JRSSEM 2026, Vol. 5, No. 10, May
E-ISSN: 2807 - 6311
P-ISSN: 2807 - 6494

Pen: Solution for Food Freshness

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Keywords:
Ice Blocks; Long Nipah Ice Factory; Business Model Creation; Food Freshness; Capture Fisheries

Abstract

This research aims to design and develop a sustainable ice block business model as a solution to the problem of imbalance between the demand and supply of ice blocks in coastal areas, especially in supporting the sustainability of the capture fisheries sector. Ice blocks have a strategic role in maintaining the freshness of fish catches, but in various coastal areas of Indonesia, there are still limitations in production capacity, difficult distribution access, and inflexible purchasing patterns, which have an impact on declining the quality of fishery products and fishermen's income. This study used a qualitative approach with the Business Model Creation method. Data was collected through literature studies, document analysis, field observations, and interviews with business actors and fishing communities. The analysis framework used includes the Empathy Map, Value Proposition Canvas, Business Model Canvas, PESTEL analysis, and Porter's Five Forces to understand market needs, industry dynamics, and the feasibility of the business model developed. The results show that the PEN: Solution for Food Freshness business model offers key values in the form of stable ice availability, production and distribution efficiency, and support for food quality and safety. This model is expected to increase the competitiveness of ice businesses, have a positive impact on the local economy and fisheries sustainability. Further research is needed to compile financial projections, renewable energy applications, and social and environmental impact measurements.

INTRODUCTION

Indonesia is an archipelagic country that has great potential from the fisheries sector. In relation to fisheries, in Indonesia it is categorized into two types, namely the first is aquaculture and the second is capture fisheries (Halim et al., 2019; Suherman et al., 2025). Between the two, capture fisheries have greater potential. The Food and Agriculture Organization of the United Nations (FAO) in its annual report entitled The State of World Fisheries and Aquaculture places Indonesia in second place for marine capture fisheries production after China in 2024 (Anthes & De Schutter, 2018). Capture fisheries production in the first semester of 2024 exceeded the target, reaching 111.33% or 3.34 million tons (KPPP, 2024).

The high volume of national capture fisheries production creates a great need for supporting facilities, one of which is ice blocks (Alamsah et al., 2025; Seenivasan et al., 2025). Blocks of ice are large, dense ice that functions for preservation and cooling on a large scale because it lasts longer than regular ice, whether it is in its whole or incomplete form (Michael Freeman, 2023). The role of ice blocks is very strategic in the fisheries supply chain, especially to maintain the quality and freshness of fish catches from the sea to the arrival of consumers (Belton & Bahurmiz, 2026; Puthukkattu Mansoor Ahamed, 2026).

However, the reality on the ground shows different conditions. Based on interviews conducted by researchers with fishermen in Nipah Panjang District, East Tanjung Jabung Regency, Jambi Province on January 8, 2026, it was found that the main problems faced by fishermen are closely related to the limited quality and availability of ice blocks. Fishermen have difficulty maintaining the freshness of their catch because the available ice melts quickly and is unable to maintain storage temperatures for a long time ((BIOHAZ) et al., 2020; Brown & Dave, 2021; Erikson et al., 2021). In addition, the low production capacity of ice blocks in the region causes fishermen to be unable to go to sea for an optimal duration, so that fishing activities are less than optimal.

This condition is exacerbated by the uneven distribution of ice factories throughout Indonesia's coastal areas. Some areas with significant capture fisheries activities still have limited access to the supply of ice blocks, both in terms of distance, production capacity, and continuity of supply (Kimani et al., 2020; Kyule et al., 2025). One of the areas facing these conditions is Nipah Panjang, which although it is known as a coastal area with fairly high capture fisheries activity the total catch in Nipah Panjang in 2022 reached 26,541 tons (Antara, 2023) the availability of ice block factories in this area is still very limited.

This imbalance between the demand and supply of ice blocks has a direct impact on the decline in the quality of catches, reduced fishermen's income, and inhibited distribution of fishery products to the wider market (Macusi et al., 2022; Pomeroy et al., 2016; Vasilyev & Lisunova, 2022). Similar conditions are also found in various other coastal areas such as Anambas, Mentawai Islands, Ende, and Bengkulu. The problem in Anambas, for example, is that the price of ice blocks ranges from 600 to 800 thousand rupiah per ton (Permana, 2022), a cost burden that is very burdensome for fishermen.

Several studies have examined the problem of ice blocks in coastal areas. **First**, Permana (2022) found that the price of ice blocks in Anambas reached IDR 600,000–IDR 800,000 per ton, becoming a burden on fishermen. Rizal et al. (2018) identified that limited access to ice block distribution in coastal areas causes a decrease in fish quality by up to 30% before reaching consumers. Nurcahyo et al. (2023) highlight that the unavailability of stable ice blocks during the peak catch season results in fishermen reducing the duration of their sea use, which has a direct impact on income.

Although these studies have identified the scarcity and price problems of ice blocks, there is still a gap in the absence of an integrated, sustainable, and purpose-built business model based on the Business Model Creation (BMC) approach that combines the Empathy Map, Value Proposition Canvas, PESTEL, and Porter's Five Forces simultaneously. The novelty of this research lies in the development of the PEN: Solution for Food Freshness business model which not only focuses on production aspects, but also on supply stability, distribution efficiency, payment flexibility, and price affordability for fishermen in coastal areas who have not been touched by similar business models so far.

Based on the description above, this study aims to design and develop a sustainable ice block business model through the Business Model Creation approach, with a case study on the Nipah Panjang Ice Factory (PEN) in East Tanjung Jabung Regency, Jambi Province. The business model developed is expected to answer the problem of limited supply of ice blocks while having a positive impact on the local economy and the sustainability of the fisheries sector. The benefits of this research are to provide concrete solutions for fishermen and fishery

entrepreneurs in overcoming the scarcity of ice blocks, enriching the literature on the application *of Business Model Creation* in the capture fisheries sector, as well as supporting the increase of fishermen's income, reducing the damage to catches, and encouraging the sustainability of the fisheries sector in Indonesia's coastal areas.

RESEARCH METHOD

This research used a qualitative approach with the Business Model Creation method. Data were collected in four ways, namely: (1) literature review to examine relevant theories and previous research; (2) document analysis in the form of secondary data from related agencies; (3) field observation in Nipah Panjang District, East Tanjung Jabung Regency; and (4) in-depth interviews with fishery business actors and fishing communities which will be held on January 8, 2026.

The analysis frameworks applied include the Empathy Map and Value Proposition Canvas (VPC) to understand customer needs in depth, PESTEL analysis to map the macro business environment, Porter's Five Forces to analyze the attractiveness of the industry, and the Business Model Canvas to comprehensively design business models. The validity of the data is maintained through source triangulation, which is combining field data, secondary data, and interviews.

RESULTS AND DISCUSSION

Market Analysis and Business Environment

Market Size

Market size is the total number of potential consumers in a given market segment. The author conducted a market analysis using the TAM (Total Available Market), SAM (Served Available Market), and SOM (Share of Market) approaches. Based on data from the Ministry of Maritime Affairs and Fisheries, Indonesia's capture fisheries production will reach 3.34 million tons in the first semester of 2024, so the estimated annual production is estimated to be in the range of 6-7 million tons. Referring to the standard for the use of ice for fish preservation, which is 1 ton of fish requires ±1 ton of ice blocks, the national ice demand is estimated to reach 6 million tons per year. With an average price of Rp 600,000 per ton of ice blocks, the national market value is used as the basis for calculating TAM.

Table 1. TAM, SAM, and SOM Ice Block Business

Indicator	Data Source	Total Value
TAM (Total Available Market)	6,000,000 tons × IDR 600,000/ton	IDR 3,600,000,000,000
SAM (Served Available Market)	250,000 tons × Rp 600,000/ton (5 areas with ice shortages)	IDR 150,000,000,000
SOM (Share of Market)	TAM/SAM	4,1%

Source: Processed from data from KPPP (2024), Permana (2022), and field observations in Anambas, Mentawai, Ende, East Tanjung Jabung, and Bengkulu

To calculate SAM, the author refers to the case study areas that experience a shortage of ice supply, namely Anambas, Mentawai, Ende, East Tanjung Jabung, and Bengkulu. These five regions have a total need for ice blocks of about 250,000 tons per year. Meanwhile, SOM is obtained by comparing TAM and SAM to show the proportion of markets that can be reached by the ice block business in the early stages, which is 4.1% of the total national market.

External Analysis (PESTEL)

The PESTEL analysis was conducted to understand the macro environmental dynamics that affect the ice block business in Indonesia's coastal areas. Here is a summary of the results of the analysis on each dimension:

From the political dimension, the national political situation affects the stability of the prices of raw materials and energy used in the production process of ice blocks, especially electricity, water, and fuel for distribution. The Indonesian government tends to encourage the growth of MSMEs and the food industry, thereby indirectly providing positive support for the ice block business which is widely used by the fisheries sector and the fresh food supply chain.

From the economic dimension, administrative aspects related to business licenses, hygiene certification, and operational standards are important parts of the ice block industry. The government through OSS (Online Single Submission) requires business actors to have a NIB (Business Identification Number) and other operational permits when related to food. Better administrative regulations can improve the professionalism of the ice block industry.

From the social dimension, the need for ice blocks is greatly influenced by people's consumption behavior, especially in the culinary, fisheries, and distribution sectors of fresh foodstuffs. The high consumption of marine products and the increasing activities of culinary MSMEs have created a stable demand for ice blocks. Public understanding of the importance of hygienic ice is starting to increase, which encourages businesses to implement cleaner and more standardized production processes.

From the Technology dimension, technology plays an important role in improving the efficiency of ice block production, including the use of modern ice making machines, energy-saving cooling systems, and cold storage technology. Digitalization in distribution management such as order recording, delivery schedules, and stock monitoring has also begun to be implemented by business actors who want to increase productivity.

From the Environmental dimension, the ice block business is greatly influenced by the availability of clean water and the quality of the surrounding environment. Rising global temperatures and extreme weather may expand the market as the demand for refrigeration products is increasing, but on the other hand, it adds to the operational burden on refrigeration facilities. Large amounts of electricity use is associated with a carbon footprint, so ice block businesses need to consider energy efficiency.

From the legal dimension, the ice block business is included in the category of food businesses so it is mandatory to meet hygiene and health standards according to government regulations. Regulations related to clean water quality, environmental permits, sanitation standards, and business licenses through OSS are legal bases that need to be met. Overall, PESTEL's analysis shows that the ice block business has great opportunities driven by economic growth, stable market demand, and increasingly modern technological developments.

Industry Analysis (Porter's Five Forces)

The authors use Porter's Five Forces to identify the position of PEN's business model in the industry, by analyzing and anticipating potential threats and opportunities (Porter, 2008).

First, Threat of New Entrants is in the Moderate category. There are several obstacles that make the threat level of new entrants in the moderate category, including the need for initial capital to buy ice makers, high electricity costs, and the need for access to clean water supply. The ice block business also requires adequate cold storage infrastructure and distribution vehicles.

Second, Threat of Substitute Products is in the Low category. Substitute products for ice blocks are relatively very limited. The use of portable refrigerators or modern freezers cannot completely replace the function of ice blocks in maintaining the freshness of fish, foodstuffs, and large-scale trade activities. For fisheries, restaurants, and the culinary sector, ice blocks are still the main choice due to their large cooling capacity and affordable price.

Third, the Bargaining Power of Buyers is in the Moderate category. Ice block consumers such as fishermen, fish traders, culinary MSMEs, and distributors have several choices of ice block providers in certain areas. However, in many coastal areas and traditional markets, the number of ice block producers is still limited so consumers do not have many alternatives. The quality of the ice blocks and the speed of distribution greatly influence the buyer's decision.

Fourth, the Bargaining Power of Suppliers is in the Low category. The main suppliers in the ice block industry are the providers of clean water, electricity, as well as fuel for distribution transportation. Since water and electricity are common commodities that are widely available, the power of suppliers tends to be low. No single supplier has complete control over the main raw materials.

Fifth, Rivalry Among Existing Competitors is in the Moderate category. Competition between ice block producers is in the moderate category. In some areas there are many local ice block manufacturers that offer competitive prices. However, the differentiation between competitor services is relatively low because the ice block products are essentially the same. Competition lies more in the factors of price, speed of delivery, ice quality, and availability of supply, especially during the fishing season.

The conclusion of Porter's Five Forces analysis shows that the majority of components are in the moderate to low category, which indicates that the ice block industry is a relatively stable and viable industry. The threat of low substitution products and small supplier bargaining power provide a strong enough position for new business actors.

Value Proposition Canvas

Customer Jobs, Pains, and Gains

The Value Proposition Canvas was developed by Dr. Alexander Osterwalder in 2014 as a strategic framework that aims to align a product or service with customer needs and values in depth. The author uses this approach to understand customers in depth and ensure the suitability of PEN's products and services to the market.

Customer jobs in the ice block business are mainly the need for fishermen to get ice quickly, easily, and at an affordable price so that the fish stay fresh during the journey from sea to land. They need a stable supply of ice, especially during the high season, a close factory location to save time and costs, and good quality ice so that the catch is not damaged. Collectors and MSMEs also need ice for daily storage and operations.

From Pain's side, fishermen often struggle due to unstable ice stocks, especially during the fishing season when demand increases sharply. They have to travel long distances to get ice, thus costing additional time and fuel costs. The price of ice, which often rises during the high season, makes operational costs even heavier.

From the Gain side, customers, especially fishermen, want a stable and always available supply of ice, so they don't have to worry about shortages during the fishing season. They want consistent and affordable prices, as well as a close factory location to save more time and fuel. Fishermen also hope to get hygienic, hard, and durable ice, so that the fish stays fresh longer and the selling value increases.

Pain Relievers and Gain Creators

As Pain Relievers, the Long Nipah Ice Factory (PEN) addresses the complaints of fishermen by providing large and stable ice production, so that stock is always available even during the high season. The plant's location near the port helps reduce diesel costs and travel time for fishermen. Stable prices throughout the year are also one of the main pain relievers that PEN offers to its customers.

As Gain Creators, PEN provides an added advantage by providing more durable and high-quality ice, so that the fish stays fresh longer and the selling value increases. Fast and modern production provides certainty of supply, making fishermen feel calmer during the high season. The provision of services such as delivery to the dock, choice of ice types (block, crushed, flake), and digital ordering systems make the customer experience easier and more efficient.

Table 2. PEN Consumer Pain Points and Gains Matrix

Yes	Consumers	Bread Points	Earnings
1	Fishermen Catch Fish	Ice scarcity during the catch season. The quality of fish is rapidly declining. The selling price of fish is low.	The freshness of the fish is maintained. The selling price is higher. Certainty of ice supply.
2	Fish Traders & Collectors	Risk of damaged fish. Losses due to unstable supply. Distriution is disrupted.	The quality of the fish is still worth selling. Smooth distribution. The risk of loss is reduced.
3	Culinary Businesses & Seafood MSMEs	The quality of raw materials decreased. Food safety risks. The reputation of the business is compromised.	Fresh raw materials. Food safety is maintained. Customer trust increases.

Source: Interviews with fishermen and fish traders in Nipah Panjang (Jan 8, 2026), processed with VPC (Osterwalder et al., 2010)

Business Model Canvas Pen

Customer Segments

The segmentation of PEN's business model serves various customer groups with different needs, especially local fishermen in TPI who need ice every day to maintain the freshness of fish. Mobile fish traders and people's markets are also important customers because they

require a medium amount of ice. Seafood collecting agents require a large and regular supply, while small to medium-scale seafood restaurants require ice for the storage of fresh ingredients. In addition, the F&B sector uses ice crystals for beverage and serving needs.

Value Proposals

The PEN ice factory offers the main value in the form of strong, dense, and durable ice blocks, making it suitable for keeping marine produce fresh. Hygienic ice crystals are also an added value for F&B customers and beverage stalls. The use of stable and competitive prices throughout the year gives confidence to customers, especially fishermen. The business also provides direct delivery to customers' locations and provides flexible subscription options that make it easy for them to get their regular supply of ice.

Channels

Although for the current reality, PEN does not require a specific channel, but in its development, there are several potential channels that PEN will use. First, social media to reach customer segmentation and as a marketing tool for service services. Second, the Website that can be accessed by customers, displays the purpose of the business and the services available. Third, the Mobile Application which aims to make it easier for customers to access and reach services, including digital ordering features, pick-up services, and reward redemption for loyal customers.

Revenue Streams

In the PEN business model, customer payment patterns are differentiated based on the type of customer segment, namely Business to Business (B2B) and Business to Consumer (B2C). In the B2B segment, customers are business actors such as fish traders, seafood collectors, or fishery distributors who buy large quantities of ice blocks on a regular basis. Payment patterns in this segment generally use a tempo payment system or periodic payments through bank transfers or other non-cash payment methods.

Meanwhile, in the B2C segment, customers are individual consumers such as fishermen or direct buyers who buy relatively smaller quantities of ice blocks. The payment pattern in this segment is generally carried out directly at the time of the transaction, either through cash payments or transfers. With these differences in payment patterns, the PEN business can adjust its service strategy to each customer segment while maintaining the company's smooth cash flow.

Key Activities, Key Resources, and Key Partners

PEN's Key Activities focus on three main areas: the production of large quantities and quality ice blocks, the management of direct distribution to customers, and the development of cooperation with investors, sales channels, and technology vendors. Meanwhile, Key Resources includes capital from investors, plant and production machinery facilities, local workforce, as well as market data collected through surveys, direct observations, and data analysis.

PEN's Key Partners include investors as financial capital providers, local governments as policy and regulatory partners, fishermen's cooperatives as distribution partners, and technology vendors to support the development of digital systems. With this strategic combination of partnerships, PEN is expected to optimize its business model, reduce operational risks, and acquire the resources it needs.

Cost Structure

The cost structure of PEN's business model is dominated by several main components: (1) Operational Costs, which are all costs needed for the organization's operations to run properly; (2) Employee Salary, which is compensation for employees who carry out daily business activities; (3) Cost of Purchase of Operational Support Equipment, including necessary hardware and software; and (4) Warehouse and Office Rental Fees as product development and storage places.

Segmentation, Targeting, and Positioning

Market Segmentation

STP (Segmentation, Targeting, Positioning) analysis is useful for marketing communication planning because it can help businesses prioritize value propositions. The PEN market segmentation is divided into two main groups based on the Needs-Based Segmentation approach, namely: (1) Ice Block Buyers in the fisheries sector (B2B), and (2) Non-fisher Ice Block Consumer Community (B2C).

The B2B segment includes fishermen, fish collectors, fish traders, and fishery business actors based in the Nipah Panjang area with an age range of 25–55 years and an income of IDR 5,000,000–IDR 50,000,000 per month. They use ice blocks intensively and regularly every day, especially during the fishing season. The B2C segment includes beverage traders, seafood sellers, culinary MSMEs, and households with an age range of 20–50 years and an income of IDR 2,000,000–IDR 20,000,000 per month.

Targeting

Based on the market segmentation that has been carried out, the main target market of PEN: Solution for Food Freshness is fishery business actors in coastal areas, especially fishermen, seafood collectors, and fish traders in areas that experience limited supply of ice blocks such as Anambas, Mentawai Islands, East Tanjung Jabung, Ende, and Bengkulu. This segment has a high level of dependence on the availability of ice blocks to maintain the freshness of marine catches and minimize economic losses.

Positioning

To determine the position of PEN's business model, the author uses perceptual map as an analysis tool to compare PEN with similar competitors, namely Agronesia and PMP Group's Ice Factory. Based on the results of the mapping based on two variables (flexibility of service innovation and completeness of service features), PEN occupies a position in the upper right quadrant, which indicates a high level of innovation flexibility and a wide range of service feature completeness compared to competitors.

This position reflects PEN's excellence in adaptability to market needs, both in terms of the quality of ice block production, supply continuity, and the development of services that support the needs of fishermen and fishery business actors. Thus, PEN positions itself as a leading ice block factory that not only prioritizes product quality, but also service innovation and a more comprehensive distribution system.

Marketing Strategy

PEN implements five complementary marketing strategies. First, Relationship Marketing emphasizes the development of personal relationships between PEN and key customers through direct communication and active involvement of factory managers in port activities. Second, Word of Mouth Marketing relies on recommendations from fellow fishermen or

community leaders who are considered more trusted than formal promotions.

Third, On-Site Marketing is carried out by strengthening PEN's visual and operational presence at ports and fish unloading sites through the installation of signage, the provision of price information, and the use of distribution vehicles with the PEN logo. Fourth, Service-Based Marketing makes service quality the main promotional tool by ensuring timely distribution and payment flexibility. Fifth, Community-Based Marketing actively involves PEN in the social and economic activities of the fishing community to build long-term customer loyalty.

Financial Feasibility and Production Simulation

Production Capacity Simulation

The PEN production capacity simulation is compiled based on realistic operational assumptions and is commonly applied to medium-scale block ice mills. The basic assumptions used are the production of commercial ice blocks weighing 20 kg per block, a production capacity of 600 blocks per day, one production cycle per day, 30 operational days per month, and a 100% machine utilization rate for the initial simulation.

Table 3. PEN Production Capacity Calculation

About	Calculation	Results
Daily Production	600 beams × 20 kg	12 tons/day
Monthly Production (blocks)	600 blocks × 30 days	18,000 blocks/month
Monthly Production (weight)	12 tons × 30 days	360 tons/month
Annual Production	360 tons × 12 months	4,320 tons/year

Source: Simulation based on 600 blocks/day (20 kg/block), 30 days/month (Freeman, 2023)

Financial Projections

PEN's financial projections are prepared based on the assumption that the selling price of ice blocks is IDR 30,000 per block (20 kg) and variable costs per block of IDR 18,000, with a monthly fixed cost of IDR 25,000,000.

Table 4. PEN Financial Projections

Components	Per Day	Per Month	Per Year
Revenue	IDR 18,000,000	IDR 540,000,000	IDR 6,480,000,000
Variable Costs	IDR 10,800,000	IDR 324,000,000	IDR 3,888,000,000
Gross Profit	IDR 7,200,000	IDR 216,000,000	IDR 2,592,000,000
Fixed Fees	-	IDR 25,000,000	IDR 300,000,000
Net Profit (EBIT)	-	IDR 191,000,000	IDR 2,292,000,000

Source: Calculated from selling price IDR 30,000/block, variable cost IDR 18,000/block, fixed cost IDR 25 M/month

Estimated Initial Investment (CAPEX)

For an ice plant with a capacity of 12 tons per day (equivalent to 600 blocks), the estimated construction cost includes: Ice Plant Machine with a capacity of 12 tons/day complete with cold storage of IDR 2,000,000,000, 100–200 m² semi-permanent building/warehouse of IDR 300,000,000, ice block units (molds) and forklifts of IDR 100,000,000, electricity and water installations of IDR 100,000,000, and initial working capital (3 months of operation) of IDR 573,000,000. The total estimated initial investment is IDR 3,073,000,000 (Three Billion Seventy-Three Million Rupiah).

Investment Feasibility Analysis

Based on financial projections, PEN's investment feasibility analysis shows positive results. Annual Return on Investment (ROI) is calculated as follows: ROI = (Annual Net Profit / Total Investment) × 100% = (IDR 2,292,000,000 / IDR 3,073,000,000) × 100% = 74.6%. These results show that under optimal operational conditions, the PEN business has the ability to generate a high return on investment.

Payback Period (breakback time) is calculated as follows: (IDR 3,073,000,000 / IDR 2,292,000,000) × 12 = 16.1 months (approximately 1 year and 4 months). The sensitivity simulation at 70% utilization still produces a net profit of IDR 126,200,000 per month with a payback period of around 24.3 months (2 years). From the aspect of business safety, the break-even point only requires 2,084 blocks per month, or only 11.6% of production capacity, which means that PEN's business safety margin is very high reaching 88.4%.

Product Price Comparison

Table 5. Comparison of Ice Block Products

Yes	Manufacturers	Type of Ice	Weight	Pricing	Remarks
1	PMP Group Ice Factory	Ice Crystal	10 kg	IDR 15,999 – IDR 18,999	Market price of hygienic ice crystal packaging
2	PMP Group Ice Factory	Ice Crystal	20 kg	IDR27,000 – IDR28,755	Used for general consumption
3	PT Agronesia Saripetojo	Ice Beam	20–25 kg	IDR 30,000/unit	Prices vary by location
4	PEN (Long Nipah Ice Factory)	Ice Beam	20 kg	IDR 17,000/unit	Fishermen and fresh fish focus

Source: Market survey (Jan 2026) from PMP Group, PT Agronesia, and PEN pricing strategy

Based on the comparison table above, the price of PEN ice blocks (±Rp17,000 per 20 kg) is below the market price of ice blocks from large-scale producers such as PT Agronesia Saripetojo which reaches ±Rp30,000 per unit. By focusing on the use of ice as a guardian of the freshness of fish catches, durable ice quality, and hygienic production processes using clean water, PEN offers higher value for money for the coastal fisheries market segment.

Risk Management and Exit Strategy

Identify Business Risks

Every business model has potential risks that need to be anticipated and mitigated. In the PEN business, there are several main risk categories that need to be considered. Operational risks include machine breakdowns that can stop production, fluctuations in electrical voltage (brownout/blackout) that affect the production process, and raw water quality problems. Market Risk includes unstable seasonal demand (seasonality) and the risk of billing failure (bad receivables) from B2B customers. Financial risks include rising electricity tariffs which are the largest component of production costs and high fixed overheads. Meanwhile, External Risks include natural disasters and abrasions relevant to coastal locations, as well as regulatory risks and regional levies.

Competitor Risk Mitigation

Competitor risk is a risk that arises due to competition with similar businesses that offer similar products. To mitigate these risks, PEN implements several strategies: building a strong brand image through consistent product quality; maintain good relationships with customers by providing responsive and timely service; set competitive prices and in accordance with the quality of the product; to innovate and develop businesses regularly; as well as expanding the marketing network and cooperation with new customers.

Exit Strategy

In building a business, it is important for business owners to consider the worst possible future. PEN needs to have an exit strategy as an anticipatory step to minimize losses and maintain business value.

The first strategy is business selling to investors or other parties who are interested in continuing business operations. This can be done if the business has grown and has attractive economic value. The second strategy is a strategic partnership with other companies engaged in the fisheries sector or the distribution of marine products to expand the scale of the business. The third strategy is business liquidation, which is selling the company's assets if the business can no longer run profitably. With a clear exit strategy, PEN's business has more careful planning in dealing with various possible conditions in the future.

CONCLUSION

Based on all the results of the analysis carried out using various approaches in Business Model Creation, this study produced several main conclusions. First, the results of the analysis of customer needs using the Empathy Map and Value Proposition Canvas (VPC) show that fishermen need a stable, quality, and easily accessible supply of ice near ports or fish landing sites. PEN's business model is designed to address these needs by providing hygienic, durable ice block production and more efficient distribution services. Second, based on market analysis using the TAM, SAM, and SOM approaches, the market potential for ice blocks in the fisheries sector is still very large, especially in coastal areas that experience a shortage of ice supply. TAM reaches IDR 3.6 trillion per year with SAM of IDR 150 billion and SOM of 4.1%, showing that business opportunities in the ice block industry are still wide open. Third, the results of the business environment analysis through PESTEL and Porter's Five Forces show that the ice block industry has a high level of attractiveness. The threat of product substitution and supplier strength is relatively low, while the level of competition is still at a moderate level

so it still provides opportunities for new business actors to enter and develop in this industry. Fourth, through the design of the Business Model Canvas (BMC), PEN's business model is designed with a focus on the customer segment of fishermen and fishery business actors, with the main value proposition in the form of stable ice supply availability, hygienic product quality, competitive prices (Rp17,000 per 20 kg), and a distribution system that is closer to customers. Fifth, from the financial aspect, the results of the analysis show that PEN's business model has the potential to be run sustainably with an ROI of 74.6%, a Payback Period of 16.1 months, and a Safety Margin of 88.4%. The projected annual net profit reaches IDR 2,292,000,000 with a total initial investment of IDR 3,073,000,000. Based on all the results of the analysis, it can be concluded that the PEN: Solution for Food Freshness business model is able to be a solution to the problem of limited ice supply in coastal areas while having viable business potential to be run and developed in the fisheries sector.

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