obtain a business license, with local governments responsible for issuing the necessary licenses for MSMEs to operate legally within the region.

Despite these supportive regulations, MSMEs face challenges such as limited knowledge about legalities and compliance requirements, difficulties in accessing financing due to stringent banking criteria, and insufficient assistance in improving product quality and competitiveness. While the regulations encourage the growth and competitiveness of MSMEs across various sectors, including fisheries, there remains a need for greater awareness of these regulations and addressing financial constraints.

## Government Support

According to a government press release on Government Program Support in Empowering MSMEs to Strengthen Regional Economic Stability in 2022, several programs were implemented to support women entrepreneurs and help MSMEs recover from the 2020 pandemic. Measures included affordable cooking oil prices to aid MSME operations and the National Economic Recovery Program with a budget of IDR 96.21 trillion in 2021. Subsidies were provided, along with capital support through government fund placements at partner banks, loan restructuring, credit guarantees, funding assistance, and tax incentives. Additionally, support included waivers on minimum account balances, electricity fees, and subscription costs. These efforts create a conducive environment for startup businesses and enhance economic growth. The Coordinating Ministry for Economic Affairs of the Republic of Indonesia projected that by the end of 2021, IDR 83.19 trillion would have been distributed, benefiting around 34.59 million MSMEs, with significant uptake in Central Java, including over 1.6 million Bantuan Produktif Usaha Mikro (BPUM) recipients. In 2022, the government increased the People's Business Credit (KUR) limit to IDR 373.17 trillion and extended the 3 percent KUR interest subsidy until June.

## Challenges Faced By Micro, Small, and Medium Enterprises (MSMEs) in The Fisheries Sector In Central Java

The challenges faced by MSMEs in the fisheries sector are categorized into internal and external challenges.

**Internal Challenges**

1. Water Quality Management: Maintaining optimal water quality is crucial for fish health and productivity. Many small-scale fish farmers struggle with inadequate monitoring and management practices, leading to poor yields.

2. Poor Feeding Practices: Farmers often have difficulties providing the right quantity and timing of feed, directly affecting fish growth and product sustainability.
3. Lack of Technical Expertise: There is a deficiency in technical knowledge among farmers regarding best practices in aquaculture, including breeding, feeding, and disease management (Tita & Albert, 2017).

**External Challenges**

1. Market Access: Many MSMEs have limited access to broader markets due to inadequate distribution networks. They often rely on local markets or collectors who may not offer favorable prices or timely payments (Suhada, 2024).
2. Competitive Market: The fisheries sector is highly competitive, with fluctuating prices significantly impacting profitability. This is exacerbated by illegal fishing practices that undermine legitimate businesses.
3. Regulatory Requirements: Obtaining necessary licenses and meeting regulatory requirements can be cumbersome for small enterprises, limiting their ability to expand operations or access larger markets (Kompas, 2022).
4. Technological Adoption: MSMEs often face difficulties with digital transformation due to unfamiliarity with emerging trends such as e-commerce and digital marketing, limiting their customer reach. Additionally, inadequate infrastructure hampers the adoption of new technologies.

## Conclusion

Fishery waste management is a pressing global issue due to its significant environmental impacts and potential economic benefits when managed sustainably. Innovative techniques can convert waste into valuable products by embracing circular economy principles, transforming fish farms into hubs where waste becomes a resource rather than pollution. By recycling by-products such as offal into fertilizer or aquaculture feed, businesses reduce their dependency on virgin resources while generating additional revenue streams through product sales. Advanced technologies like biorefineries can transform multiple components from fish waste into diverse value-added products. For example, Japan has developed methods using enzymatic hydrolysis and fermentation processes to recover proteins, lipids, and other bioactive components from fish waste for use in food, feed, and pharmaceutical industries. They prioritize resource recovery from fish waste through various technologies aimed at recovering valuable components such as carbon-based nanomaterials from treated fish waste. This approach minimizes environmental impact while maximizing resource utilization.

Effective fishery waste management is crucial for mitigating environmental pollution and optimizing resource utilization. Global trends highlight the necessity for sustainable practices that convert previously considered waste into valuable commodities. Regulatory frameworks combined with innovative technologies aim to reduce waste generation and promote recycling practices throughout the seafood industry. In conclusion, the synergy between effective fish waste

management practices and supportive regulations in Central Java creates a robust framework for the growth of MSMEs. By transforming waste into valuable resources, these enterprises not only contribute to economic development but also promote environmental stewardship. The ongoing commitment from local governments to empower MSMEs through training and infrastructure support is vital in ensuring their resilience and success in an increasingly competitive market. As Central Java continues to embrace sustainable practices within its fisheries sector, it sets a precedent for other regions to follow, highlighting the potential of MSMEs as key drivers of both economic prosperity and environmental sustainability.

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