INTERNATIONAL JOURNAL OF SOCIAL SCIENCE, EDUCATIONAL, ECONOMICS, AGRICULTURE RESEARCH AND TECHNOLOGY (IJSET) | ISSN (E): 2827-766X
Website: https://ijset.org/ | Volume 5 No. 11 (2026)

CAVENDISH BANANA VALUE CHAIN AND GREEN MSME BUSINESS MODEL: A MIXED METHODS STUDY IN ACEH AND BENGKULU

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Received: 05/11/2026 | **Revised:**10/11/2026 | **Accepted:**19/11/2026 | **Published:** 27/11/2026

Abstract

Cavendish bananas have the potential to increase farmer incomes, but their value chains in Aceh and Bengkulu are constrained by infrastructure, price volatility, and limited access to high-value markets. This study diagnoses priority value chain constraints and designs a green MSME business model. A sequential mixed-methods design combines Importance Performance Analysis (IPA) of 20 indicators with 111 farmers (Aceh 44; Bengkulu 67) in three districts, Group Model Building (GMB) with 23 stakeholders, and Business Model Canvas (BMC). The IPA reveals two barrier profiles: Aceh has one critical gap in road accessibility (gap 1.90), while Bengkulu has four key priorities: price stability, access to export/modern markets, cultivation training, and distributor collaboration (gaps 1.45–1.90). In the combined data, price stability and export market access are the largest gaps (1.35). The GMB reveals a mutually reinforcing infrastructure–market–price nexus through a feedback loop, making partial interventions less effective. All MSMEs are at the Eco-Adopter level. The proposed business model combines eco-certification, digital traceability, contractual partnerships through cooperatives, revenue diversification, and green financing with a sequence of interventions tailored to the provincial profile.

Keywords: Systems thinking; Importance Performance Analysis; Cavendish banana; Value chain; Green MSMEs

INTRODUCTION

Bananas are a strategic fruit commodity for food, nutrition, and the livelihoods of rural communities. Cavendish cultivars account for nearly half of the banana varieties grown globally and account for nearly all fresh bananas traded internationally (Voora et al., 2023). Indonesia, along with India and China, is consistently among the world's largest producers (Voora et al., 2023), with national production reaching 9.34 million tons in 2023 (Fadhlurrahman, 2024). This large volume does not automatically translate into farmer welfare, as value is determined by quality, market access, and supply chain governance.

Aceh and Bengkulu demonstrate the paradox between commodity potential and poverty. Aceh's poverty rate was 12.33% in March 2025 (Muhamad, 2025) and Bengkulu's 12.52% in September 2024 (Central Statistics Agency [BPS] of Bengkulu Province, 2025), both above the national average of 8.47% (BPS, 2025). Bengkulu's banana production was only 20.73 thousand tons in 2023, among the ten lowest-producing provinces, while major centers such as East Java produced 2.81 million tons (Fadhlurrahman, 2024). At such a small scale, increasing farmer incomes is more realistic through quality differentiation and access to high-value markets rather than volume-based strategies. Cavendish development in Bener Meriah (Aceh) and Kepahiang and Central Bengkulu (Bengkulu) faces limited market access, low selling prices, and dependence on intermediaries (Nabila et al., 2026). Similar constraints, namely limited market information, lack of refrigerated storage, and weak cooperatives, were reported in the banana value chain in Ethiopia (Gebre, Rik, et al., 2020).

Banana value chain studies generally examine partial aspects, while multi-indicator performance diagnosis, participatory systemic strategy formulation, and sustainable business model design are rarely combined. To the author's knowledge, no study has integrated all three in the Cavendish banana value chain in Aceh and Bengkulu.

The novelty of this research lies in (i) differentiating the barrier profiles between provinces and identifying the systemic nodes that connect them, (ii) applying Bank Indonesia's green MSME classification (Eco-Adopter, Eco-Entrepreneur, Eco-Innovator) to the agricultural commodity value chain, and (iii) triangulation of IPA–GMB–BMC linking diagnosis, strategy, and business model.

The research objectives are (i) to diagnose the interest-performance gap in 20 value chain indicators using IPA, (ii) to identify the causal structure and leverage points for joint intervention with stakeholders through GMB, and (iii) to design a green MSME business model along with an integrated intervention framework using BMC.

LITERATURE REVIEW

Banana value chain and upgrading

Value chain analysis examines the creation, distribution, and capture of value from production to marketing; governance between actors determines the opportunities for small-scale actors to move up the chain (Gereffi et al., 2005). Humphrey and Schmitz (2002) differentiate between process, product, functional, and intersectoral upgrading. A study of the banana chain in Arba Minch, Ethiopia, showed moderate sustainability performance: good profitability and employment, but weak coordination, value sharing, market diversity, transportation, and market information (Gebre, Rik, et al., 2020; Gebre, Fikadu, et al., 2022). In Kenya, contract farming increased the productivity and income of small-scale banana farmers, with recommendations for strengthening infrastructure and market access (Murigi et al., 2024). In the Costa Rican export banana chain, certification was a significant driver of change but not the sole solution (Alho et al., 2021).

Green MSMEs and business model innovation

Business model innovation is seen as a means to systematically create a sustainable business case (Schaltegger et al., 2012), and Bocken et al. (2014) formulated sustainable business model archetypes as a design guide. Bank Indonesia (2023) classifies green MSMEs into three levels based on production, marketing, human resources, and finance dimensions: Eco-Adopter (starting to adopt environmentally friendly practices, but sustainability is not yet at the core of the business model), Eco-Entrepreneur (sustainability is at the core of the business model and able to enter the green market), and Eco-Innovator (conducting environmentally friendly innovation across production, processes, marketing, and organization). The latest guidelines add a Pre-Adopter level , emphasize the need for clear assessment parameters, and aim to expand sustainability-based MSMEs' access to markets and financing (Bank Indonesia & Climate Policy Initiative, 2026). In Indonesian MSMEs, green business strategy, environmental focus, and product differentiation positively influence green innovation, which in turn positively influences economic success (Jumpakita Pinem & Listyorini, 2022).

Analytical and conceptual framework

IPA maps attribute importance and performance assessments into four quadrants to determine improvement priorities (Martilla & James, 1977). GMB involves stakeholders developing a shared causal model to build system understanding and identify intervention leverage points (Richardson & Andersen, 1995; Vennix, 1996); its effectiveness has been assessed through assessment studies (Rouwette et al., 2002). BMC decomposes a business model into nine blocks (Osterwalder & Pigneur, 2010). Figure 1 integrates all three: value chain theory and sustainable business model innovation serve as the foundation, IPA serves as the diagnosis, GMB as the systemic strategy formulation, BMC as the model design, and the level of MSME green readiness as the evaluation criteria.

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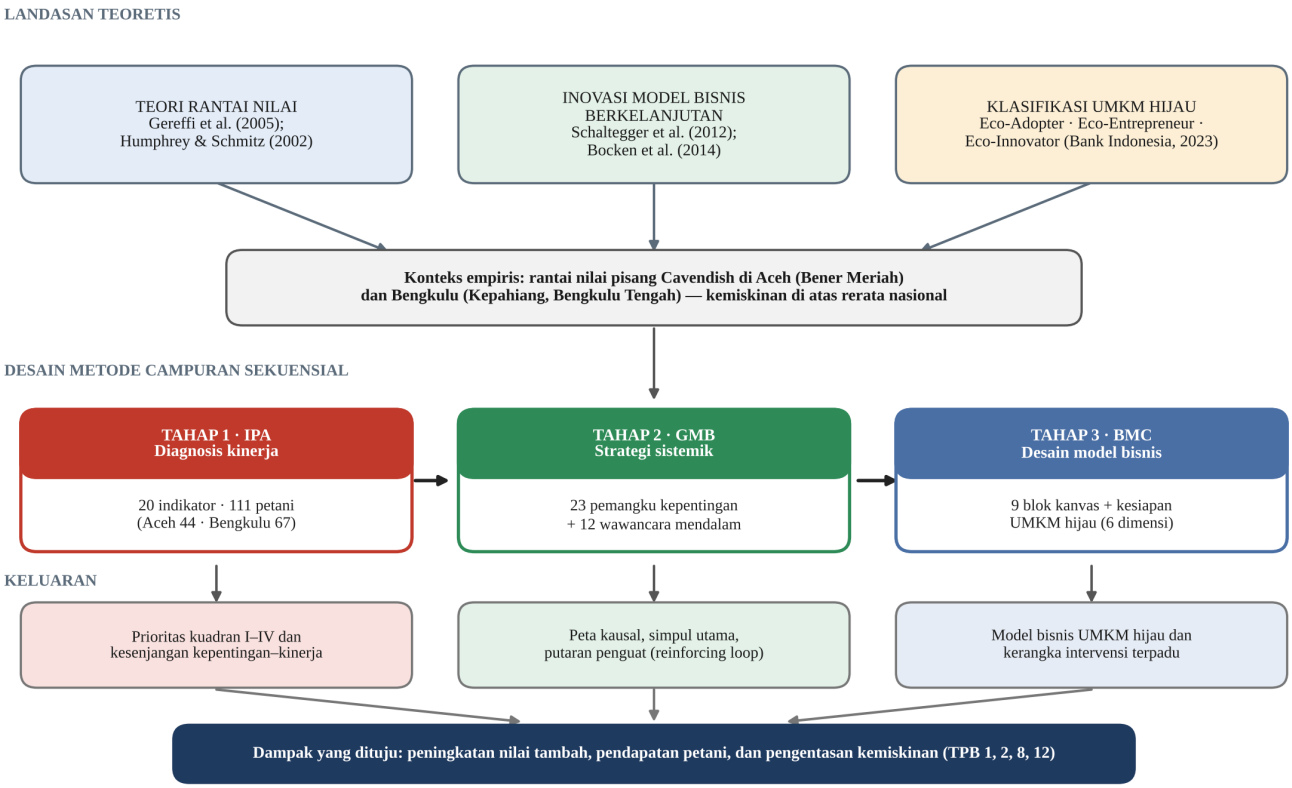

Figure 1. Conceptual framework of the study: theoretical basis, sequential mixed methods design, intended outcomes, and impacts. Source: author's synthesis.

METHOD

Design and location

The study used a sequential mixed methods design (Creswell & Plano Clark, 2018): a quantitative survey for the IPA, a participatory GMB study, and the development of a BMC. The locations were selected based on (i) established Cavendish production activities, (ii) provincial poverty levels above the national average, and (iii) institutional accessibility for participatory data collection, namely Bener Meriah Regency (Aceh) and Kepahiang and Central Bengkulu Regencies (Bengkulu).

Respondents and instruments

Respondents were selected purposively (Patton, 2015) with a minimum of two years of experience in Cavendish cultivation, processing, or distribution. The IPA survey included 111 farmers (Aceh 44; Bengkulu 67) for 20 value chain performance indicators, meeting the minimum 5:1 ratio of respondents per indicator (Hair et al., 2019). Importance and performance were assessed using a seven-point Likert scale (1 = very low, 7 = very high). A pilot test with 30 respondents showed factor loadings of all items ≥ 0.60, with Cronbach's alpha coefficients of 0.847 (importance) and 0.821 (performance), exceeding the threshold of 0.70 (Nunnally, 1978). The GMB session involved 23 stakeholders: farmers (6), MSMEs (5), distributors (4), agricultural extension workers (4), and representatives from cooperatives and trade offices (4). In-depth interviews with 12 informants were used for triangulation.

Data analysis

Mean importance ($\bar{I}$) and performance ($\bar{P}$) scores per indicator were calculated for Aceh and Bengkulu; the combined score was calculated as a weighted average based on the number of respondents per province. The quadrant axis for each unit of analysis was the mean of the 20 indicators (Aceh: $\bar{I} = 3.65$, $\bar{P} = 3.42$; Bengkulu: $\bar{I} = 3.72$, $\bar{P} = 3.35$; combined: $\bar{I} = 3.70$, $\bar{P} = 3.38$). Quadrant I (KI) represents high importance and low performance (top priority), KII represents high–high (maintain), KIII represents low–low (low priority), and KIV represents low importance and high performance (review efficiency) (Martilla & James, 1977). The gap is defined as the difference $\bar{I} - \bar{P}$. The GMB refers to the GMB approach that places roles and facilitation scripts (Richardson & Andersen, 1995; Vennix, 1996): problem elicitation, variable identification and causal mapping, group validation, and strategic intervention identification; sessions were recorded and transcribed with participant consent. The BMC was structured in three stages: mapping IPA and GMB findings into nine blocks, integrating green MSME principles, and validation on

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subgroups of GMB participants. The green MSME readiness was assessed based on Bank Indonesia's (2023) classification across six dimensions: production, marketing, human resources, finance, regulatory compliance, and ecological performance.

RESULTS AND DISCUSSION

Two obstacle profiles: Aceh and Bengkulu

The IPA results are summarized in Table 1 and Figure 2. In Aceh, only road accessibility is at KI ($\bar{I}$ = 4.70; $\bar{P}$ = 2.80), with a gap of 1.90, significantly above the other indicators; nine indicators are at KII, eight at KIII, and two at KIV. In the Bener Meriah highlands, poor farm roads are suspected of extending transport times, increasing post-harvest losses and logistics costs, and depressing farm-gate prices. The nine KII indicators (including seeds, fertilizer, quality control, logistics, and labor) indicate that the agronomic and logistics foundations are functioning.

Bengkulu shows a distinct profile with four KI indicators: price stability ($\bar{I}$ = 4.65; $\bar{P}$ = 2.75; gap 1.90), export/modern market access ($\bar{I}$ = 4.55; $\bar{P}$ = 2.65; 1.90), cultivation training ($\bar{I}$ = 4.40; $\bar{P}$ = 2.85; 1.55), and distributor cooperation ($\bar{I}$ = 4.35; $\bar{P}$ = 2.90; 1.45). The gap for these four indicators (1.45–1.90) far exceeds that of the other indicators (maximum 0.50), while roads are at KII ($\bar{I}$ = 4.30; $\bar{P}$ = 4.10). This pattern points to weak market governance and institutional linkages, rather than infrastructure constraints. These findings align with Nabila et al. (2026) found that the marketing capabilities of Cavendish farmers in Bengkulu were moderate, with promotion as the weakest indicator, and this is consistent with Ethiopia's findings regarding limited alternative markets and market information (Gebre, Rik, et al., 2020). The training at KI indicates that the existing program is deemed less responsive and needs to be redesigned, not simply continued.

Table 1. Importance ($\bar{I}$), performance ($\bar{P}$), gap ($\bar{I} - \bar{P}$), and IPA quadrant scores

No	Indicator	$\bar{I}$ / $\bar{P}$	Gap	Kd	$\bar{I}$ / $\bar{P}$	Gap	Kd	$\bar{I}$ / $\bar{P}$	Gap	Kd
1	Road accessibility	4.70 / 2.80	1.90	I	4.30 / 4.10	0.20	II	4.46 / 3.58	0.88	II
2	Price stability	3.05 / 2.55	0.50	III	4.65 / 2.75	1.90	I	4.02 / 2.67	1.35	I
3	Export/modern market access	3.10 / 2.60	0.50	III	4.55 / 2.65	1.90	I	3.98 / 2.63	1.35	I
4	Superior seed varieties	4.45 / 4.20	0.25	II	4.40 / 4.20	0.20	II	4.42 / 4.20	0.22	II
5	Distributor cooperation	4.30 / 4.15	0.15	II	4.35 / 2.90	1.45	I	4.33 / 3.40	0.93	II
6	Logistics cost efficiency	4.35 / 4.10	0.25	II	4.30 / 4.15	0.15	II	4.32 / 4.13	0.19	II
7	Cultivation training	3.05 / 4.00	-0.95	IV	4.40 / 2.85	1.55	I	3.86 / 3.31	0.55	I
8	Fertilizers and pesticides	4.40 / 4.25	0.15	II	4.35 / 4.20	0.15	II	4.37 / 4.22	0.15	II
9	Availability of labor	4.15 / 4.05	0.10	II	4.20 / 4.00	0.20	II	4.18 / 4.02	0.16	II
10	Quality control and food safety	4.45 / 4.30	0.15	II	4.40 / 4.25	0.15	II	4.42 / 4.27	0.15	II
11	E-commerce	2.80 / 2.30	0.50	III	2.75 / 2.25	0.50	III	2.77 / 2.27	0.50	III
12	Product packaging	2.90 / 2.45	0.45	III	2.85 / 2.40	0.45	III	2.87 / 2.42	0.45	III
13	Storage facilities	3.00 / 2.50	0.50	III	2.95 / 2.50	0.45	III	2.97 / 2.50	0.47	III
14	Product promotion	2.75 / 2.35	0.40	III	2.70 / 2.30	0.40	III	2.72 / 2.32	0.40	III
15	Digital information system	2.85 / 2.40	0.45	III	2.80 / 2.35	0.45	III	2.82 / 2.37	0.45	III
16	Access to market information	3.05 / 2.65	0.40	III	3.00 / 2.60	0.40	III	3.02 / 2.62	0.40	III
17	Production technology	4.30 / 4.15	0.15	II	3.15 / 4.25	-1.10	IV	3.61 / 4.21	-0.60	IV
18	Recording of production costs	3.00 / 3.95	-0.95	IV	4.20 / 4.05	0.15	II	3.72 / 4.01	-0.29	II
19	Timely delivery	4.20 / 4.35	-0.15	II	3.05 / 4.15	-1.10	IV	3.51 / 4.23	-0.72	IV
20	Transportation equipment	4.25 / 4.30	-0.05	II	3.10 / 4.20	-1.10	IV	3.56 / 4.24	-0.68	IV

Aceh (columns 3–5), **Bengkulu** (6–8), **combined** (9–11). Kd = quadrant; shaded cells = Quadrant I. Combined score = weighted average of number of respondents (Aceh 44; Bengkulu 67). Source: primary data (processed).

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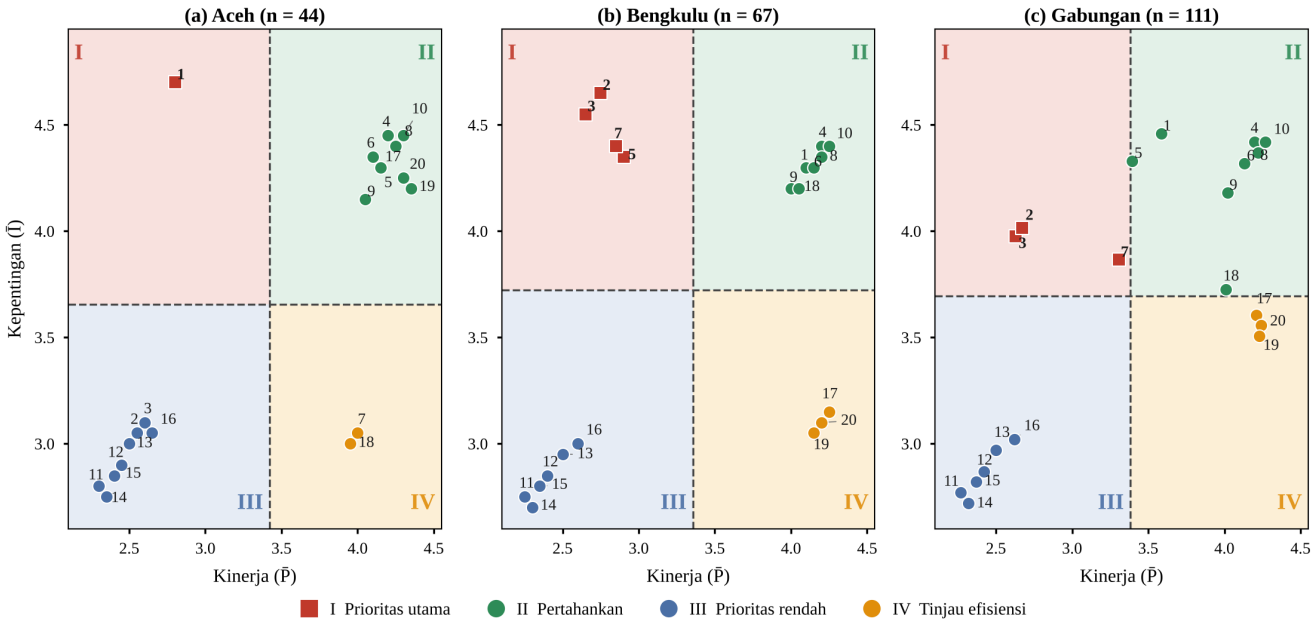

Figure 2. Cartesian diagram of science: (a) Aceh, (b) Bengkulu, and (c) combined. The dotted line is the overall mean for each analysis unit; numbers refer to Table 1.

Aggregate gap and low importance meaning

In the aggregated data, three indicators are in the KI: price stability ($\bar{I}$ = 4.02; $\bar{P}$ = 2.67; gap 1.35), export/modern market access ($\bar{I}$ = 3.98; $\bar{P}$ = 2.63; 1.35), and cultivation training ($\bar{I}$ = 3.86; $\bar{P}$ = 3.31; 0.55). Roads ($\bar{I}$ = 4.46; $\bar{P}$ = 3.58; 0.88) and distributor cooperation ($\bar{I}$ = 4.33; $\bar{P}$ = 3.40; 0.93) are in the KII because the barriers to both are concentrated in one province; distributor cooperation is even right on the quadrant boundary ($\bar{P}$ 3.40 versus axis 3.38). The aggregate analysis thus masks very sharp barriers at the provincial level, so policy formulation needs to rely on individual provincial profiles, not aggregate averages.

One interesting finding is that price stability ($\bar{I}$ = 3.05; $\bar{P}$ = 2.55) and export market access ($\bar{I}$ = 3.10; $\bar{P}$ = 2.60) in Aceh are ranked in KIII: rated low, both in terms of importance and performance. The similarly low performance in Bengkulu (2.75 and 2.65) indicates similar real conditions, but Acehnese farmers do not rate them as important. The authors interpret this as an aspiration gap: farmers' perceived importance is shaped by market exposure. Farmers who have never sold to high-value markets tend not to prioritize them, despite their potential disadvantages. This interpretation requires further testing, but suggests that KIII should not be automatically interpreted as low priority; digital indicators in KIII in both provinces (e-commerce, promotion, information systems) should be read similarly, so that interventions are sequenced after infrastructure and market governance constraints are addressed.

Systemic nodes and reinforcing circles (GMB)

The causal map of the GMB results (Figure 3) shows three pathways leading to price stability and export market access. The production pathway: seeds, fertilizer, labor, training, and technology determine productivity and quality, followed by supply capacity, distributor partnerships, and export market access. The market information pathway: e-commerce, promotions, and digital information systems enhance access to market information, which supports price stability. The cost and logistics pathway: roads determine logistics costs, while cost recording determines business efficiency; both influence price stability, and timely delivery and food quality determine the added value received.

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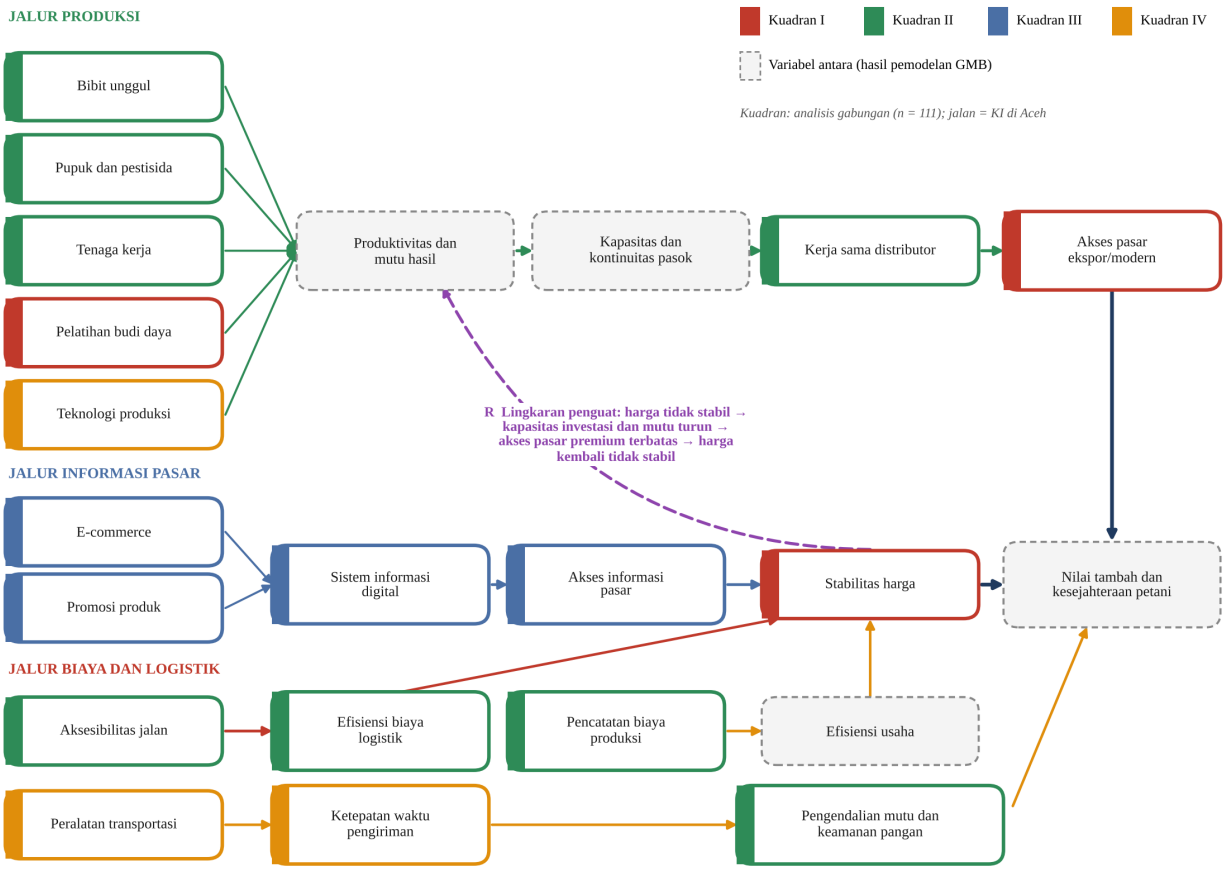

Figure 3. Causal map of GMB results. The box outline color indicates the combined IPA quadrant; the dashed box is the intermediate variable of the modeling results. Road accessibility is in the KI for Aceh, while distributor cooperation and cultivation training are in the KI for Bengkulu.

This structure contains a reinforcing loop: unstable prices reduce investment capacity and quality; low quality limits access to premium markets; and reliance on local markets maintains buyer concentration and price volatility. Price stability serves as a convergence node that receives influence from all three pathways, so improving one pathway without the others risks being weakened by the remaining two. This infrastructure–market–price node aligns with the IPA results, with different entry points: roads in Aceh, and prices, market access, and distribution governance in Bengkulu. These findings also align with the Kenyan experience, where market-stabilizing contract farming was only effective with the support of infrastructure and market access (Murigi et al., 2024).

Green MSME readiness

Cavendish MSMEs in both provinces are at the Eco-Adopter level, the entry level of Bank Indonesia's three categories (2023), across all six dimensions. In the production dimension, basic agronomic practices are adequate, but renewable energy, organic waste utilization, and certification (HACCP, ISO 14001, GlobalG.AP) are missing. In marketing, MSMEs have not yet reached export markets and have not differentiated green products. In human resources, training is not yet responsive, especially in Bengkulu. In finance, green financing instruments have not been utilized; in regulatory compliance, environmentally-based operational standards are minimal; and in ecological performance, monitoring of carbon footprint and resource efficiency has not been carried out. This condition is consistent with the finding that green business strategies and product differentiation drive green innovation (Jumpakita Pinem & Listyorini, 2022): without differentiation and certification, MSMEs cannot advance to the Eco-Entrepreneur level.

Integrated intervention framework

Table 2 translates the results of the IPA, GMB, and green MSME readiness into interventions per indicator and their priorities. Priorities are determined from the combined quadrants and adjusted to the provincial profile (column 3).

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Table 2. Integrated intervention framework per indicator

No	Indicators (combined quadrant)	Dimensions of green MSMEs	Priority	Main interventions
1	Road accessibility (II)	Production	Very high (KI Aceh)	Improvement of farm roads in the highlands (Bener Meriah) through collaboration between the public works department and village government; collective scheduled transportation
2	Price stability (I)	Marketing	Very high	Price buffer funds and base price contracts through cooperatives; open price information; buyer diversification
3	Export/modern market access (I)	Marketing	Very high	GAP/HACCP/GlobalG.AP certification; purchasing contracts with modern retailers; partnerships with exporters
4	Superior seed varieties (II)	Production	Keep it up	Certified seeds through cooperatives or breeders
5	Distributor cooperation (II)	Marketing	High (KI Bengkulu)	Formal contract-based partnerships that include quality standards and pricing mechanisms
6	Logistics cost efficiency (II)	Ecology	Keep it up	Load consolidation and route optimization
7	Cultivation training (I)	HR	Very high (KI Bengkulu)	Needs-based training: GAP field school, green economy, sustainable mentoring
8	Fertilizers and pesticides (II)	Ecology	Keep it up	Gradual transition to organic/biological inputs and integrated pest management
9	Availability of labor (II)	HR	Keep it up	Harvesting and post-harvest skills; farmer working groups
10	Quality control and food safety (II)	Regulation	Keep it up	SOP for food quality and safety; residue testing; certification preparation
11	E-commerce (III)	Marketing	Development (gradually)	Digital market assistance and platform literacy after IP is handled
12	Product packaging (III)	Marketing	Development	Eco-friendly packaging and green branding
13	Storage facilities (III)	Production	Development	Cold storage and fermentation room owned by the cooperative
14	Product promotion (III)	Marketing	Development	Co-branding, trade shows, product origin storytelling
15	Digital information systems (III)	Marketing	Development (gradually)	QR traceability and pricing dashboard
16	Access to market information (III)	Marketing	Development	Regular price and market information from government agencies and cooperatives
17	Production technology (IV)	Production	Review efficiency	Selectively conserve resource technologies; avoid overinvestment
18	Recording of production costs (II)	Finance	Keep it up	Simple cost recording application as a condition for accessing green financing (e.g. green MSME program, BPDLH)
19	Timeliness of delivery (IV)	Marketing	Review efficiency	Cooperative coordinated delivery schedule
20	Transportation equipment (IV)	Ecology	Review efficiency	Cooperative fleet and energy-efficient vehicles

Shaded cells = very high priority. Source: synthesis of the results of science, GMB, and green MSME analysis.

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Green MSME business model

The synthesized business model is presented in Table 3. Its value proposition, certified eco-friendly and traceable export-grade Cavendish bananas, addresses the export market access constraints faced by KI. Because certification is a driver of change but not a sole solution (Alho et al., 2021), the model combines it with cooperative aggregation, purchasing contracts, and green financing. Contract farming has been shown to increase banana farmer productivity and income in Kenya (Murigi et al., 2024), making formal distributor partnerships a core component, particularly for Bengkulu. Diversifying revenues from fresh fruit to processed products, seedlings, and cooperative services is designed to reduce dependence on a single market price, in line with the notion that the business case for sustainability needs to be systematically created through business model innovation (Schaltegger et al., 2012). The sequence of implementation differs: in Aceh, roads and logistics consolidation should precede certification and contracts; in Bengkulu, contracts, distributor partnerships, and training can begin immediately.

Table 3. Business Model Canvas of Cavendish banana agribusiness based on green MSMEs in Aceh and Bengkulu

<table>
<tr>
<td rowspan="2">8. Main partners
– Farmers' cooperative
– Department of Agriculture and Cooperatives/MSMEs
– Distributors and exporters
– Certification body
– Digital platform provider
– Bank Indonesia and banking
– BPDLH and development partners</td>
<td>7. Main activities
– Cultivation according to GAP
– Sorting, grading, and quality control
– Cold chain logistics and eco-friendly packaging
– QR Traceability
– Green MSME training
– Certification and compliance
– Cooperative governance</td>
<td rowspan="2">2. Value proposition
– Export-grade Cavendish, environmentally certified, with traceable origins
– Consistent and safe supply of food
– Processed products
– Fair partnership for small farmers</td>
<td>4. Customer relations
– QR-based supply chain transparency
– Long-term B2B contracts
– After-sales quality assurance
– Green consumer education</td>
<td rowspan="2">1. Customer segments
– Modern retail and supermarkets
– Export market
– Food processing industry
– Hotels, restaurants and catering
– Healthy/organic product market</td>
</tr>
<tr>
<td>6. Main resources
– Certified seeds
– Highland land
– Traceability platform
– Post-harvest and packaging facilities
– Trained facilitators
– Access to green finance
– Certification credentials</td>
<td>3. Channels
– Modern retail
– B2B contract platform
– Export agent and logistics partner
– Cooperative hub
– Online market</td>
</tr>
<tr>
<td colspan="3">9. Cost structure
– Environmentally friendly inputs and GAP technology
– Cold chain and post-harvest
– Digital platform
– Packaging and branding
– Certification and audit
- Training
– Cooperative overhead
– Green capital costs
– Logistics and export documents</td>
<td colspan="2">5. Income stream
– Fresh fruit (domestic and premium export)
– Processed products
– Certified product price premium
– Certified seeds
– Cooperative service fees
– Green grants and financing
– Carbon credits (prospective, medium–long term)</td>
</tr>
</table>

Aligned with SDGs 1 (no poverty), 2 (no hunger), 8 (decent work and economic growth), and 12 (responsible consumption and production). Source: author's synthesis.

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Policy implications and limitations

For local governments and relevant ministries, these results imply five sequential steps: (i) prioritizing farm roads in Aceh's highland centers; (ii) strengthening cooperatives as price buffers and supply aggregators through purchasing contracts, particularly in Bengkulu; (iii) facilitating food quality and safety certification; (iv) connecting MSMEs with green programs and financing; and (v) sequencing digital interventions once infrastructure and market constraints are addressed. Theoretically, this study demonstrates that cross-regional data aggregation can mask local barriers, and that IPA–GMB–BMC triangulation can link diagnosis, causal structure, and business model design.

Limitations include a purposive sample size within a single period, which limits generalizability, untested interpretation of the aspiration gap, and validation of the BMC on a subgroup of GMB participants without a financial feasibility test. Carbon credit revenue is also still prospective. Further research is needed to test financial feasibility, pilot the model through cooperatives, and evaluate its impact on farmer incomes.

CONCLUSION

The Cavendish banana value chain in Aceh and Bengkulu is constrained by infrastructure-market-price links with different entry points: road accessibility in Aceh (gap 1.90), and price stability, export/modern market access, cultivation training, and distributor cooperation in Bengkulu (gap 1.45–1.90). GMB results indicate that these three factors are mutually reinforcing through feedback loops, making it unlikely that partial interventions will result in sustained value increases. All MSMEs are at the Eco-Adopter level with relatively functional agronomic and logistical foundations. The proposed business model combines eco-certification, digital traceability, contractual partnerships through cooperatives, revenue diversification, and green financing, with the sequence of interventions tailored to the profile of each province.

FUNDING, ACKNOWLEDGMENTS, AND DISCLAIMERS

Funding. This research was supported by the Ministry of Higher Education, Science, and Technology of the Republic of Indonesia through the Directorate of Research, Technology, and Community Service (DRTPM) under the Research and Innovation Collaboration for National Progress (KATALIS) scheme for the 2025 Fiscal Year. **Acknowledgements.** The authors thank the LPPM of Teuku Umar University and the farmers, MSMEs, and stakeholders in Aceh and Bengkulu for their participation. **Conflict of interest.** The authors declare no conflict of interest. **Data availability.** Data are available from the corresponding author upon reasonable request; data are not published to protect the confidentiality of respondents.

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