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Integrating Business Model Canvas and Balanced Scorecard for Porang Tuber Business Development: A Case Study of Koperasi Porang Garut Agro

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Abstract

Indonesia is expected to face a decline in rice harvest areas in 2024, which threatens national food security and highlights the need for alternative food sources from local commodities such as *Amorphophallus muelleri* (porang). Koperasi Porang Garut Agro (KPGA), a community-based cooperative in Garut Regency, has the potential but still struggles with supply stability, logistics, and institutional capacity. This study formulates a business management strategy for KPGA by integrating the Business Model Canvas (BMC) with the Balanced Scorecard (BSC). Data were collected through interviews, field observations, and document reviews, then analyzed using descriptive quantitative methods to assess tuber availability and distribution, complemented by financial feasibility analysis. The business model was developed through SWOT-BMC analysis and then mapped into the 4 perspectives of the BSC to design appropriate management strategies. The results indicate that porang availability in Garut is sufficient for KPGA's operations, although price fluctuations and unequal profit distribution persist. Additionally, financial analysis suggests that KPGA's operations are feasible but have not yet achieved optimal returns. To address these challenges, integration of the BMC and BSC produced 13 core strategies focusing on improving product quality and standards, developing processed products, enhancing human resource competencies, strengthening distribution and storage efficiency, expanding market segments, and improving financial management and support for farmers. These strategies offer a clear roadmap for enhancing KPGA's competitiveness and supporting Indonesia's broader goal of sustainable food diversification.

Keywords: agribusiness strategy; business model; cooperative development; financial feasibility; local commodity

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INTRODUCTION

As of now, Indonesia is facing a decrease in rice harvest area of 167.25 thousand hectares, or approximately 1.64% in 2024, compared to the previous year. In 2023, the total area reached 10.21 million hectares, but it decreased to 10.05 million hectares in 2024 (Statistics Indonesia, 2024). This reduction is also accompanied by a decline in rice production of 1.32 million tons of milled dry grain (GKG). This decline poses a severe challenge to the Indonesian food security situation, considering the country's population relies heavily on rice as a primary source of carbohydrates (Pravitasari et al., 2019). To address this issue, promoting local commodities is a key solution to foster food diversification to achieve a sustainable and

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resilient food system (Nchanji and Lutomia, 2021). Porang or *Amorphophallus muelleri* holds significant potential to be developed in Indonesia.

Porang is a native Indonesian tuber plant that naturally grows in forested areas. Traditionally, it has been harvested from the wild by local communities, often as a seasonal crop with minimal cultivation efforts (Santosa et al., 2019). It is supported by the high glucomannan compounds in its tubers, ranging from 45 to 65%. Due to its glucomannan compound, porang has wide applications in the food, pharmaceutical, and cosmetic industries as a raw material for processed foods, capsule shells, diabetes supplements, and thickening agent for cosmetic goods (Simatupang et al., 2022).

The growing interest in porang cultivation among Indonesian farmers began in 2019 and increased significantly in 2020 because of the high international market value (Salama et al., 2024). According to the Director General of Food Crops, Indonesia's porang export volume increased by 160% to countries such as China, Vietnam, and Japan in 2020. However, the porang industry in Indonesia still faces numerous challenges, such as unstable pricing in the domestic market and limited absorption capacity within domestic processing industries. This instability is evident from the significant fluctuations in porang tuber prices, which peaked at 13,000 IDR kg^{-1} in 2020 but dropped to 1,700 IDR kg^{-1} in 2022. As a result, many porang farmers and business owners suffered losses and ceased operations in 2022 (Suhardi et al., 2025). Moreover, the harvested volume of porang tubers in Indonesia reached 600,000 tons in 2024, while the industry's processing capacity remains limited to approximately 160,000 tons per year (Nuraini et al., 2023). This imbalance between supply and market demand has created instability in the porang value chain, potentially leading to price suppression by middlemen or processing factories (Riptanti et al., 2022; Suhardi et al., 2025).

Koperasi Porang Garut Agro (KPGA) is an agribusiness cooperative that recognizes the significant potential of porang and focuses on empowering local farmers by serving as a central collector and manager of porang harvests in Garut Regency, West Java. KPGA plays a crucial role in expanding market access, maintaining product quality, and improving the welfare of its farmers. However, like other agribusiness cooperatives, KPGA faces significant challenges related to price fluctuations, market competition, and distribution inefficiency (Wahidah et al., 2021; Handayani et al., 2024). These issues require a comprehensive business management strategy to ensure KPGA's sustainable growth and competitiveness. Therefore, this study aims to develop an integrated business model using the Business Model Canvas (BMC) approach, combined with the Balanced Scorecard (BSC), to systematically identify, design, and evaluate KPGA's key business components and performance indicators.

The BMC offers a clear and structured overview of key business elements, including value propositions, customer segments, customer relationships, channels, revenue streams, key resources, key activities, key partners, and cost structures. These elements help visualize KPGA's current business model and identify areas for strategic improvement (Osterwalder and Pigneur, 2010). Meanwhile, the BSC provides a complementary performance management tool, focusing on 4 key perspectives: financial, customer, internal processes, as well as learning and growth (Kaplan and Norton, 1996). By aligning these perspectives with KPGA's strategic objectives, the model helps bridge the gap between operational activities and long-term goals (Rachman and Tricahyono, 2025).

Previous research on porang agribusiness and related cooperative models has largely focused on individual components of the business, such as cultivation techniques or basic processing operations. Some studies have introduced the SWOT matrix to explore strengths, weaknesses, opportunities, and threats within the porang industry. For instance, Kurniawan et al. (2023) conducted research at Indobreed Agro Nusantara to identify potential methods for advancing porang seed development through SWOT analysis. Although this research provided practical insights into the expansion of the porang seeds business, it didn't elaborate on the financial feasibility aspects or long-term performance measurement. Meanwhile, Irianto et al. (2023) proposed a sustainable porang farming model to support export growth with Structural Equation Modeling (SEM) analysis. Their model highlights the importance of household labor, land availability, and institutional support in sustaining porang production. However, despite offering a structured sustainability model, their study does not integrate these findings into a practical business framework.

Many of the models proposed in earlier research are either conceptual or focused on private enterprises. Previous studies have

demonstrated the integration of BMC with BSC across various purposes, including business model development in response to digital transformation and the COVID-19 pandemic (Stalmachova et al., 2022), as well as planning for financial sustainability (Al-Filali et al., 2024). However, such integration has rarely been explored within community-based agribusiness models. This study contributes to filling that gap by contextualizing the BMC-BSC framework for an agricultural cooperative and enhancing it with a SWOT-informed analysis to generate strategies relevant to small-scale, local commodity-based value chains.

The proposed framework here is designed not only to improve operational efficiency and financial feasibility but also to align with the broader goals of rural empowerment, value chain stability, and long-term competitiveness. Ultimately, this study contributes to a better understanding of how agricultural cooperatives can transform local commodities into sustainable and resilient business ventures through integrated strategic planning. Furthermore, the strategies developed through this research are expected to optimize the potential of porang tubers, enhance KPGA's competitiveness in both domestic and international markets, and make a meaningful contribution to national food security and economic resilience. By aligning business planning with the actual conditions faced by agricultural cooperatives, this study aims to support a practical and comprehensive business management strategy for KPGA, thereby strengthening operational sustainability and improving agribusiness in Indonesia's agro-industrial sector.

MATERIALS AND METHOD

Research design

This study employed a descriptive mixed-methods design combining qualitative and quantitative approaches to formulate a business management strategy for KPGA (Sandelowski, 2000). The research was conducted from September 2024 to June 2025 in Garut Regency, West Java. The study focuses on analyzing supply availability, distribution channels, financial feasibility, and business model design. The qualitative component involved exploring organizational processes, strengths, weaknesses, and opportunities through in-depth analysis, while the quantitative component aimed to support findings with numerical data and measurable indicators, reflecting the performance targets and key performance indicators (KPIs) defined in the BSC.

Respondents

The sample collection in this study was conducted using a purposive sampling technique for partner farmers, collectors, and KPGA members. These respondents were chosen for their in-depth knowledge about the case or phenomenon under study, which facilitated the researchers' access to and understanding of the social situation being investigated (Sandelowski, 2000; Bakkalbasioglu, 2020). In addition, this study also employed a snowball sampling approach for porang collectors and farmers, where samples were obtained gradually, from 1 respondent to the next, based on recommendations from previous informants. A total of 10 respondents were selected, comprising 5 experienced porang farmers, 4 cooperative managers, and 1 local collector. This composition enabled the study to capture diverse perspectives and operational experiences across different stages of the supply chain (Onyeneke and Karam, 2022).

Data collection

Qualitative data were gathered through semi-structured interviews, field observations, and document reviews, covering supply conditions, institutional processes, and operational constraints. Quantitative data, on the other hand, comprised production volumes, cost components, and revenue streams from each actor. Additionally, investment expenditures were collected from KPGA's financial records and supporting documents. The collected data focused on porang tuber availability, production, distribution, financial aspects, and business model elements. This approach aimed to capture key information on cultivation stages, supply patterns, post-harvest capacity, distribution flows and logistics, as well as costs and revenues. It also covered elements of the BMC, including value proposition, customer segments, distribution channels, key activities and resources, partners, revenue streams, and cost structure. This comprehensive dataset provided a solid basis for analyzing cooperative operations, identifying challenges, and supporting efficient management and strategic planning.

Data analysis

The interview data were analyzed by highlighting important information, grouping

similar points, and identifying main themes related to the supply chain, business processes, and strategic factors. Data validity was ensured through triangulation of sources and member checking with selected respondents. To maintain reliability, the analysis was conducted through a careful and repetitive process in which the data were reviewed multiple times, groupings were checked and refined, and interpretations were kept consistent throughout the analysis. Moreover, the quantitative analysis focused on evaluating the cooperative's cost structure and assessing financial feasibility using standard investment indicators, including total costs, net income, net present value (NPV), internal rate of return (IRR), benefit-cost ratio (B/C ratio), and payback period. These calculations followed established financial appraisal methods.

Porang supply chain system and financial analysis

The porang supply chain system was mapped to assess the flow of goods, finances, and information from farmers to cooperatives and ultimately to the industry (Kotler and Keller, 2006). This analysis helped identify distribution efficiency, transportation costs, and potential barriers within the supply chain. Furthermore, to better understand economic viability, this study conducted a cost and income analysis at the farmer, collector, and cooperative levels. The analysis focuses on identifying the cost structure, calculating total revenue, and estimating net income, which are essential for evaluating the profitability and profit distribution within the supply chain (Gu and Yu, 2022). The total cost (TC) incurred during porang production and collection is calculated using Equation 1.

$$TC = TFC + TVC \quad (1)$$

Where: TC = Total cost; TFC = Total fixed cost; and TVC = Total variable cost of porang tubers production and distribution (IDR).

Total revenue (TR) is calculated as the product of the selling price (P) per unit of porang in kilograms (IDR) and the total quantity (Q) of porang sold, as shown in Equation 2.

$$TR = P \times Q \quad (2)$$

Net income or profit (I) is derived from the difference between total revenue (TR) and total cost (TC), as shown in Equation 3.

$$I = TC - TR \quad (3)$$

To determine the minimum volume required to avoid financial losses, a break-even point (BEP) analysis was first conducted. This analysis determines the minimum number of units that must be sold for a business to reach the point where total revenue equals total costs, resulting in neither profit nor loss (Park, 2007). The BEP is calculated using Equation 4.

$$BEP = \frac{FC}{P - VC} \quad (4)$$

Where: FC = Fixed cost (IDR); P = Price per unit of porang tubers in kilograms (IDR); and VC = Variable cost (IDR).

Financial analysis was performed using investment appraisal methods, including NPV, B/C ratio, payback period, and IRR (Gitman and Zutter, 2015). These indicators were used to evaluate the business feasibility of the porang cooperative. NPV reflects the difference between the present value of cash inflows and the present value of costs over the business's lifetime. A project is considered feasible if the NPV is greater than 0 (Damodaran, 2012). The formula used is presented in Equation 5.

$$NPV = \sum_{t=0}^{n} \frac{(Bt-Ct)}{(1+i)^t} \quad (5)$$

Where: Bt = Benefit (cash inflow) in year *t* (IDR); Ct = Cost (cash outflow) in year *t* (IDR); i = Discount rate (%); and n = Business lifetime (years).

B/C ratio is used to assess the economic efficiency of the investment by comparing the present value of benefits with the present value of costs, as shown in Equation 6. A B/C ratio greater than 1 indicates that the investment is financially worthwhile (Park, 2007).

$$B/C = \frac{\sum_{t=0}^{n} \frac{(Bt-Ct)}{(1+i)^t}}{\sum_{t=0}^{n} \frac{(Ct)}{(1+i)^t}} \quad (6)$$

The payback period measures the time required for the business to recover its initial investment from cumulative cash inflows. A shorter payback period implies faster recovery and better feasibility (Park, 2007). The payback period is calculated using Equation 7.

$$\text{Payback period} = n + \frac{(a-b)}{(c-b)} \times 1 \text{ year} \quad (7)$$

Where: n = Last year before the investment is fully recovered; a = Initial investment (IDR); b = Cumulative cash flow at year *n*; and c = Cumulative cash flow at year *n* + 1.

IRR indicates the discount rate at which the NPV equals 0. If the IRR exceeds the opportunity cost of capital, the investment is considered acceptable (Park, 2007). The IRR is estimated through interpolation using Equation 8.

$$IRR = i_1 + \left(\frac{\sum NPV(+)}{\sum NPV(+) - \sum NPV(-)}\right) \times (i_2 - i_1) \quad (8)$$

Where: NPV(+) = Positive NPV; NPV(−) = Negative NPV; i_1 = Discount rate yielding positive NPV; and i_2 = Discount rate yielding negative NPV.

These indicators collectively provide a robust basis for determining whether the porang-based business venture is financially feasible, efficient, and worth pursuing under current market and operational conditions.

Business model development

The business model was developed using BMC, based on the analysis of the cooperative's existing operational conditions. The model was then further examined using the SWOT framework to identify internal strengths and weaknesses as well as external opportunities and threats (Mustaniroh et al., 2020). Insights from the SWOT–BMC analysis were subsequently used to refine and redesign the cooperative's business model into an ideal or improved model that aligns with strategic priorities and supports long-term business development (Widadie et al., 2024).

Strategic objective formulation

The improved business model was further translated into the BSC framework to design strategic objectives across 4 perspectives: financial, customer, internal processes, as well as learning and growth (Kaplan and Norton, 1996). The perspective weight was calculated using Equation 9 (Norton, 2000).

$$\text{Perspective weight (\%)} = \frac{\text{Assigned score}}{\text{Total score of all perspectives}} \times 100 \quad (9)$$

The conceptual foundation for translating BMC into BSC was drawn from Richardson (2014), who proposed a process of mapping the 9 components of the BMC into the 4 strategic perspectives of the BSC. Strategic objectives were then formulated based on the organization's vision, mission, and actual business conditions, as previously outlined through the BMC (Kaplan and Norton, 1996; Osterwalder and Pigneur, 2010). However, as this translation model has not yet been supported by recognized academic theory, this study also aims to examine Richardson's approach and explore its applicability and contribution to the development of business strategy frameworks. All data collection, sampling procedures, and analysis methods were selected to ensure that the research design was appropriate, reliable, and capable of providing actionable strategies for improving porang business management at KPGA (Mio et al., 2022).

RESULTS AND DISCUSSION

The process of cultivating porang in Pakenjeng Sub-district, Garut Regency

In Pakenjeng, porang farmers combine local traditional wisdom with modern agronomic practices. They use 2 main types of planting material: young tubers and bulbils (approximately 10 g). Bulbils are small tubers that occur naturally. Although they may take longer to mature and produce smaller tubers, they are a cost-efficient way to multiply plants without sacrificing the main harvest volume. This propagation method is also supported by research, which shows that bulbils are frequently used because they are more economical and do not undergo long dormancy (Tresniawati and Ibrahim, 2021).

Porang is a semi-perennial crop with distinct growth and dormancy phases. Based on Figure 1, during the first two years, the plants focus on vegetative growth, forming leaves, tubers, and bulbils, while the third year brings flowering and potential seed formation. Understanding this cycle is crucial for determining planting, harvesting, and propagation times (Klupczyńska and Pawłowski, 2021). In Pakenjeng, porang planting typically begins with the rainy season (September to November), at about 40,000 bulbils per hectare, with a spacing of 50 cm, and a cultivation cycle lasting between 8 and 10 months. This distance enables each plant to receive enough nutrients, water, and sunlight, which is important for healthy tuber growth (Dwiyono and Djauhari, 2021; Liang et al., 2024). Under ideal conditions, the productivity of porang can reach up to 30 tons ha^{-1} $year^{-1}$. Farmers apply 10 tons of organic fertilizer and 2 tons of dolomite per hectare as part of standard cultivation practices to balance pH

and provide calcium and magnesium for porang development.

Harvesting occurs during dormancy, when leaves have dried, and each plant produces bulbils for the next planting cycle. After harvest, the tubers undergo a quarantine period of no more than 2 weeks, and only those that have entered dormancy and weigh at least 500 g are considered market-ready. These quality standards are particularly enforced in transactions involving KPGA. In this cultivation system, KPGA helps farmers sell their produce more quickly and reliably by linking them with industrial buyers, which not only reduces post-harvest losses but also supports the community's economic well-being. According to Gusmalawati et al. (2021), drying or quarantining porang tubers for 2 weeks can reduce their weight by 6.35%, while a 20-week quarantine can decrease tuber weight by as much as 30.27%. For this reason, farmers or collectors need to sell porang tubers as quickly as possible to prevent significant weight loss.

Analysis of the supply chain of porang tubers

The porang supply chain under KPGA comprises interconnected relationships among farmers, collectors, and the cooperative itself, as shown in Figure 2. This structure is designed to manage the movement of porang tubers from production areas to processing industries, while also coordinating financial transactions and information exchange that sustain the system (Riptanti et al., 2024). The flow of goods, finance, and information occurs through 2 distinct pathways. In the first pathway, porang moves from farmers to collectors, then to KPGA, and finally to the processing industry. In the second pathway, collectors bypass KPGA altogether and deliver directly to processors. These dual distribution routes reflect both the flexibility and fragmentation inherent in the porang trade.

Although KPGA provides training, input access, and guaranteed markets for its partner farmers, not all producers are integrated into the cooperative system. Many choose to sell their products through independent collectors, often motivated by immediate cash payments and fewer administrative requirements. The presence of collectors, while useful in aggregating production, also introduces competitive dynamics that can fragment the supply chain, especially when they offer higher spot prices that encourage farmers to bypass the cooperative. This situation is also explained by Li et al. (2025) and Suhardi et al. (2025), who note that collectors often capture a larger share of the profit, as their direct access to buyers allows them to bypass the formal structure and reduce the cooperative's margin.

Supply availability across years has shown strong sensitivity to market price fluctuations, as summarized in Table 1. In 2020, KPGA was able to aggregate 1,000 tons of porang due to favorable prices. However, a steep price drop following China's export ban in 2021 to 2022 led to a sharp decline in supply, reaching zero in 2022 as farmers chose not to plant or harvest. Supply volumes only recovered in 2024, in line with improved price levels. This pattern illustrates how porang production is highly reactive to price

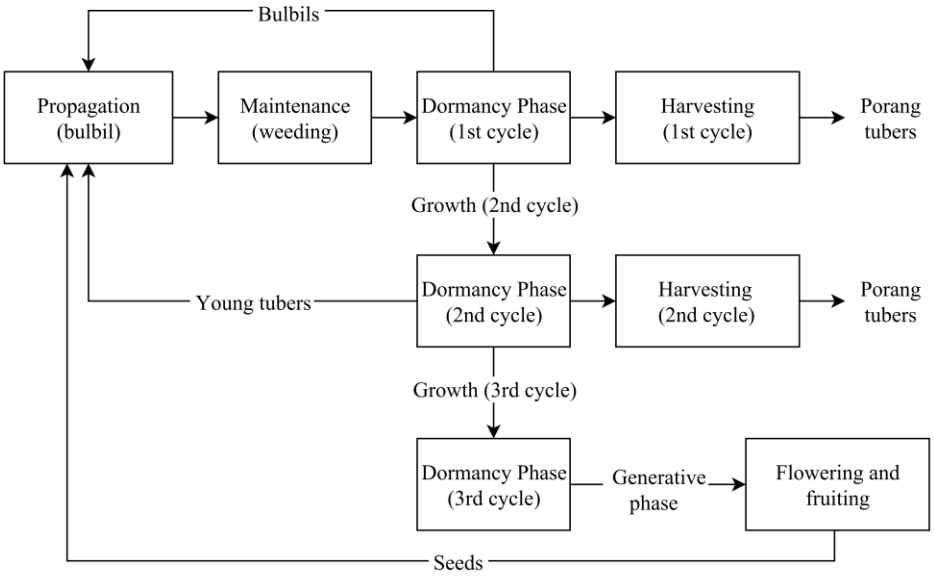

Figure 1. The cultivation cycle of porang

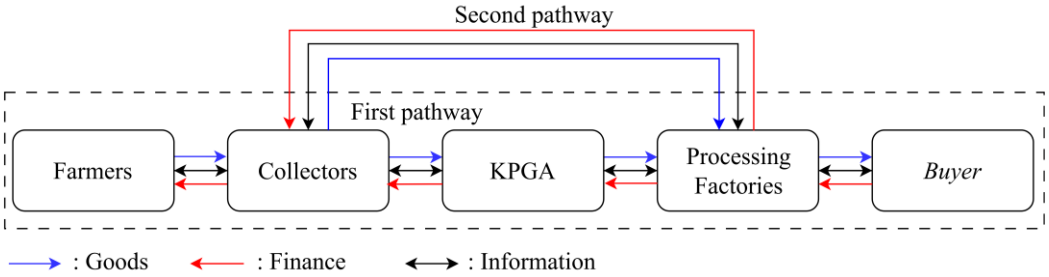

Figure 2. Distribution chain of porang tubers under KPGA

signals and external trade dynamics (Farhana et al., 2022; Utami et al., 2025). Notably, the selling price of porang tubers in the flour industry is generally higher than in the chip industry. This price difference reflects a derived demand where the price is based not only on the raw material quality but also on the final market value of the processed porang flour in functional food, pharmaceutical, and export sectors (Emediegwu and Rogna, 2024).

In this context, KPGA faces the dual challenge of maintaining steady supply volumes while managing farmer behavior in response to market signals. One of the cooperative's strategies is to stagger planting schedules among farmer groups, ensuring that harvests are distributed more evenly throughout the year. KPGA also attempts to stabilize prices through guaranteed purchase mechanisms, although its capacity is limited by financial resources and market demand. The distribution of value or profit among actors in the porang tuber trade reveals significant disparities across the chain, as shown in Table 2.

Partner farmers, who are responsible for the production process and bear the highest agronomic risk, receive the largest portion of the margin per kilogram sold. This high margin reflects the relatively low input costs and favorable market prices in that year, although such conditions were not consistently sustained in subsequent years due to price volatility. Although collectors' margins were considerably lower than those of the farmers, collectors also assumed fewer risks, as they were not involved in cultivation and instead operated as intermediaries focused on aggregation and short-term trade (Li et al., 2025). Meanwhile, KPGA sustains the lowest margin per kilogram but plays the most critical role in market integration, long-term sustainability, and bargaining power enhancement across the chain. These asymmetries in value distribution highlight the need for institutional strategies that ensure a more equitable distribution of benefits. Strengthening the cooperative's capacity for direct marketing, processing, and value-added services may help rebalance margins and create a more inclusive and resilient porang distribution ecosystem (Babalulu et al., 2025).

A financial feasibility analysis was conducted to assess whether KPGA's porang agribusiness model can generate returns that justify capital investment and operational risks. Based on Figure 3, the NPV was estimated at 1,011,238,818.73 IDR over 5 years with a 10% discount rate, suggesting the project generates a net economic benefit, albeit below the scale required to fully

Table 1. The relationship between the selling price and the amount of supply of porang tubers

Year	Supply quantity (tons)	Selling price in the industry per kilogram (IDR)	
		Flour	Chips
2020	1,000	15,500.00	15,000.00
2021	100	8,500.00	8,000.00
2022	0	2,500.00	2,000.00
2023	20	5,500.00	5,000.00
2024	1,000	10,500.00	10,000.00

Table 2. Distribution of profits for each actor in the sale of porang tubers in 2020

Distribution actor	Average selling price per kilogram (IDR)	Profit margin per kilogram (IDR)
Farmers	12,500.00	9,460.04
Collectors	14,000.00	1,128.60
KPGA	15,250.00	135.39

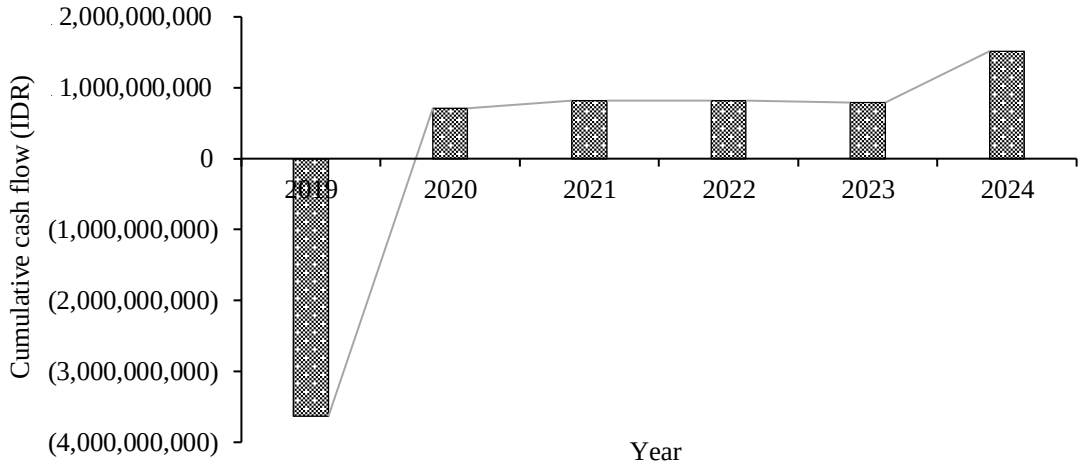

Figure 3. Cumulative cash flow of KPGA

recover the initial investment of over 3.6 billion IDR. The IRR reached only 7.82%, falling short of the assumed minimum attractive rate of return (MARR) of 15%, which implies limited investor appeal from a purely financial standpoint. However, the B/C ratio of 1.41 indicates that for every 1 IDR invested, 1.41 IDR is returned in benefits, pointing to underlying economic viability.

Supporting this interpretation, the project's payback period was calculated at 0.84 years (approximately 10 months), primarily due to high first-year revenues, although such performance was not sustained in subsequent years due to market disruptions. In addition to investment criteria, the BEP analysis indicated that KPGA needed to sell approximately 3.78 tons of porang to cover total operational costs, resulting in revenue of 38,769,798.06 IDR at that production level. This indicates that KPGA began generating profit after this threshold was surpassed, offering insight into the minimum viable scale of operation.

Prasetyowati et al. (2023) found that porang cultivation in East Lombok Regency has a B/C ratio of 1.01, reaching its BEP at around 9.23 tons of production. Meanwhile, Salama et al. (2024) reported a lower B/C ratio of 0.67 in Gowa Regency, suggesting that porang farming there is unprofitable. The results from the previous research show that KPGA demonstrates a comparatively stronger and more promising level of feasibility, but still needs enhanced operational efficiency and price stabilization strategies to improve its attractiveness from an investment standpoint. The findings emphasize that, beyond financial returns, cooperatives like KPGA serve broader roles in rural development and farmer empowerment, which justify continued support even when financial indicators remain moderate.

These financial results provide a clear foundation for mapping KPGA's strategic objectives. The revenue streams, cost structure, and investment indicators highlight areas of strength, such as the cooperative's ability to generate positive economic benefits. At the same time, limitations in IRR point to weaknesses in long-term financial sustainability, indicating the need to improve operational efficiency, stabilize pricing, and expand market access. This financial insight informs the subsequent SWOT-BMC analysis, guiding the identification of opportunities for growth and threats from market fluctuations. Connecting financial feasibility with strategic planning helps to identify areas that require reinforcement to strengthen both economic viability and overall cooperative performance.

Business model canvas development

The existing business model of KPGA was formulated using the BMC to map the organization's core elements, as shown in Figure 4. The existing BMC was synthesized from interviews, field observations, and supporting documentation. Through coding and thematic grouping, several core operational patterns of the cooperative were identified, regarding the roles of partner farmers and collectors, the mechanisms of tuber procurement, and the cooperative's interaction with processing industries. These emerging themes formed the basis for mapping 9 key elements that define the cooperative's operations within the BMC.

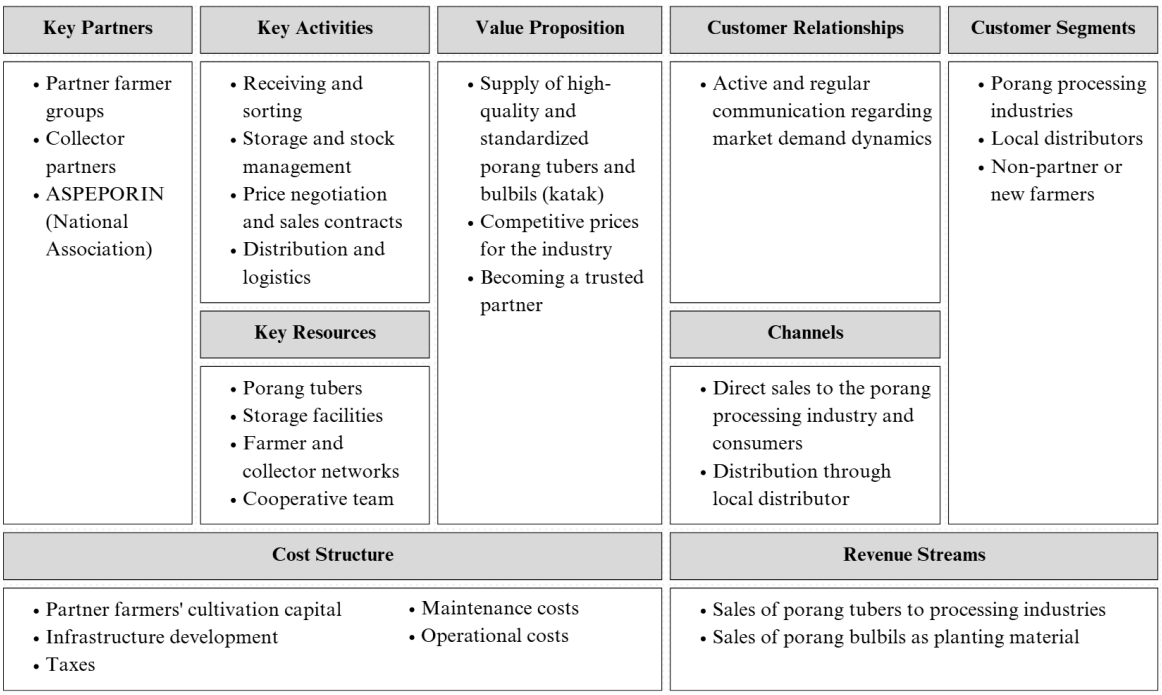

Figure 4. KPGA's existing BMC

Value propositions

KPGA offers high-quality, standardized porang tubers at competitive prices for industrial use, as well as high-grade porang seeds (bulbils) for cultivation. Beyond product quality, the cooperative acts as a trusted bridge between smallholder farmers and industrial buyers. Farmer 1 stated, "*KPGA ensures our tubers meet industry standards, which gives us confidence that they will be sold quickly*." This value proposition emphasizes product quality, reliability, and trust.

Customer segments

KPGA targets 3 main customer groups: porang processing industries, local distributors that extend KPGA's market reach, and non-partner or new farmers seeking quality planting materials. Farmer 2 noted, "*Through KPGA, even new farmers can access good bulbils for planting, which is hard to get elsewhere*." This segmentation ensures that the cooperative meets both production and cultivation needs in the supply chain.

Channels

KPGA utilizes multiple distribution pathways, combining direct sales to industrial buyers with partnerships with local distributors to reach broader markets. Collector 1 explained, "*Through KPGA, I can help connect farmers' products to buyers that I could not reach on my own*." These diverse channels improve accessibility and ensure broader market penetration.

Customer relationship

KPGA maintains active and continuous communication with customers, responding to changes in market demand and supply conditions. Staff 1 explained, "*We regularly check with our buyers about their orders and adjust our supply accordingly*." This proactive approach strengthens customer trust and loyalty.

Revenue streams

The cooperative earns revenue primarily from the sale of raw porang tubers and bulbils. Staff 2 explained, "*Our revenue depends on connecting farmers with reliable buyers, ensuring a steady flow of products to the market*." Revenue is therefore closely linked to the cooperative's role in facilitating market access and maintaining supply consistency.

Key resources

To support this value chain, KPGA leverages several key resources, including its network of farmer partners and collectors, storage facilities, and an internal management team. As is known, KPGA relies on quality porang materials, storage facilities, skilled staff, and strong market connections. Staff 3 stated, "*Our advantage lies in having good tubers and solid relationships with buyers*." These resources enable KPGA to deliver consistently on its promises.

Key activities

These resources enable the cooperative to carry out essential operational activities such as

Table 3. Results of the SWOT analysis of KPGA's existing BMC

Aspect	Strengths	Weaknesses	Opportunities	Threats
Value proposition	• Provides high-quality and standardized raw products • Competitive price • Acts as a reliable intermediary	• Still focused on raw products • Competitive pricing is not supported by certification	• Potential for value-added products (processed or certified)	• Buyers may bypass KPGA and deal directly with farmers or collectors • Price volatility
Key resources	• High-quality porang tubers • Existing warehouse for storage • Reliable supply from partner farmers • Active team	• Limited post-harvest technology • Dependence on small farmers • Limited digital systems reduce management efficiency	• Post-harvest processing facilities • Implement digital systems to improve efficiency	• Overreliance on a single warehouse • Supply disruption if some partner farmers exit
Key activities	• Clear routines with SOPs • Organized stock handling • Established negotiation practices • Reliable delivery	• Manual process, informal SOPs • Limited post-harvest handling • Documentation not formalized	• Add downstream processing • Digitalized SOP and activity documentation to improve efficiency and coordination	• Seasonal supply fluctuations • Market demand volatility
Key partnership	• Partnership with farmers, collectors, and ASPEPORIN can facilitate market linkage	• Limited legal formalization • No financial partners	• Collaborations with the government or institutions for support • Access to funding	• Weak partnerships may disrupt supply • Risk of partner defection
Customer segments	• Strong links to industrial buyers • Reliable local partnerships • Ability to serve new farmers through high-quality bulbils	• Limited number of buyers • Market reach remains local/regional • Dependence on informal networks	• Expand to new B2B and farmer groups • Penetrate export markets	• Declining industrial demand • Competitor price pressure reduces KPGA's bargaining position
Channels	• Efficient direct delivery • Effective cooperative distribution	• Limited marketing and channels • No digital presence	• Open direct export access • Using digital platforms for marketing/sales	• Declining industrial demand • Middlemen are taking market share
Customer relation-ships	• Close and active engagement ensures a supply-demand match	• No formal customer relationship management (CRM) system • Relationships depend on personal ties	• Implementation of CRM tools to formalize engagement and track interactions	• Informal ties risk client loss • Competitors with better service may attract buyers

Table 3. Continued

Aspect	Strengths	Weaknesses	Opportunities	Threats
Revenue streams	• Dual income from tubers and bulbils sales • Reliable income due to guaranteed market linkage	• Low margins from raw products • No value-added income streams	• Develop value-added products to increase margins	• Price drops directly reduce revenue • Competitors with lower prices affect income stability
Cost structure	• Manageable cost at current operational scale • Clear understanding of operational expenses	• Small-scale operations limit cost efficiency • High dependence on variable costs	• Funding programs for farmers can improve the products • Investment or automation can improve infrastructure efficiency	• Rising prices of fuel, electricity, and labor increase operational costs • Seasonal income may not cover fixed expenses

sourcing, sorting, inventory management, contract negotiation, and logistics coordination. Staff 4 noted, "*The quality and supply of porang tubers are the most important factors in the business success of KPGA*." Therefore, these activities are critical for maintaining operational efficiency and reliability.

Key partnerships

The cooperative's operations are strengthened by partnerships with farmer groups, aggregator networks, and ASPEPORIN (the national porang business association). These alliances facilitate access to raw materials, knowledge exchange, and broader market linkages. Farmer 3 emphasized, "*Without KPGA connecting us to factories, it would be hard to get fair prices for our porang.*"

Cost structure

KPGA's main costs are tied to cultivation support for partner farmers, infrastructure development, maintenance, taxation, and routine operational expenditures (including procurement, labor, and utilities). Staff 4 shared, "*Maintaining the warehouse and storage facilities represents the largest portion of our operational costs, but it is essential to preserve product quality*." This cost structure highlights the need for strategic diversification of revenue streams to enhance profitability, mitigate financial risks associated with raw tuber price volatility, and improve the cooperative's long-term operational performance.

Formulation of an ideal business model through SWOT-BMC analysis

Following the identification of KPGA's existing BMC as shown in Figure 4, a SWOT analysis was conducted for each element. Each point in the SWOT table represents an analytical expansion of the descriptive components in the BMC. The development of the SWOT analysis from the BMC involved thorough consideration of each element to determine its strategic implications. The results serve as a foundation for strategic operational improvements and are summarized in Table 3.

In the value proposition, the cooperative's ability to supply high-quality and standardized porang tubers represents a strength. In contrast, the focus on raw products and the absence of certification are recognized as weaknesses. Market demand trends for derived products suggest potential opportunities, while price volatility and the risk of buyers bypassing the cooperative are identified as threats. Each SWOT item reflects the interplay between internal capabilities and external market conditions. For key resources, activities, and partnerships, the analytical process assessed existing elements such as farmer networks, warehouse facilities, operational routines, and collaborative ties. Strengths include functional assets and competencies; weaknesses identify limitations in infrastructure or processes; opportunities denote areas for improvement or external support; and threats capture environmental or operational risks. These considerations transformed descriptive elements from BMC into analytical SWOT entries.

From a financial perspective, both the BMC and SWOT analyses indicate that KPGA's current model remains narrow and very sensitive to

external shocks. Relying mainly on raw-tuber sales that restrict revenue diversification, while logistical and operational costs remain high due to the lack of value-added processing. When viewed together, the BMC and SWOT reveal that KPGA has a clear operational identity and strong relational capital. Still, it needs strategic improvements to strengthen its position and stay competitive in the growing porang value chain.

Based on this SWOT analysis, a revised BMC model for KPGA is proposed to enhance business competitiveness and sustainability. This framework builds on the concept introduced by Osterwalder and Pigneur (2010), who incorporated the eliminate, reduce, raise, and create (ERRC) grid into the development of the BMC. In the case of KPGA, the enhanced BMC in Figure 5 specifically adopts only 3 components (reduced, improved/raised, and created), because the SWOT results did not indicate any aspects that required elimination.

In this framework, opportunities identified in the SWOT were translated into elements to be created, such as value-added products, post-harvest processing facilities, an internal digital system for documentation and CRM, expanded customer segments into export markets, and collaboration with formal institutions. The financial feasibility analysis presented in the previous results further shows the cooperative's dependency on raw tuber sales and the vulnerability to market price fluctuations. Consequently, strategic measures such as developing value-added porang products, expanding into export markets, and establishing partnerships with formal financial institutions become essential (Riptanti et al., 2022; Handayani et al., 2024).

Simultaneously, internal strengths were targeted for raising or improvement, including product quality, storage facilities, partnerships with farmers and collectors, infrastructure development, direct sales, existing key partners, etc. The model also emphasizes reducing operational vulnerabilities, such as dependency on manual logistics and seasonal labor, by promoting efficiency through digitalization and automation. Dewati et al. (2025) showed that partial downstream processing yields a higher value-added than raw tuber sales alone. Similarly, Dermoredjo et al. (2021) highlight that

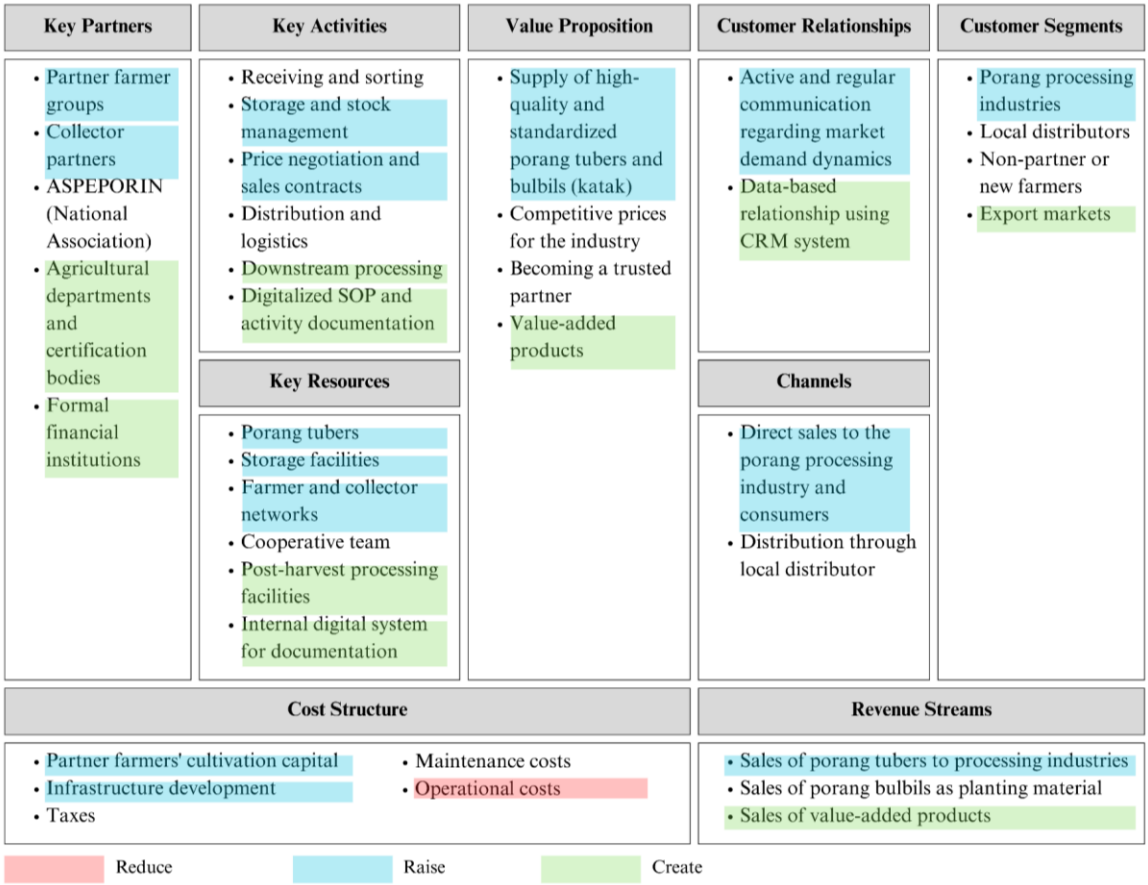

Figure 5. Refined BMC of KPGA formulated through SWOT analysis

collaboration, technological support, and regulation across the porang value chain are key to increasing value added and making porang agribusiness feasible for green economic growth. These previous studies support the findings of KPGA's strategy, which translates opportunities identified in the SWOT analysis into actionable elements. Overall, this revised BMC offers a resilient structure for KPGA to respond to market dynamics, enhance value creation, and scale its impact sustainably.

The development of management strategy through the integration of BMC into BSC

The business strategy formulation at KPGA was carried out by mapping the BMC building blocks into BSC perspectives. Additionally, it required identifying strategic objectives for each BMC component, based on KPGA's operational needs. A total of 13 strategic objectives were formulated, as presented in Table 4. Each element marked as reduced, raised, or created in Figure 5 signifies an area that KPGA needs to strengthen or develop. The highlighted components then became the foundation for formulating the strategic objectives under each BSC perspective. This ensures that the strategies align with the improvements outlined in the refined BMC.

Based on Table 4, the 3 strategic objectives were formulated in a learning and growth perspective in response to managerial limitations caused by inadequate human resources. The learning and growth perspective connects to key resources and cost structures because these investments are essential for supporting long-term organizational growth and innovation. SO-LG1 aims to enhance member competencies through training, while SO-LG2 focuses on investing in technology and infrastructure to improve efficiency in data management and reporting. SO-LG3 seeks to optimize warehouse and collector networks to strengthen upstream-to-downstream operations. Together, these strategies reinforce KPGA's internal capacity and resilience in a dynamic market. Technological advancement requires that agribusiness cooperatives, such as KPGA, adapt rapidly to stay relevant. Previous studies from Dermoredjo et al. (2021), Cao et al. (2025), and Martos-Pedrero et al. (2025) emphasize the importance of human resource development and digital innovation in improving cooperative performance and competitiveness.

From the internal business process perspective, strategic objectives focus on optimizing operational workflows, distribution channels, and strategic partnerships, since efficient processes enable reliable delivery and quality assurance. SO-IB1 emphasizes the need for new strategic partnerships with buyers, banks, or government agencies to improve product quality, legality, and market access. SO-IB2 and

Table 4. KPGA's objective strategy through the integration of BMC and BSC

BSC perspective	BMC building block	SOs code	SOs
Learning and growth	Key resources	LG1	Improve the cooperative team's competencies
	Cost structures and key resources	LG2	Invest in an internal digital system and infrastructure development
	Key resources	LG3	Optimize utilization of storage facilities and networks
Internal business process	Key partners	IB1	Strengthen partnerships with farmers, collectors, and new institutional partners
	Channels	IB2	Improve distribution channels through direct sales and local distributors
	Key activities	IB3	Increase efficiency through streamlined operational processing and SOP documentation
Customer	Value propositions	C1	Ensure product quality and standards
		C2	Develop value-added processed products
	Customer relationships	C3	Implement CRM to boost engagement and loyalty
	Customer segments	C4	Expand the porang market segments (including industrial and export markets)
Financial	Revenue streams	F1	Increase revenue sources
	Cost structures	F2	Reduce business costs with digitalization or process optimization
		F3	Enhance financial support for farmers

Note: SOs = Strategic objectives

SO-IB3 aim to strengthen distribution channels and optimize processed activities (including post-harvest handling), addressing current inefficiencies. This was driven by the statement of Sawicka (2019), who stated that harvest losses are common in agriculture, making distribution and storage crucial areas for improvement.

From the customer perspective, 4 strategic objectives aim to create and maintain value for specific market segments, improve product offerings, and strengthen customer relationships. This reflects the cooperative's need to build loyalty and market share through value propositions, customer segments, and relationship management. SO-C1 focuses on ensuring consistent product quality, while SO-C2 encourages the development of processed porang products in response to rising demand. According to Nurlela et al. (2022) and Dewati et al. (2025), high glucomannan content in porang tubers makes it highly valued in international markets. SO-C3 and SO-C4 prioritize customer satisfaction and market expansion through stronger relationship management and segment targeting (Handayani et al., 2024). These align with Porter (2008), who stated that competitive advantage comes from understanding customer needs and customizing value propositions accordingly.

Lastly, the financial perspective emphasizes revenue generation, cost efficiency, and farmer support, as these initiatives directly impact KPGA's financial sustainability, linking naturally to revenue streams and cost structures in the BMC. SO-F1 promotes revenue diversification through value-added products and new services, while SO-F2 focuses on reducing operational costs to protect margins. Without cost control, KPGA's sustainability may be at risk amid market fluctuations (Salama et al., 2024). SO-F3 addresses capital access for porang farmers, aiming to secure raw material supply and empower upstream actors, consistent with Dermoredjo et al. (2021) and Christian et al. (2024) arguments that cooperatives succeed by strengthening farmers' production and marketing capacities.

All strategic objectives previously formulated under each BSC perspective are interconnected to illustrate how each strategy aligns with and supports others. These relationships are visualized to form a pathway toward achieving KPGA's overall strategic goals. The strategic objective map of KPGA is presented in Figure 6.

As illustrated in Figure 6, the strategy map begins with the learning and growth perspective, which represents foundational asset strategies such as enhancing human capital and strengthening infrastructure. These resources enable improvements in internal business processes, which serve as key drivers for achieving organizational goals. Through more efficient operations and stronger partnerships, cooperatives can deliver better value to customers, reflected in output strategies such as increased satisfaction and market expansion. Ultimately, these efforts are expected to generate financial benefits, including greater revenue, cost efficiency, and improved financial support for farmers. This integrated map was developed through stakeholder discussions to ensure

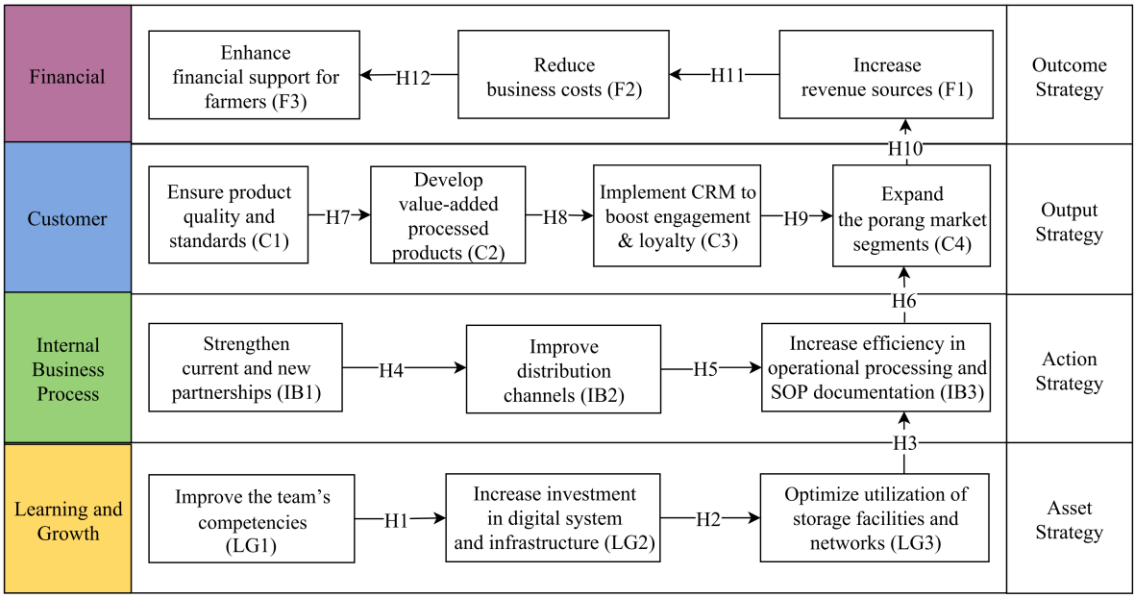

Figure 6. KPGA's objective strategy map

Table 5. KPGA balanced scorecard strategy summary

BSC perspective	BMC component	Key strategies	KPI	Target	Scoring
Customer (31%)	Value propositions	Ensure product quality and standards	Percentage of quality-compliant products	95%	HB
			Post-harvest training frequency	Once per year	HB
			Customer complaints	2 complaints per year	LB
		Develop value-added processed products	Types of processed products	1 type	HB
			Processed product sales per year	30 tons	HB
	Customer relationships	Implement CRM to boost engagement and loyalty	Partner repeat orders	5 partners per year	HB
			Complaint response time	2 days	LB
			Customer service interactions	10 interactions per year	HB
	Customer segments	Expand the porang market segment	New customers per year	2 customers	HB
			Distribution regions	3 regions	HB
Learning and growth (23%)	Key resources	Improve the team's competencies	Members trained	10 people	HB
			Technical and managerial training	1 session per year	HB
			Field mentoring sessions	Once per year	HB
		Optimize utilization of storage facilities (infrastructure) and networks	Warehouse capacity usage	70%	HB
			Active collection points	1 point	HB
			Harvest collection frequency	8 times per year	HB
	Cost structures	Increase investment in the digital system	New technology adoption	1 technology	HB
			Equipment usage training	Once per year	HB
			Technology utilization rate	60% of working hours	HB
Internal business process (23%)	Key partners	Strengthen partnerships with farmers, collectors, and new institutional partners	Active collaborations	5 partnerships	HB
			Collaborative activities	2 activities per year	HB
			Partner coordination frequency	Twice per month	HB
	Channels	Improve distribution channels	Active distribution channels	5 channels	HB
			Active collectors	42 collectors	HB
			Delivery frequency	5 times per year	HB
	Key activities	Increase efficiency through streamlined operational processing and SOP documentation	Average distribution time	3 working days	LB
			Product damage during delivery	1%	LB
			Warehouse utilization rate	70%	HB
			SOP implementation coverage	90%	HB
Financial (23%)	Revenue streams	Increase revenue sources	Main product total revenue	2 billion IDR per year	HB
			Processed product contribution	20% of total revenue	HB
			Active sales channels	3 channels	HB
	Cost structures	Reduce business costs	Production cost per kilogram	9,000 IDR per kilogram	LB
			Operating cost ratio	80%	LB
		Enhance financial support for farmers	Farmer groups that receiving financing	42 groups per year	HB
			Total financing disbursed	200 million IDR per year	HB

Note: HB = Higher is better (higher values indicate better performance); LB = Lower is better (lower values indicate better performance)

relevance to KPGA's operations. Based on the weighting calculations, the customer perspective has the highest weight of 31%, while the learning and growth, internal business process, and financial perspectives each have a weight 23%.

Based on Table 5, the targets set in the BSC were derived directly from the qualitative findings. During interviews, KPGA members explained the cooperative's current operational capacity and the realistic level of improvement they can achieve within one year. Several activities (structured technical training, downstream processing, and digital documentation) had not previously been implemented formally or regularly. As Staff 1 noted, "*Our training has always been informal. If we formalize it, one structured session per year is what we can handle for now*." These statements provided the baseline for determining feasible targets rather than suggesting that no activity existed in the past.

Similarly, targets related to processed products, warehouse utilization, technology adoption, and distribution channels were aligned with KPGA's existing resources and the improvement opportunities identified through SWOT and BMC refinement. For example, Staff 4 highlighted that "*The warehouse is not fully used yet; reaching around 70% utilization is realistic at this stage*." Because of this, the BSC targets represent achievable short-term milestones that are grounded in KPGA's current capabilities and informed by direct insights from the interview data. This approach ensures that each indicator is both evidence-based and contextually justified.

The study's results demonstrate that KPGA places primary strategic importance on the customer perspective. This aligns with the "Balanced Scorecard theory" by Kaplan and Norton (1996), which emphasizes that delivering customer value is essential for long-term financial success. By focusing on product quality assurance and the development of processed porang products, KPGA aims to build customer loyalty and expand its market share. The strategy to develop processed products, particularly porang chips, represents a rational and calculated diversification step. Furthermore, the sales target of 30 tons per year is based on the raw material availability and porang's moisture content, as explained by Setiavani et al. (2025). This diversification not only improves KPGA's competitiveness but also mitigates the risk of dependency on a single product and broadens its export potential.

In the learning and growth perspective, KPGA's focus on improving human resource competencies and technology adoption aligns with Barney's (1991) resource-based theory, which highlights the importance of internal capabilities as a source of sustainable competitive advantage. Regular training and field mentoring are designed to enhance both technical and managerial skills, while investments in new technologies aim to boost operational efficiency. The target of 60% technology utilization indicates KPGA's efforts to ensure that technology investments deliver real value to daily operations.

Strategic partnerships play a critical role from an internal business process perspective. By establishing active partnerships and strengthening distribution channels, KPGA seeks to build an efficient, responsive, and sustainable supply chain. The target of an average distribution time of 3 working days and a product damage rate of less than 1% demonstrates KPGA's commitment to delivering timely and quality products. These operational efficiency targets are supported by the findings of Salama et al. (2024) and Vuong (2025), which indicate that internal process improvements significantly impact customer satisfaction and financial outcomes.

From a financial perspective, KPGA's revenue target of 2 billion IDR per year, along with the 20% contribution from processed products, indicates a strategic effort to strengthen the revenue structure and increase profitability. Focusing on cost control, with a maximum operating cost ratio of 80%, reflects KPGA's commitment to financial sustainability. Additionally, KPGA's financial support to farmers, with a target of disbursing 200 million IDR per year to 42 farmer groups, is expected to improve farmer productivity and ensure a steady supply of raw materials. This support is critical in maintaining long-term supply chain stability.

Overall, the study highlights that integrating the BMC with BSC provides a comprehensive strategic management framework that is measurable, systematic, and well-suited to KPGA's operational context. The customer-focused strategy, supported by investments in human capital, operational efficiency, and sound financial management, is deemed capable of addressing the competitive challenges of the porang industry while ensuring the cooperative's long-term sustainability.

CONCLUSIONS

KPGA's porang agribusiness has untapped potential but faces post-harvest inefficiencies and profit imbalance in its supply chain. Financial analysis shows limited viability based on the IRR. By integrating BMC and BSC frameworks through SWOT analysis, 13 strategies are proposed to enhance internal capacity and market competitiveness: ensuring product quality and standard, develop value-added products, implementing CRM to enhance customer satisfaction and loyalty, expand the market segments, improve KPGA's team competencies, investing in internal digital systems and infrastructure, optimize storage facilities and network utilization, develop strategic partnerships, improve distribution channels, increasing operational efficiency through streamlined processing and SOP documentation, increase revenue sources, reduce business costs, and enhance financial support for farmers. Further research could evaluate the long-term effectiveness of these strategies, assess the feasibility and scalability of processed porang products, and explore system-based approaches to optimize cooperative supply chains under dynamic market conditions.

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