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A Sustainability-Oriented Value Chain and Financial Feasibility Analysis of Zero-Waste Catfish By-Product Processing in Pasuruan, Indonesia

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ABSTRACT

Small-scale catfish processing generates substantial by-products that are often underutilised, limiting value creation and business sustainability. This study evaluates the sustainability of a zero-waste catfish by-product processing micro, small, and medium enterprises (MSMEs) in Pasuruan Regency, Indonesia, by integrating Porter's value chain analysis with financial feasibility assessment. A descriptive case study approach was employed using primary data collected through observation, interviews, questionnaires, and documentation. The value chain analysis identifies that operational activities dominate both asset allocation and cost structure, accounting for approximately 66.7% of total operating costs, indicating that processing operations are the main source of value creation. Financial results demonstrate short-term profitability, with a Revenue–Cost Ratio of 1.38, a profit margin of 27.35%, and a Return to Total Capital (RTC) of 17.57%. Long-term feasibility is supported by a positive Net Present Value (NPV) of IDR 68,001,876, a Net Benefit–Cost Ratio of 1.19, an Internal Rate of Return of 9.84%, and a payback period of 6.25 years. However, sensitivity analysis reveals high vulnerability to cost increases and revenue declines, indicating that business sustainability depends on operational efficiency and revenue stability. This study demonstrates that integrating value chain analysis with financial feasibility assessment provides a comprehensive framework for evaluating sustainability in fisheries-based MSMEs.

1. INTRODUCTION

Indonesia's aquaculture production in 2023 reached 15,361,425 tons, of which catfish constituted an important component [1]. In 2023, national catfish aquaculture production totalled 348,379 tons annually. In East Java Province, catfish production reached 22,663 tons per year, making the province one of the main contributors to national output. One of the contributing areas in East Java is Pasuruan Regency, where catfish production in 2023 reached 87 tons per year [2]. This production level indicates that public interest in catfish consumption is relatively high. Catfish is also widely favoured because it is easy to process and consume.

Catfish is a high-value freshwater aquaculture commodity that is easy to cultivate. Nutritionally, catfish contains 12.6–15.6% protein, 1.09–5.8% fat, and 80–85% water [3]. Catfish can be consumed in fresh form or further processed using both traditional and modern methods. Traditional processed catfish products include smoked catfish and fried catfish, while modern processing produces value-added products such as crackers, shredded fish, meatballs, jam, nuggets, and fillets. These characteristics indicate that catfish has strong potential for sustainable development through value-added processing, creating business opportunities for micro, small, and medium enterprises (MSMEs) [4, 5].

MSMEs are individual business entities classified as small-scale enterprises, typically characterised by limitations in sales turnover, total assets, and labour absorption. The technology used by MSMEs is generally still simple, with limited adoption of modern processing technologies [6-9]. According to the East Java Provincial Office of Cooperatives and MSMEs in 2018, the food processing sector comprised 356,047 business units, indicating continued growth. In Pasuruan Regency alone, 9,781 MSMEs operate in the fish processing sector, indicating rapid growth in the industry.

Porter's value chain conceptualises the firm as a configuration of interrelated activities through which inputs are transformed into outputs that create value for customers, emphasising that competitive advantage arises not from the firm but from how specific activities are performed and coordinated. Within this activity-based framework, value chain analysis serves as a strategic diagnostic tool to examine how primary and support activities shape cost behavior, differentiation potential, and margin formation. Value is

defined as the amount buyers are willing to pay, and a firm achieves superior performance when the value generated by its activities exceeds its total costs. Accordingly, the value chain provides a coherent analytical basis for linking internal activity configurations to competitive outcomes and economic performance, particularly in small-scale enterprises where efficiency and strategic integration of activities are critical [10, 11].

In Porter's value chain framework, value activities are classified into primary and support activities. Primary activities are directly related to product creation and delivery, including inbound logistics, operations, outbound logistics, marketing and sales, and services. Inbound logistics involve receiving, storing, and distributing inputs, while operations encompass processes that transform inputs into final products. Outbound logistics involve product handling, storage, and distribution to buyers, whereas marketing and sales focus on promotion, sales management, and relationships with distribution channels. Service activities aim to enhance or maintain product value through after-sales support and customer assistance. Support activities facilitate the effectiveness of primary activities and include firm infrastructure, human resource management, technology development, and procurement. Firm infrastructure covers general management, planning, finance, accounting, legal affairs, and quality management. Human resource management involves recruiting, training, developing, and compensating employees, while technology development supports innovation and process improvement. Procurement concerns the acquisition of raw materials, inputs, and productive assets required across the value chain [10, 12].

Although value chain analysis was originally developed in industrial strategy, recent studies have demonstrated its applicability to small-scale fisheries. Empirical research shows that value chain frameworks can be used to map how primary and support activities influence value addition, market outcomes, and upgrading opportunities in small-scale fishing systems, including processing and distribution stages. For instance, value chain assessment has been applied to small-scale fisheries fleets to understand structural dynamics and stakeholder activity linkages, and to examine how improvements in product design and diversification enhance producer value. Such analyses underline that an activity-based view of internal and inter-actor linkages remains valid for fisheries-based MSMEs, where competitiveness is shaped by efficiency, coordination, and market integration [13, 14].

One MSME processes catfish, generates by-product waste, and uses catfish as its main raw material to produce various processed products. This enterprise has demonstrated significant product innovation, producing up to 29 different products. Previously, catfish was mainly processed into short-shelf-life food products, while by-products were rarely used. To address this issue, the enterprise developed innovations through zero-waste-based processed products, maximizing the use of catfish by-products.

Although MSMEs operate on a relatively small scale and often rely on simple technologies, their business activities can still be systematically decomposed into distinct primary and supporting activities [6, 9]. Like larger firms, MSMEs perform a series of interrelated activities ranging from input procurement and processing to marketing and supporting functions, which collectively determine their cost structure and value creation. In many cases, the limited scale and relatively unstructured nature of these activities make MSMEs particularly suitable objects for value chain analysis to identify inefficiencies and potential sources of competitive advantage [10, 12].

Business sustainability is strongly influenced by a firm's competitive advantage. One method commonly used to analyze competitive advantage is value chain analysis [15]. Among value chain approaches, Porter's value chain model is widely applied. According to Porter [10], in the value chain, a firm is viewed as a series of activities that transform inputs into outputs that create value for customers. Value chain analysis can also serve as a management tool to reduce costs and improve product quality and productivity. In this context, value chain analysis should not be interpreted merely as a mapping of production processes or supply flows, but rather as a strategic, activity-based framework that examines how individual activities contribute to value creation, cost accumulation, and differentiation. By focusing on the configuration and coordination of activities, Porter's value chain enables the identification of strategic points where efficiency improvements or value enhancement can be achieved, ultimately influencing the firm's margin and competitive position [16-18]. In addition, business sustainability can be evaluated through financial feasibility analysis. At the early stage of business development, feasibility analysis is essential to minimise the risk of business failure.

Previous studies on small-scale fish processing enterprises have often examined operational performance or financial outcomes separately. However, integrated analyses that combine activity-based value chain assessment with financial feasibility evaluation remain limited, particularly for zero-waste processing practices in MSMEs. Such an integrated approach is essential to comprehensively understand how internal activities, cost structures, and financial viability jointly influence business sustainability.

In this study, Porter's value chain is employed as an activity-based diagnostic framework to analyse how zero-waste processing practices are embedded within the internal activities of a small-scale catfish processing enterprise. Zero-waste practices are not treated merely as environmental initiatives, but as strategic configurations of activities that influence both cost efficiency and differentiation potential. The use of by-products, integration of processing stages, and diversification of outputs are considered value chain choices that alter cost behaviour and margin formation across primary activities.

To extend the explanatory power of the value chain framework, this study integrates value chain analysis with financial feasibility assessment. While value chain analysis identifies sources of competitive advantage at the activity level, financial feasibility indicators—such as Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period (PP)—capture the economic implications of these activity configurations over time. This integration enables a more comprehensive evaluation of business sustainability by linking internal operational activities to long-term financial viability.

Within this conceptual framework, business sustainability is understood primarily in terms of operational and economic sustainability, with environmentally oriented practices such as zero-waste processing contributing indirectly through efficiency gains, product differentiation, and risk mitigation. By positioning value chain analysis as a diagnostic bridge between operational activities and financial outcomes, this study contributes to the literature by demonstrating how

activity-level strategic choices shape the sustainability prospects of fisheries-based MSMEs.

Based on the above considerations, catfish processing businesses need to be comprehensively analysed to assess their sustainability. Although classified as small-scale enterprises, these businesses demonstrate strong competitiveness through product innovation based on zero waste. Therefore, this study aims to analyse the competitive advantage of a catfish processing business using Porter's value chain analysis and to assess its financial feasibility.

2. RESEARCH METHOD

The research method in this study is descriptive, with a case study approach. According to Nazir, a case study is a research method that focuses on an in-depth analysis of the research subject's conditions. The primary objective of case study research is to provide a detailed description of the background, characteristics, and actual conditions of the object under investigation, thereby enabling comprehensive and context-specific conclusions to be drawn [19]. The research was conducted at an MSME that processes catfish by-products in Pasuruan Regency, Indonesia. Pasuruan Regency was selected as the study area because it has substantial fisheries potential, supported by both capture fisheries and aquaculture activities, which ensure a continuous and diverse supply of raw materials. This condition contributes to the development of fish-processing activities and supports the growth of fisheries-based MSMEs in the region. The selected enterprise was chosen for its ability to utilize by-products from catfish fillet processing, which are typically discarded, and to transform them into various value-added fishery products such as instant noodles, fish balls, crackers, and fish oil. This practice reflects the application of a zero-waste processing approach, where all parts of the raw material are optimally utilized to enhance resource efficiency and generate additional economic value. This characteristic makes the enterprise particularly relevant for examining how by-product utilization contributes to value creation and business sustainability.

Primary data were collected through direct observation, semi-structured interviews, and documentation of the enterprise's operational and financial records. The respondents consisted of the enterprise owner and key personnel directly involved in production and business management, and the collected data were used to map internal activities for value chain analysis and to construct projected cash flows for financial feasibility assessment. Data triangulation was applied by cross-checking information obtained from observations, interviews, and enterprise documents to enhance data reliability and consistency.

The value chain results are presented in a descriptive–diagnostic manner to highlight activity configurations, sources of operational efficiency, and downstream bottlenecks. The value chain refers to a series of activities performed by an organisation to create value for customers [20]. Value chain analysis demonstrates that a firm's competitive advantage does not solely originate from the external market environment, but also from internal organisational and managerial activities [21]. Customer-perceived value generally arises from three main aspects: activities that generate product differentiation, activities that contribute to cost efficiency, and activities that enable firms to respond to customer needs rapidly and accurately [12]. Consequently, company profitability is strongly influenced by the effectiveness of value chain management. The firm's profitability would depend on how effectively it manages various activities along the value chain. Strategies can be developed to focus on activities that will help businesses attain a sustainable competitive advantage [22, 23]. Porter's value chain framework comprises primary and support activities, which together provide a comprehensive perspective for understanding and enhancing competitive advantage.

2.1 Value chain

Value activities are classified into primary and support activities. Primary activities are directly related to product creation and delivery, including inbound logistics, operations, outbound logistics, marketing and sales, and service. Inbound logistics involve receiving, storing, and distributing inputs, while operations encompass processes that transform inputs into final products, including equipment and facility maintenance. Outbound logistics relate to the handling, storage, and distribution of products to buyers. Marketing and sales activities focus on promotion, sales management, and relationships with distribution channels, whereas service activities aim to enhance or maintain product value through after-sales support and customer assistance. The support activities examined in this study include firm infrastructure, human resource management, technology development, and procurement, which support the effectiveness and coordination of primary activities [10]. Within the value chain framework, competitive advantage can be achieved through cost leadership or differentiation strategies. Cost efficiency and differentiation are assessed at the activity level to identify strategic sources of competitive advantage embedded within the firm's value chain [10, 24, 25].

Porter's value chain framework was applied not only to map primary and support activities but also to identify the structural sources of margin along the value chain. In this context, margin refers to the difference between the total value created by the configuration of activities and the cumulative cost of performing those activities; therefore, it serves as a diagnostic tool to explain where and how margin is generated across activities, rather than to quantify its magnitude. The numerical measurement of profit margin is conducted separately through financial feasibility analysis, consistent with value chain research practices that distinguish structural margin formation from financial performance indicators [10, 26].

Within this research design, Porter's value chain is adopted as an activity-based analytical lens to structure the examination of internal business activities at the firm level, allowing the decomposition of organisational activities into strategically significant elements related to cost behaviour and value creation. While the value chain analysis identifies the structural sources of margin across activities, the financial feasibility analysis evaluates whether the resulting profit margin and returns are sufficient to confirm the business's overall feasibility.

Financial feasibility analysis in this study evaluates the enterprise's economic viability by examining its ability to generate returns relative to the capital invested and the costs incurred. The analysis comprises three main components: profitability analysis, investment time-horizon assessment, and sensitivity analysis. Profitability indicators assess the efficiency of capital utilisation and income generation, while investment time-horizon analysis evaluates the period required

to recoup the initial investment and achieve acceptable returns. Sensitivity analysis examines how changes in key cost and revenue parameters affect financial performance. These analytical components are supported by calculations of capital requirements and cost structures, as well as by standard financial appraisal formulas presented in the subsequent sections.

Capital. Capital is the result of production used for further production, with emphasis on the value, purchasing power, or use capacity embedded in capital goods. Capital may take the form of money or physical assets. Based on their duration of circulation, a company's assets are classified as either liquid or fixed. Liquid assets are consumed within a single production cycle and have a short turnover period (generally less than one year), whereas fixed assets are long-lasting assets that are not consumed or are consumed gradually during the production process and have a long turnover period [27].

Cost. Costs are classified as fixed and variable. Fixed costs do not change with the level of output, while variable costs vary proportionally with changes in production volume [27]. Cost analysis employed a value chain–based approach in allocating costs and assets to activities rather than analysing them solely at the aggregate firm level. Cost data were first classified as fixed and variable, then assigned to value chain activities. Cost allocation was conducted based on the direct relationship between each cost component and the activity incurred, enabling identification of cost behaviour at the activity level. Following allocation, the share of costs and assets for each activity was calculated as a percentage of the total.

Revenue. Revenue represents the total income generated by a business over a given period [27].

Profit. profit is defined as the difference between total revenue and total costs incurred by the business. Profit is achieved when total revenue exceeds total costs [28].

Profit Margin. Profit margin was then calculated to express profit as a proportion of total revenue, using the following formula:

$$\text{Profit Margin (\%)} = \left(\frac{\pi}{TR}\right) \times 100 \quad (1)$$

The resulting profit margin represents the proportion of revenue retained after covering all production and operational costs. This indicator was used to complement the value chain analysis by illustrating the extent to which value created through operational and support activities is translated into economic returns.

Revenue Cost Ratio (R/C). R/C is an indicator used to compare total revenue with total costs incurred by a business, thereby reflecting its operational feasibility [17], with formula calculation as follows:

$$R/C\ Ratio = \frac{TR}{TC} \quad (2)$$

Break-Even Point (BEP). The Break-Even Point represents the level at which total revenue equals total costs, resulting in neither profit nor loss. BEP is calculated in terms of sales value and production units [29], with formula calculation as follows:

$$BEP_s = \frac{FC}{1 - \frac{VC}{TR}} \quad (3)$$

Profitability. The Return to Total Capital (RTC) analysis determined the profitability of all resources used in business operations. RTC was then compared to the loan interest set by banks [30, 31]. Business profitability is calculated as follows:

$$RTC = \frac{\pi - UFL}{M}\ x\ 100\% \quad (4)$$

where, *UFL* = Unpaid Family Labor, *M* = Working Capital (IDR).

Net Present Value (NPV). NPV represents the net value obtained by comparing the present value of net cash inflows with the initial investment over a specified period. An investment is considered financially feasible if its NPV is greater than zero [32]. The NPV formula is as follows:

$$NPV = -A_0 + \sum_{t=1}^{n} \frac{A_t}{(1+i)^t} \quad (5)$$

where, A_0 = Investment expenditure in year 0 (IDR), A_t = Net cash inflows in year t (IDR), i = Interest rate (%), n = Economic life of the project (years).

Net Benefit Cost Ratio (Net B/C). Net *B*/*C* is s used to evaluate the efficiency of investment expenditures by comparing the present value of benefits with the present value of costs [33]. Net *B*/*C* is calculated as follows:

$$\frac{B}{C} = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{C_t}{(1+i)^t}} \quad (6)$$

where, B_t = Gross income in year t (IDR), Ct = Gross cost in year t (IDR).

Internal Rate of Return (IRR). IRR is the discount rate at which the net present value of an investment equals zero [17]. IRR is calculated using the following interpolation formula:

$$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2}(i_2 - i_1) \quad (7)$$

where, NPV_1 = Positive NPV (IDR), NPV_2 = Negative NPV (IDR), i_1 = Interest rate when NPV is positive (%), $i2$ = Interest rate when *NPV* is negative (%).

Payback Period (PP). PP represents the length of time required to recover the initial investment from net cash inflows generated by the business [34].

Sensitivity Analysis. Sensitivity analysis examines how changes in key variables affect a business's financial performance and feasibility [29]. Variables that commonly influence investment decisions include production costs, cash flows, balance sheet values, and taxes. In this study, sensitivity analysis is conducted using three scenarios: Scenario I (Increased Costs), Scenario II (Decreased Benefits), and Scenario III (Increased Costs and Decreased Benefits).

The results of these analyses are presented and discussed in the following section to provide an integrated understanding of how value chain configuration and financial performance influence business sustainability.

3. RESULTS AND DISCUSSION

This section presents the results of the value chain analysis,

followed by financial feasibility assessment, allowing a structured interpretation of how operational activities contribute to cost structure, value creation, and overall business sustainability.

Porter's value chain analysis is employed to identify internal business activities that contribute to value creation and margin formation within the firm. The value chain framework emphasises how competitive advantage is generated through the configuration of activities spanning inbound logistics, operations, outbound logistics, marketing and sales, and supporting functions. In this study, value chain analysis is used as a descriptive–diagnostic tool to examine how value is created and costs are structured across primary and support activities, thereby explaining the structural sources of margin before its quantitative assessment through financial feasibility analysis. The mapping of these activities provides the basis for analysing operational efficiency, identifying bottlenecks, and linking value creation to business feasibility, as illustrated in Figure 1. The following section elaborates on each primary activity to provide a more detailed understanding of their roles in value creation and cost formation.

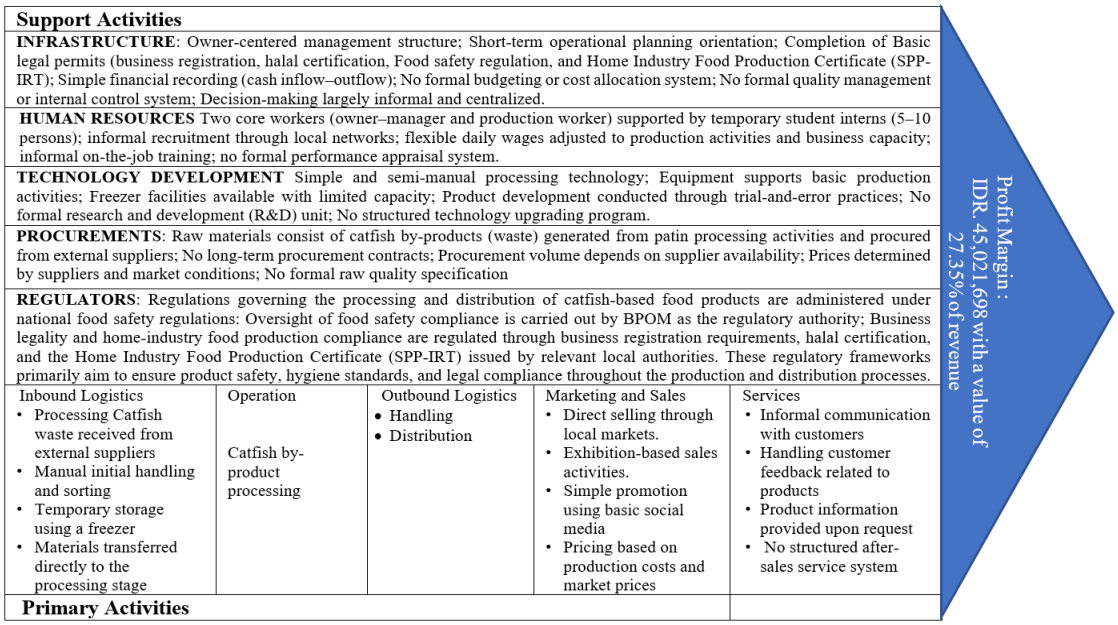

Figure 1. Catfish processing value chain in Pasuruan, Indonesia

Value-Adding Primary Activities

Primary activities in the catfish processing business consist of inbound logistics, operations, outbound logistics, marketing and sales, and services (Figure 1).

Inbound Logistics. Inbound logistics activities begin with the receipt of catfish processing waste from external partners and its delivery to the production site in fresh condition, according to the production schedule. Upon arrival, raw materials undergo basic manual inspection and sorting to separate usable components, such as meat and skin, from impurities and unsuitable parts, ensuring that only appropriate materials enter the production flow. Sorted raw materials are then temporarily stored in freezer facilities to maintain freshness and prevent quality deterioration prior to processing, with storage duration adjusted to avoid prolonged holding periods. Before production commences, raw materials are removed from freezer storage according to planned production batches and transferred directly to the processing stage, without intermediate warehousing. This inbound logistics configuration supports short-term production continuity and minimises spoilage risks; however, it also reflects limited storage capacity and a high dependence on timely scheduling, suggesting that the inbound logistics function primarily serves as an operational support activity rather than a strategic buffer within the value chain.

Operation. Operational activities constitute the core value-adding stage in the catfish by-product processing business, focusing on transforming processing waste into various food products at a home-based production facility. These activities are carried out using a combination of semi-manual processes and basic modern equipment, which remains limited in scale due to capital constraints, resulting in varying production capacity across cycles. Prior to processing, raw materials are removed from freezer storage according to the production schedule and prepared by product type to ensure an efficient production flow. Processing methods vary across products: fried products such as sticks, shredded catfish, and crackers involve seasoning followed by frying, with excess oil reduced to improve product quality; catfish noodles are produced through mixing, dough forming, frying, and baking; while dim sum and catfish meatballs are prepared by mixing ground catfish with spices, shaping, and steaming. Although routine cleaning and basic maintenance are conducted after each production cycle, the absence of standardized operating procedures contributes to inconsistencies in resource utilization and process control. Through these activities, catfish by-products are converted into value-added outputs, reflecting a zero-waste processing approach and confirming operational activities as the primary driver of value creation within the value chain.

The implementation of a zero-waste processing approach not only reflects resource efficiency but also directly contributes to the enterprise's competitiveness and economic sustainability. By utilizing catfish by-products that would otherwise be discarded, the enterprise generates additional value through a diversified product line. This strategy reduces raw material waste, improves cost efficiency, and creates multiple revenue streams. Furthermore, product

diversification enhances market flexibility and reduces dependency on a single product, thereby strengthening business resilience and long-term sustainability. This finding is consistent with the study [35], indicating that circular production practices and effective resource utilization can enhance value creation, operational efficiency, and firm competitiveness.

Outbound Logistics. Outbound logistics activities consist of handling and distribution of finished products. Handling begins immediately after the production process is completed and the products have reached a stable condition. Finished products are allowed to cool before packaging to prevent condensation and deterioration in quality. Packaging is conducted according to product characteristics, using vacuum packaging for dry and semi-dry products and jars or bottles for paste and liquid products. These packaging methods are selected to protect product quality and extend shelf life. After packaging, products are temporarily stored in freezer facilities and display cases to maintain quality prior to delivery, with storage duration adjusted to product type and order schedules.

Distribution activities are carried out directly in accordance with agreements with consumers. Products destined for out-of-town markets are delivered via third-party delivery services, while distribution within the city is handled directly by the business owner on a motorcycle. Distribution arrangements prioritise timely delivery and product condition upon arrival rather than distribution scale. Delivery service costs are charged to consumers and vary by delivery distance. Through this outbound logistics configuration—covering careful handling and direct distribution—the business ensures that processed products reach consumers in acceptable condition.

Marketing and Sales. Marketing and sales activities are primarily conducted through direct selling in local markets and exhibition-based sales events. Direct selling through local markets enables products to be offered to consumers in the surrounding area, supporting routine sales activities and maintaining a regular market presence. In addition, exhibition-based sales activities, particularly MSME bazaars and expos organized by government institutions, serve as an important marketing channel, enabling direct interaction between producers and consumers and allowing consumers to experience products firsthand.

Promotional activities are conducted simply using basic social media platforms. Social media is used mainly to provide product information, announce participation in exhibitions, and facilitate communication with potential customers, rather than as a structured digital marketing tool. This promotional approach supports product recognition without requiring extensive marketing resources.

Pricing decisions are determined based on production costs and prevailing market prices. This pricing approach reflects a cost-oriented marketing strategy aimed at maintaining sales volume and market acceptance rather than maximizing profit margins.

Services. Service activities play a very limited role in the value chain and do not yet contribute to systematic value enhancement. The absence of a structured after-sales service mechanism means that customer interaction remains reactive rather than proactive, reducing opportunities for product improvement and customer retention. This limitation also constrains the enterprise's ability to gather consistent market feedback that could support product differentiation and pricing strategies. Consequently, service activities remain underutilized as a potential source of competitive advantage within the value chain.

In addition to primary activities, support activities play a crucial role in facilitating the efficiency and effectiveness of the overall value chain. These activities provide the necessary organisational, human, technological, and procurement support that enables the smooth execution of core production processes. In the context of this enterprise, support activities are characterised by relatively simple organisational structures, limited technological development, and informal management practices, reflecting the typical conditions of micro-scale businesses. Despite their supporting role, these activities significantly influence cost structure, operational flexibility, and overall business performance.

Support Activities

Support activities are described at the top of the value chain and represent the institutional arrangements that enable the primary activities. Institutions and types of support are according to infrastructure, human resources, technology development, procurement, and regulators.

Firm Infrastructure. Business planning begins with selecting catfish by-products as the primary commodity, reflecting the enterprise's intention to implement a zero-waste processing approach that utilises all parts of the catfish. Production planning is carried out directly by the business owner and is strictly order-based, meaning that production activities are adjusted to existing customer orders without predetermined production targets or inventory stock benchmarks. Marketing and sales planning also remains limited, as promotional activities mainly follow the schedule of MSME exhibitions and events organised by government institutions, without an independent marketing calendar or long-term promotional planning.

Organisational functions are implemented through simple task allocation among workers, while supervision is conducted directly by the business owner, who is actively involved in daily production activities. Financial management is handled using basic financial records that focus on monitoring income and expenses, without the application of formal accounting or budgeting systems. In addition, the enterprise receives substantial support from government institutions in the form of business mentoring, assistance with permits and certifications, and facilitated access to MSME exhibitions, which support operational continuity and market access. This condition is consistent with the limited cost and asset allocation to firm infrastructure shown in Figure 1, where infrastructure activities primarily serve as administrative support rather than as drivers of strategic planning or value creation.

Human Resource Management. Human resource management in the catfish by-product processing business is characterised by informal and flexible labour arrangements. The workforce consists of two core workers, including the owner, who also acts as manager, and one production worker. In addition, temporary support is provided by student interns, typically ranging from 5 to 10 persons, particularly during certain production periods or institutional programmes. Recruitment is conducted informally through local community networks and is not based on specific skill qualifications, as technical knowledge and production procedures are provided directly by the owner through informal on-the-job training. This approach allows workers and interns to adapt quickly to production activities without formal training programmes.

Labour roles are primarily concentrated on supporting production processes. Core workers are involved in daily

production activities with an average working time of approximately eight hours per day, while interns provide additional assistance as needed. Compensation is provided in the form of daily wages, adjusted according to production intensity and the enterprise's financial capacity, rather than through a fixed salary system. The business does not use a formal performance appraisal mechanism; instead, work performance is monitored informally through direct supervision by the owner during production. While this arrangement enables flexibility and immediate operational control, it reflects the absence of structured human resource planning and performance management.

Technology Development. Information technology in the business is limited to smartphones for receiving orders and communicating with customers, including handling feedback and complaints. Digital tools are not used for structured production planning, inventory management, or marketing analytics, indicating that information technology does not yet support systematic managerial decision-making. Production technology relies on a combination of semi-modern machinery and household-scale equipment to support daily processing activities. This configuration reflects a semi-manual production system appropriate for small-scale operations but constrained by limited capital availability. Some production tools and machinery have been obtained with assistance from government agencies and academic institutions, while knowledge of production methods and equipment operation is primarily acquired through experiential learning and occasional training. Technology utilisation is therefore oriented toward meeting immediate operational needs, with limited scope for process standardisation and technological upgrading.

Procurement. Procurement activities in the catfish by-product processing business are limited to the acquisition of production equipment and sourcing raw materials for daily operations. Equipment procurement is conducted on a needs-based basis, primarily when existing tools are damaged and no longer function effectively. There is no scheduled replacement plan or periodic investment in new machinery, reflecting the enterprise's limited production scale and financial capacity. The main raw materials, namely catfish by-products, are sourced from three suppliers engaged in catfish fillet processing. Supplier selection is based on their ability to provide raw materials continuously and in quantities aligned with production requirements, as supply interruptions directly affect production schedules. Supporting materials, including spices and auxiliary inputs, are sourced from nearby markets, enabling flexible purchasing and short procurement lead times. Relationships with raw material suppliers established since 2018 are maintained through informal arrangements based on trust and repeated transactions rather than formal contracts.

At the value chain level, the analysis of primary and support activities indicates that the enterprise's value creation mechanism is predominantly cost-driven rather than market-driven. The limited contribution of marketing and service activities constrains pricing flexibility and revenue stability, particularly under a cost-based pricing approach and reliance on government-facilitated promotional channels. Similarly, the relatively low cost and asset allocation associated with regulatory and support activities reflect substantial dependence on external support from government and academic institutions. These conditions suggest that improvements in value chain performance are more closely related to better coordination and balancing of existing activities than to structural expansion, with implications for the enterprise's long-term economic sustainability.

Following the value chain analysis, financial calculations are performed to quantify the economic outcomes of the observed activity configuration. Cost and revenue data are used to calculate cost structure, profit margin, and financial feasibility indicators to assess the business's economic performance.

The financial analysis begins with an examination of the capital structure, which represents the initial investment required to support production and operational activities. Capital components include expenditures for processing equipment and supporting facilities that form the basis for calculating fixed costs and depreciation. The composition and value of capital investment used in this study are presented in Table 1, which serves as the foundation for subsequent cost structure, profit margin, and financial feasibility calculations.

Table 1. Capital in business processing catfish products for 1 year

No.	Description	Amount (IDR)
1	Processing machinery	44,693,800
2	Supporting equipment and utensils	8,016,200
3	Packaging and sealing equipment	1,670,800
4	Cold storage and display facilities	5,150,000
5	Transportation equipment	20,000,000
6	Information technology equipment	15,000,000
7	Building and land	270,000,000
	Total	364,530,800

The MSME's capital structure in Table 1, indicates that asset allocation is predominantly in primary value chain activities (Figure 1), with the operations stage accounting for the biggest share of total assets. Fixed assets are mainly allocated to operational activities (43.27%), followed by outbound logistics (14.94%) and marketing and sales (2.89%), while inbound logistics and services each account for a relatively small proportion (0.34%). A similar pattern is observed for liquid assets, where operational activities dominate (27.56%), followed by outbound logistics (4.49%), marketing and sales (1.05%), and inbound logistics (1.00%), with services remaining negligible due to the absence of a structured after-sales system. Support activities account for a limited share of assets, including firm infrastructure (1.03%), human resource management, technological development, and procurement (each 0.69%), and regulatory-related activities (1.00%). Furthermore, this section presents the MSME's cost structure, classified into fixed and variable costs. The detailed cost composition is shown in the following Table 2.

The total costs presented in Table 2 serve as the basis for assessing cost contributions across value chain activities. Cost components are allocated to primary and support activities based on where they occur in the production process, enabling activity-level cost contributions to be evaluated relative to total operating costs. The distribution of operating costs across the value chain (Figure 1) indicates that operational activities account for the dominant share of costs. Within operations, purchased operating inputs account for 32.87% of total costs, while human resource costs contribute 33.83%, confirming that production processes are both input- and labour-intensive and constitute the main cost driver of the enterprise. Outbound logistics represents the second-largest cost component, driven primarily by purchased operating inputs related to packaging and distribution (16.69%), compared with human resource

costs (6.34%). In contrast, inbound logistics and services each account for only 0.50% of total costs, reflecting minimal expenditure due to the use of processing byproducts and the absence of a structured after-sales service system. Marketing and sales activities also absorb a relatively small share of costs, with purchased input and labour accounting for 2.34% and 2.11%, respectively, consistent with simple promotional practices. Support activities contribute modestly to overall costs, including firm infrastructure (1.50%) and human resource management, technological development, and procurement (each 1.00%).

Table 2. Total cost in business processing catfish products for 1 year

No.	Description	Amount (IDR)
	Fixed Costs	
1	Depreciation	16,843,582
2	Promotion Expenses	2,400,000
3	Labour Costs (Permanent and Daily Workers)	49,440,000
	Total Fixed Cost	**68,683,582**
	Variable Costs	12,996,000
1	Utilities (Electricity, Water, Gas)	16,380,000
2	Raw Materials (Catfish By-products)	15,774,720
3	Packaging Materials	5,814,000
	Total Variable Cost	**50,934,720**
	Total Cost	**119,618,302**

Overall, the combined distribution of assets and costs across the value chain confirms that operational activities are the central driver of value creation in the enterprise. The concentration of resources in production reflects the processing-oriented, labour-intensive nature of catfish by-product utilisation, where efficiency and operational continuity are prioritised. Meanwhile, the relatively small allocation of assets and costs to regulatory, marketing, and service activities indicates that these functions do not impose significant financial burdens, partly due to government-facilitated licensing, certification, promotional support, and contributions from student interns and externally supported equipment.

Fishery business income is the total product value of a business within a certain period [31]. The revenue structure by product, as presented in Table 3, shows the revenue per product from the MSMEs that have stable sales in one year.

Table 3 shows that crackers are the most demanded product in the Catfish MSME value chain, with salted egg crackers recording the highest sales volume. Dim sum and meatballs follow moderate demand, indicating a relatively balanced contribution across processed products. This revenue distribution suggests that product processing adds value. Based on the revenue composition presented in Table 3, a financial analysis is conducted to evaluate the business's cost structure, profitability, and financial feasibility. This analysis provides a quantitative basis for assessing whether the observed product sales performance is sufficient to support business sustainability and operational continuity, as shown in Table 4.

Table 3. Revenue of the business processing catfish products in 1 year

No.	Product	Amount (IDR)
1	Cracker 50g	17,340,000
2	Cracker Salted Egg 50g	32,400,000
3	Raw Crackers 250g	40,800,000
4	Shredded 100g	15,600,000
5	Stick 50g	14.400,000
6	Noodles 100g	11,700,000
7	Dim sum 200g	18,000,000
8	Meatballs 200g	14,400,000
	Total (IDR)	164,640,000

Table 4. Profitability analysis and financial feasibility in the business processing of catfish products

Analysis	Unit	Amount
Profitability Analysis		
BEPsales	IDR.	99,450,658
Profit	IDR.	45,021,698
R/C		1.38
Return To Total Capital	%	17.57
Financial Feasibility of df 5% in 10 years		
NPV	IDR.	68,001,876
Net B/C		1.19
IRR	%	9.84
PP	Year	6.25

Based on the results presented in Table 4, it can be explained as follows:

1) In the profitability analysis, the minimum sales are BEP sales to get the break-even point of IDR 99,450,658, divided according to the product type. The business records a net profit of IDR 45,021,698, with an R/C ratio of 1.38 (> 1), indicating that total revenue exceeds total costs. The 27.35% profit margin (Figure 1) reflects the proportion of revenue retained after covering production costs throughout the value chain, particularly at the processing stage. The RTC of 17.57% (> 6%) indicates that the business can recover its invested capital at a relatively adequate level under the observed conditions.

2) In the financial feasibility analysis, the NPV value is IDR 68,001,876. The Net B/C value is 1.19 (> 1), which means that in the long term, this business is feasible, while the Internal Rate Return value is 9.84% (> 6%), which means that the MSME's ability to return capital in the long term is relatively adequate. From the Net B/C and IRR values, this business can continue with an estimated PP of 6.25 years.

Table 5. Sensitivity analysis of business processing catfish products

No.	Assumptions	(%)	NPV (IDR)	Net B/C	IRR (%)
1.	Increased Costs	9.5	-90,293,692	0.9	5.7
2.	Decreased Benefits	6	-90,932,899	0.9	5.7
3.	Increased Costs Decreased Benefits	6 8	-60,332,098	0.8	1.4

Market price fluctuations make businesses more prone to cost changes in costs. Therefore, that needs to be done to analyze sensitivity and know how sensitive the business is to change. Sensitivity analysis was performed using three scenario conditions, as presented in Table 5.

Sensitivity analysis was used to evaluate the impact on the business by predicting possible optimistic and pessimistic conditions [36]. It can be seen from Table 5 that the results of the sensitivity analysis on the business show that it is known:

1. Scenario 1, on the assumption of increased costs and fixed benefits, shows that a 9.5% increase in operating costs leads to financial infeasibility, as indicated by a negative NPV and an IRR below the discount rate. This condition is primarily driven by the enterprise's cost structure, where operational activities account for approximately 66.7% of total costs. Since production-related expenses, including raw materials and processing inputs, dominate the cost composition, even a slight increase in costs significantly reduces profitability. This indicates that the business operates with a relatively narrow margin and high dependency on operational efficiency. This finding is consistent with the study [37], indicating that cost components such as labor and operating expenses significantly influence the financial performance of small-scale enterprises. Therefore, improving cost efficiency becomes essential, particularly through optimizing raw material utilization, reducing production waste, and enhancing process efficiency.
2. Scenario 2, on the assumption of fixed costs and decreased benefits, shows that a 6% decrease in benefits results in an unviable financial condition. This finding indicates that the business is highly sensitive to revenue declines. This condition arises because the enterprise relies heavily on product sales as its primary source of income, with certain products contributing more to total revenue. As a micro-scale enterprise, the business is highly dependent on market demand, making it more vulnerable to sales fluctuations. In this case, crackers represent the most demanded product and contribute the largest share of total revenue, supported by both high sales volume and relatively higher price levels compared to other products. Therefore, any decline in the demand for this product has a substantial impact on total revenue, while operating costs remain relatively fixed. As a result, reductions in sales directly reduce profitability, indicating that the business is highly dependent on market demand and has limited resilience to demand fluctuations. This result is consistent with the study [38], indicating that sales have a significant effect on the profitability of small and medium enterprises, where higher sales contribute to increased profits, while declines in sales directly reduce profitability. Accordingly, strategies to stabilize and enhance revenue become essential, including diversifying market segments, expanding distribution channels, and strengthening marketing efforts to maintain sales volume and reduce dependency on a single dominant product.
3. Scenario 3, assuming increased costs (6%) and decreased benefits (8%), the business is not feasible. This shows that the business is highly sensitive when cost increases, and revenue decreases occur simultaneously. This finding highlights the business's high sensitivity to the combined effects of rising costs and declining revenue, where even minor changes can significantly weaken financial performance and indicate low financial resilience. Such a condition is characteristic of micro-scale enterprises, which face significant resource limitations and are therefore more vulnerable to external pressures. Previous study [39] indicated that small businesses are more vulnerable to external shocks due to their limited internal resources and operational capacity. Therefore, adaptive strategies are required to enhance business resilience, including improving operational flexibility, strengthening cost and revenue management simultaneously, and developing more adaptive business strategies to cope with fluctuating conditions.

Based on the three scenarios, the business is highly sensitive, as even small changes in costs or benefits result in an unviable financial condition. The value chain diagnosis indicates that operational activities dominate both asset allocation and the cost structure, reflecting the enterprise's processing-intensive nature. While this concentration supports value creation through diversified zero-waste processing, it also increases financial vulnerability, as the sensitivity analysis confirms. The strong dependence on operational efficiency implies that small fluctuations in input costs or labor expenses can significantly affect overall feasibility.

This condition reflects the characteristics of micro-scale enterprises, which tend to exhibit higher sensitivity and vulnerability due to limited resources and adaptive capacity in responding to changes. Previous studies [40, 41] indicated that firm size plays an important role in determining a firm's ability to respond to adverse conditions, where SMEs face significant limitations due to resource constraints and are therefore more vulnerable in terms of operational flexibility and capacity. Therefore, enhancing adaptive capacity and improving operational and strategic flexibility are essential to strengthen business resilience under changing conditions.

4. CONCLUSION

This study integrates Porter's value chain analysis with financial feasibility assessment to evaluate the sustainability of a zero-waste catfish by-product processing MSME in Pasuruan Regency, Indonesia. The value chain analysis reveals that operational activities represent the highest-value and highest-cost segment, accounting for the largest share of both asset allocation and operating costs. This confirms that the enterprise's competitive advantage is primarily process-based, driven by the integration of zero-waste processing, diversified product transformation, and direct utilisation of catfish by-products. In contrast, inbound logistics and service activities contribute minimally to overall costs, while marketing and regulatory-related activities remain structurally weak and underdeveloped due to heavy reliance on government facilitation and informal business arrangements.

Overall, the financial analysis indicates that the MSME is economically viable but operates within a relatively narrow margin of financial flexibility. Profitability indicators confirm that current operations can generate positive returns, while investment feasibility results indicate that the business

remains financially feasible over the long term under baseline conditions. However, the moderate profitability and sensitivity of financial performance to cost increases and revenue fluctuations suggest that the business's financial sustainability is closely tied to operational efficiency. This implies that the enterprise's financial strength is derived more from maintaining stable production and cost control than from strong, market-driven revenue growth, reflecting the cost-oriented nature of its value chain.

Based on these findings, several strategic implications can be drawn to reduce financial sensitivity and improve long-term performance. Priority should be placed on improving operational efficiency through better production scheduling, energy-use optimization, and more structured cost control at the activity and product levels. In addition, marketing and sales activities need to be strengthened through the adoption of digital marketing strategies and the expansion of distribution channels to improve pricing flexibility and revenue stability, thereby reducing dependence on cost-oriented pricing and government-facilitated promotions. Strengthening coordination with raw material suppliers through more formalised procurement contracts is also essential to ensure input availability and stabilise costs. Furthermore, product differentiation strategies should be developed to reduce reliance on a single dominant product and enhance market competitiveness. Addressing these value chain weaknesses is essential to strengthening financial resilience and sustaining business viability over time.

Despite these contributions, this study has several limitations. First, the analysis is based on a single case study of a micro-scale enterprise, which limits the generalizability of the findings to other contexts or larger-scale industries. Second, the financial feasibility analysis relies on projected and observed data within a specific time frame, which may not fully capture long-term market fluctuations or external economic shocks. Third, the study focuses primarily on internal value chain activities and financial performance, while external factors such as market competition, policy dynamics, and supply chain disruptions are not examined in depth. Therefore, future research is recommended to incorporate comparative studies across multiple enterprises and integrate broader external variables to provide a more comprehensive understanding of sustainability in fisheries-based MSMEs.

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REFERENCES

[1] Prehandoko, D.S., Nurshaleha, D., Eviana, F., Margono, H., Siahaan, J.P., Agustina, N., Gunawan, T.V., Listianingrum, Y. (2025). Standar Data Statistik 2025. https://pusaka.magelangkab.go.id/uploads/publikasi/file/standar-data-statistik-2025.pdf.

[2] Wahidayat, D.I., Suswantari, B.A. (2025). Statistik Perikanan Provinsi Jawa Timur 2024 (Volume 10, 2024). https://jatim.bps.go.id/id/publication/2025/12/19/6e112d5d0dbe7eefbb6478a0/statistik-perikanan-provinsi-jawa-timur-2024.html.

[3] Salam, M.A.M.M., Sutiadiningsih, A., Purwidiani, N., Dewi, I.H.P. (2025). Karakteristik sensori Otak-Otak GreenFish dengan proporsi ikan Patin dan ikan Bandeng dengan penambahan brokoli. Jurnal Multidisiplin Ilmu Akademik, 2(4): 816-827. https://doi.org/10.61722/jmia.v2i4.6166

[4] Maharani, N.P., Purnamasari, P., Nawangsih, I.,Fauziah, S. (2026). Pengembangan umkm ikan Patin berbasis zero waste: Menuju ekonomi sirkular di desa Cipayung. Proficio, 7(1): 542-546.

[5] Intyas, C.A., Handayani, W., Swara, S.E., Adilvy, R.D. (2026). Optimization of productivity in utilizing zero-waste by-products of patin fish (Pangasius hypophthalmus) at the Poklahsar Dadhen Mandiri, Kepanjen, Malang Regency. PengabdianMu: Jurnal Ilmiah Pengabdian kepada Masyarakat, 11(1): 101-108. https://doi.org/10.33084/pengabdianmu.v11i1.10932

[6] Intyas, C.A., Putritamara, J.A., Haryati, N. (2022). Agribusiness Dynamics of the VUCA Era (Volatility, Uncertainty, Complexity, Ambiguity).

[7] Permana, S.H. (2017). Strategi peningkatan usaha mikro, kecil, dan menengah (UMKM) di Indonesia. Aspirasi: Jurnal Masalah-Masalah Sosial, 8(1): 93-103.

[8] Intyas, C.A., Firdaus, M. (2020). Analisis nilai tambah usaha kerupuk ikan cumi di desa Weru, kecamatan Paciran, kabupaten Lamongan. JFMR (Journal of Fisheries and Marine Research), 4(2): 214-221. https://doi.org/10.21776/ub.jfmr.2020.004.02.5

[9] Intyas, C.A., Fattah, M., Nurjannati, T. (2018). Institution's business role to improve smallscale fisherman's household income. Russian Journal of Agricultural and Socio-Economic Sciences, 85(1): 299-303. https://doi.org/10.18551/rjoas.2018-12.38

[10] Porter, M.E. (1998). Competitive Advantage: Creating and Sustaining Superior Performance. New York: The Free Press.

[11] Swara, S.E., Intyas, C.A. (2021). Value chain performance of the three developing Mangrove Ecotourism in East Java. Ecology, Environment and Conservation, 27: 360-365. https://www.envirobiotechjournals.com/issues/article_abstract.php?aid=11848&iid=338&jid=3.

[12] David, F.R. (2011). Strategic Management: Concepts and Cases. New Jersey: Pearson Education, Inc. 13th ed.

[13] Rosales, R.M., Pomeroy, R., Calabio, I.J., Batong, M., et al. (2017). Value chain analysis and small-scale fisheries management. Marine Policy, 83: 11-21. http://dx.doi.org/10.1016/j.marpol.2017.05.023

[14] Di Cintio, A., Scianna, C., Prato, G. (2022). Analysis of small-scale fisheries value chain: An interview-based approach in Italian marine protected areas. Fisheries Research, 252: 106358. https://doi.org/10.1016/j.fishres.2022.106358

[15] Jofre S. (2011). Strategic Management: The theory and practice of strategy in (business) organizations. DTU Management. DTU Management 2011 No. 1. https://orbit.dtu.dk/en/publications/strategic-management-the-theory-and-practice-of-strategy-in-busin/.

[16] Darmawan, A., Bagis, F., Pratama, B.C., Wahjono, S.I., Fakhruddin, I. (2020). Studi Kelayakan Bisnis. UM Purwokerto Press.

[17] Kasmir, Jakfar. (2003). Studi Kelayakan Bisnis. Jakarta:

Prenada Media. https://books.google.co.id/books?id=oQRBDwAAQBAJ&printsec=copyright&hl=id#v=onepage&q&f=false.
[18] Brealey, R.A., Myers, S.C., Allen, F. (2011). Principles of Corporate Finance. McGraw-Hill Education.
[19] Nazir M. (2014). Metode Penelitian. Jakarta: Penerbit Ghalia Indonesia. https://elibrary.bsi.ac.id/readbook/205811/metode-penelitian.
[20] Wilczek, B., Haim, M., Thurman, N. (2024). Transforming the value chain of local journalism with artificial intelligence. AI Magazine, 45(2): 200-211. https://doi.org/10.1002/aaai.12174
[21] Luo, Z., Lin, X., Wu, Y., Zhong, W. (2024). Role of energy value chain in carbon neutrality: A review. Clean Energy Science and Technology, 2(4): 192. https://doi.org/10.18686/cest.v2i4.192
[22] Ong, J.W., Guan Gan Goh, G., Lim, W., Yong, S.H.S. (2024). A winning green profile to stay ahead? Companies' green value chain profiles based on competitive advantage attainment. Sage Open, 14(4), 21582440241291264. https://doi.org/10.1177/21582440241291264
[23] Viljoen, J., Blaauw, D., Schenck, C. (2019). The opportunities and value-adding activities of buy-back centres in South Africa's recycling industry: A value chain analysis. Local Economy, 34(3): 294-315. https://doi.org/10.1177/0269094219851491
[24] Stabell, C.B., Fjeldstad, Ø.D. (1998). Configuring value for competitive advantage: On chains, shops, and networks. Strategic Management Journal, 19(5): 413-437. https://www.jstor.org/stable/3094221
[25] Kiplagat, S.C., Misoi, M., Boit, R. (2025). Porter's generic strategies and performance of insurance companies in the North Rift, Kenya. International Journal of Research and Review, 12(9): 357-577. https://doi.org/10.52403/ijrr.20250938
[26] Darmawan, M.A., Putra, M.P.I.F., Wiguna, B. (2014). Value chain analysis for green productivity improvement in the natural rubber supply chain: A case study. Journal of Cleaner Production, 85: 201-211. http://doi.org/10.1016/j.jclepro.2014.01.098
[27] Riyanto B. (1992). Dasar – Dasar Pembelanjaan Perusahaan. Yogyakarta: BPFE Yogyakarta. https://ugmpress.ugm.ac.id/id/product/ekonomi-bisnis/dasar-dasar-pembelanjaan-perusahaan.
[28] Suradi, A.A.R., Ferawati, A., Musliha, M. (2024). Pengaruh etika bisnis terhadap keuntungan pada usaha mikro kecil dan menengah (UMKM) di Kabupaten Bone. Jurnal Bisnis Digital dan Enterpreneur (BISENTER), 2(2): 199-206.
[29] Intyas, C., Purwanti, P., Tjahjono, A., Fadillah, F.A., Rifaldo, I.S. (2025). The financial feasibility analysis of seaweed product at ora food MSMEs in Yogyakarta. Agromix, 16(2): 266-276. https://doi.org/10.35891/agx.v16i2.6145
[30] Adi, I.C., Agus, T., Mochammmad, F. (2019). Financial feasibility analysis of small-scale fish smoking by fisherman in home industries. Russian Journal of Agricultural and Socio-Economic Sciences, 96(12): 175-181. https://doi.org/10.18551/rjoas.2019-12.22
[31] Soekartawi, D., John, L., Hardaker, J.B. (1986). Ilmu Usahatani dan Penelitian Untuk Pengembengan Petani Kecil. Jakarta: Universitas Indonesia Press.
[32] Chamdhani, M.A., Santoso, H., Sugiharto, F.I., Intyas, C.A. (2025). Financial feasibility analysis of Mutiara Catfish (Clarias sp.) farming using the biofloc method at PT ABAI, Malang, East Java, Indonesia. Egyptian Journal of Aquatic Biology & Fisheries, 29(4). https://doi.org/10.21608/ejabf.2025.437609
[33] Bhokaleba, B.P.P.W., Santoso, H., Intyas, C.A., Arif, M.E., Swara, S.E. (2026). Financial feasibility analysis of the Lemuru (Sardinella lemuru) dried product in Jembrana Regency, Bali, Indonesia. Egyptian Journal of Aquatic Biology and Fisheries, 30(2): 1047-1062. https://doi.org/10.21608/ejabf.2026.459749.7350
[34] Gray, C., Simanjuntak, P., Sabur, L.K., Maspaitella, P.F.L., Varley, R.C.G. (1992). Pengantar Evaluasi Proyek. Gramedia Pustaka Utama. https://books.google.co.id/books/about/Pengantar_Evaluasi_Proyek_Ed2.html?id=KlsYdLc7EEkC&redir_esc=y.
[35] Geissdoerfer, M., Savaget, P., Bocken, N.M., Hultink, E.J. (2017). The circular economy–A new sustainability paradigm? Journal of Cleaner Production, 143: 757-768. http://doi.org/10.1016/j.jclepro.2016.12.048
[36] Oraee, K., Sayadi, A.R., Tavassoli, S.M.M. (2011). Economic evaluation and sensitivity-risk analysis of Zarshuran gold mine project. In SME Annual Meeting, 27. http://hdl.handle.net/1893/3061.
[37] Wijaya, A., Jiuhardi, J., ZA, S.Z., Nurjanana, N., A., E.K. (2023). Determinants on small scale business: An empirical evidence from Indonesia. International Journal of Sustainable Development and Planning, 18(1): 305-314. https://doi.org/10.18280/ijsdp.180132
[38] Aisyah, E.N., Umami, A.K. (2022). Financial factors contribution to SMEs' profitability. Journal of Business and Banking, 12(1): 19-33. https://doi.org/10.14414/jbb.v12i1.2956
[39] Kalutara Koralalage Britto Adikaram, N., Achchi Kankanamge Nadee Sheresha Surangi, H. (2025). Exploring crisis vulnerability of small and medium enterprises (SMEs): Evidence from Sri Lanka's tourism industry. Cogent Business & Management, 12(1): 2547959. https://doi.org/10.1080/23311975.2025.2547959
[40] Isa, M., Praswati, A.N., Zulaekah, S. (2024). Vulnerability analysis: A tool for SMEs' business resilience. IDRiM Journal, 14(2): 157-175. https://doi.org/10.5595/001c.125616
[41] Miklian, J., Hoelscher, K. (2022). SMEs and exogenous shocks: A conceptual literature review and forward research agenda. International Small Business Journal, 40(2): 178-204.