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Empowering Galo-galo Honey MSMEs Through Integrated Innovation: Transforming Production, Branding, and Digital Market Access of KTH Sungai Gariang

Jonson Handrian Ginting^{1*}, Muhammad Parikesit Wisnubroto², Afrida¹

¹Department of Anthropology, Faculty of Social and Political Sciences, Universitas Andalas, Padang, Indonesia

²Department of Agroecotechnology, Faculty of Agriculture, Universitas Andalas, Dharmasraya Regency, Indonesia

*Corresponding author: jonson@soc.unand.ac.id

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ABSTRACT

Stingless-bee honey has economic potential for forest-based communities, but small producer groups often face connected constraints in quality control, production, branding, business administration, and market access. This community service program strengthened the competitiveness of the galo-galo honey enterprise managed by the Sungai Gariang Forest Farmer Group (KTH) in Lubuk Minturun, West Sumatra. Conducted from May to December 2025, the program used participatory problem identification, technical training, field mentoring, and end-line evaluation. Outcomes were assessed through observation, practical demonstrations, production and sales records, activity documentation, and before-and-after descriptive comparison. The intervention provided a moisture meter, 10 stingless-bee colonies, a digital scale and power support, three bottle formats, branding and product-diversification assistance, simple financial recording, and digital marketing training. The moisture meter enabled an initial measurable assessment of approximately 30%, demonstrating that moisture reduction remained necessary. Production increased from 10 kg to 12 kg per harvest, or 20%, while recorded sales rose by approximately 20–25% during the first three months after digital promotion began. The group adopted the Lomin brand, activated TikTok and Shopee, and obtained halal certification and a PIRT permit. The findings show that sequencing technical, managerial, institutional, and marketing interventions can strengthen enterprise capacity, although moisture-reduction technology and longer-term market monitoring remain necessary.

Keywords: community enterprise, e-commerce adoption, halal certification, product diversification, stingless bee

INTRODUCTION

Honey is a natural product with high economic, nutritional, and functional value. It is widely consumed not only as a sweetener but also as a source of bioactive compounds with antibacterial, antioxidant, and health-supporting properties. Public demand for natural honey has increased in recent years, especially after the COVID-19 pandemic, when awareness of immunity, healthy food consumption, and natural products became more prominent (Ahmed et al., 2018). In Indonesia, this opportunity is strongly supported by tropical biodiversity, which provides favorable ecological conditions for cultivating various honey-producing bee species. Among these species, stingless bees, locally known in West

Sumatra as galo-galo, have considerable potential because they contribute to pollination while producing honey with distinctive taste, nutritional characteristics, and economic value (Humaida et al., 2023). The development of galo-galo honey, therefore, has a dual significance: it can strengthen community-based economic activities while also supporting environmental sustainability.

The Sungai Gariang Forest Farmer Group, or KTH Sungai Gariang, located in Lubuk Minturun, West Sumatra, is one of the community groups with strong potential to develop galo-galo honey as a local micro, small, and medium enterprise (MSME) product. Since 2022, the group has begun cultivating stingless bees as part of post-pandemic livelihood diversification. The group cultivates stingless bees, including *Trigona* spp. and *Heterotrigona* spp., which have different physicochemical characteristics, sensory profiles, and bioactive potential (Khabibi et al., 2022). The forest-based cultivation environment also supports colony sustainability by providing continuous natural forage, which is essential for stable bee productivity and honey production (Setya Priambudi et al., 2021). This ecological setting makes KTH Sungai Gariang a strategic partner for developing a community-based honey enterprise rooted in local natural resources.

Despite this potential, the development of galo-galo honey MSMEs in KTH Sungai Gariang still faces several interrelated problems. One of the most basic problems is the absence of measurable product quality control. Before this community service program, farmers lacked a moisture meter and therefore could not determine the actual moisture content of their honey. This condition limited their ability to assess whether their products met recommended quality standards. Honey's moisture content is a critical indicator because excessive moisture can accelerate fermentation, shorten shelf life, and undermine consumer trust in product quality (Agussalim et al., 2021; Saputra et al., 2020). In the case of KTH Sungai Gariang, a moisture meter later showed that the honey's moisture content was approximately 30%, still above the recommended standard of 22–25%. This finding indicates that the main problem was not simply the lack of technology to reduce moisture content, but the absence of an initial measurement system that would enable farmers to scientifically assess and manage product quality.

Another problem concerns production capacity. Before the program, farmers produced approximately 10 kg of galo-galo honey per harvest. This production volume remained limited because the number of productive colonies was insufficient to support a more stable, scalable MSME model. In stingless bee cultivation, colony availability is directly related to production continuity, although productivity also depends on environmental factors, forage availability, colony health, and post-harvest handling. The addition of colonies, therefore, becomes an important step in increasing production capacity, but it must be accompanied by better management practices to ensure sustainability. At the same time, product handling and packaging remained relatively simple, limiting the honey's ability to compete in broader markets. Without standardized packaging, clear labeling, and attractive product presentation, local honey tends to rely on informal, local sales networks.

Marketing and branding limitations also reduce the competitiveness of galo-galo honey produced by KTH Sungai Gariang. Prior to the program, the product lacked a strong brand identity, modern packaging, or a consistent promotional strategy. Such limitations made it difficult for the product to build consumer recognition and trust. In many MSME contexts, weak branding and reliance on intermediaries often reduce producers' bargaining position and profit margins (Wijayanti & Nugraha, 2019). This problem becomes increasingly important because consumer behavior has shifted toward digital platforms, where product visibility, visual presentation, customer engagement, and trust-building are central to market expansion. Digital marketing has been shown to improve MSME competitiveness by expanding market reach, reducing distribution barriers, and enabling

producers to interact more directly with consumers (Yuliana & Putra, 2021). For local honey products, digital marketing is not merely a promotional tool but also a strategy to reposition traditional products in a broader, more modern consumer market.

Institutional and managerial capacity also remains an important issue. MSMEs lacking clear legal status, simple financial records, and basic management systems often struggle to enter formal markets or build partnerships with external actors. Business legality, including business identification and food production certification, plays an important role in strengthening consumer confidence and expanding access to formal distribution channels (Kusmanto & Warjio, 2019). Community empowerment studies also emphasize that institutional strengthening is essential for improving MSME sustainability and competitiveness, especially when community groups seek to transform household-scale activities into more professional enterprises (Nugroho & Pramesti, 2021). In this context, assistance in financial recording, business planning, and legality preparation becomes part of a broader empowerment process rather than a separate administrative activity.

Previous honey and local-MSME service programs have generated useful gains through instruction in harvesting, basic processing, packaging, promotion, or short-term training. Their principal limitation is not the absence of benefits, but the tendency to address isolated points in the value chain and to report activities without connecting measurable changes in production, organizational practice, and market performance. Product diversification can increase the attractiveness of local food enterprises, while appropriate technology, sustained mentoring, action-based empowerment, and financial literacy each contribute to business capacity (Ginting et al., 2024; Handayani et al., 2020; Harahap et al., 2019; Riyanti et al., 2019; Suryani & Hidayat, 2020; Widodo et al., 2020). What remained insufficiently addressed was a sequenced model that begins with an empirical diagnosis of product quality, links production inputs to brand and product development, formalizes business practices, activates digital sales channels, and evaluates the resulting changes with before-and-after records.

The programmatic and empirical novelty of this initiative lies in treating the KTH enterprise as one connected system rather than as separate production, packaging, and promotion problems. The intervention linked diagnostic quality measurement, colony-based production support, product differentiation, financial administration, legal certification, and digital channel activation within a single mentoring cycle. Its contribution is therefore an integrated value-chain empowerment model whose outcomes are traced through observable indicators: the ability to use a moisture meter, moisture measurement results, production per harvest, sales growth, the number of packaging formats and active digital channels, brand adoption, and business certification. Based on this framework, the program aimed to strengthen the competitiveness and sustainability of the galo-galo honey enterprise managed by KTH Sungai Gariang while identifying the technical and organizational constraints that still required follow-up.

METHOD

This community service program was conducted with KTH Sungai Gariang in Lubuk Minturun, West Sumatra, Indonesia. The partner was selected because it had cultivated galo-galo honey since 2022 but still required capacity strengthening in quality control, production management, branding, business administration, and digital marketing. The operational program ran from May to December 2025, preceded by initial communication and orientation on 29 April and action planning on 30 April 2025. The unit of intervention and analysis was one partner enterprise, KTH Sungai Gariang, with core members involved in honey production, packaging, administration, and sales, participating according to their

respective activities. The available attendance documentation did not consistently record participants' ages, genders, or educational backgrounds; consequently, numerical demographic distributions could not be reliably reconstructed. This documentation gap is acknowledged as a methodological limitation.

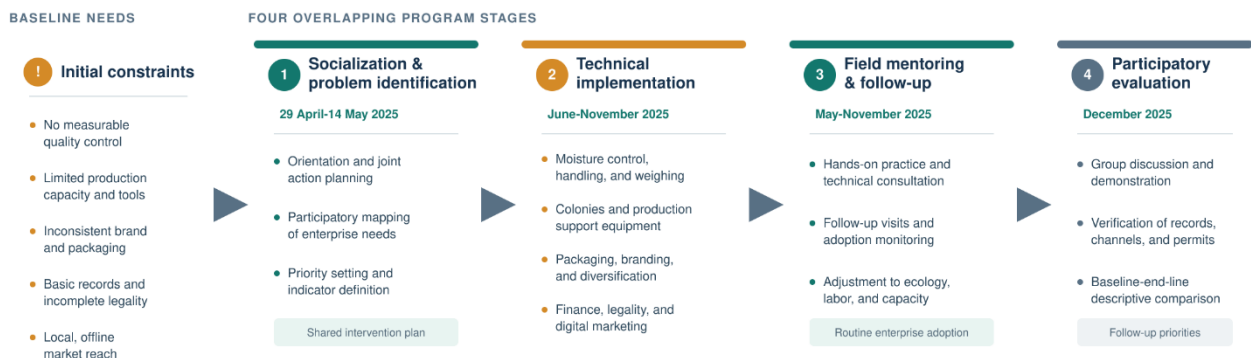


Figure 1. Community service program design and implementation flow at KTH Sungai Gariang.

The program comprised four overlapping stages. Socialization and problem identification covered orientation on 29 April, action planning on 30 April, and planning reinforcement on 3 and 14 May 2025. Technical implementation included a progress review and a discussion of the business model and legal aspects on 4 June, a production consultation on 19 June, field validation on 27 June, and the handover of 10 colonies, a moisture meter, and a red-ginger honey sample on 5 July. Power-support equipment was handed over on 19 July and 16 August. Field mentoring ran from May to November through consultations, practice, and follow-up visits. On 8 November, the team provided a large-capacity digital scale and conducted digital marketing training for use on marketplaces and TikTok. A participatory end-line evaluation was conducted in December 2025 after partners had implemented the introduced practices.

Technical training combined with explanation and hands-on practice. Materials covered moisture measurement, post-harvest handling, colony and production management, accurate weighing, three packaging sizes, brand and label use, red-ginger infused honey, and sachet or stick-pack diversification, simple financial recording, and digital promotion through TikTok and Shopee. Participants practiced operating the tools and preparing products during training and mentoring rather than receiving lecture-only instruction.

Field mentoring supported the transfer of training into routine enterprise practice. The team observed the use of the moisture meter and digital scale, discussed colony and harvesting constraints, reviewed packaging and product identity, assisted with basic cost and sales recording, and accompanied the preparation of digital content and marketplace listings. Repeated contact allowed technical and marketing decisions to be adjusted to the group's ecological conditions, available labor, and operational capacity.

Participatory evaluation combined end-line group discussion with verification of tangible outputs and records. Technical capacity was assessed through participants' ability to demonstrate tool use and interpret moisture readings. Production and commercial changes were assessed from harvest and sales records. Managerial, institutional, and marketing adoption was assessed through evidence of financial records, use of the Lomin identity and three bottle formats, activation of TikTok and Shopee, and possession of halal certification and a PIRT permit. Because the intervention was evaluated at the enterprise level, no individual competency or satisfaction score was calculated.

The tools and materials included a portable honey moisture meter, a large-capacity digital scale, battery chargers and power-support equipment, honey harvesting equipment, three bottle sizes, labels and packaging materials, digital devices and editing applications for promotional content, red ginger for product trials, and 10 additional stingless-bee colonies. Each input was tied to a defined capacity indicator rather than treated solely as donated equipment.

Data were collected through field observation, group discussions, attendance and activity records, photographs, practical demonstrations, harvest records, three-month sales reports, and verification of digital channels and legal documents. Baseline evidence described the condition before intervention, while follow-up evidence documented changes after partners used the tools, production inputs, packaging, and marketing channels.

Evaluation indicators covered five domains: (1) technical capacity, measured by correct moisture-meter use and interpretation; (2) production, measured in kilograms per harvest and number of colonies added; (3) product development, measured by brand use, packaging formats, and variants introduced; (4) management and institutional readiness, evidenced by financial records and business certifications; and (5) marketing, evidenced by active digital channels and the percentage change in recorded sales during the first three months.

Data were analyzed descriptively through triangulation of observation, demonstrations, group discussion, and enterprise records. Production change was calculated as $[(\text{post-intervention output} - \text{baseline output}) / \text{baseline output}] \times 100$. Sales growth was calculated by comparing the three-month post-intervention record with the group's baseline sales record and is reported as a range because sales varied by month. Qualitative notes were coded into recurring themes concerning adoption, perceived utility, constraints, and sustainability. This before-and-after, participatory design was appropriate for assessing practical capacity and organizational change, but it does not establish causal effects equivalent to an experimental design (Mardikanto & Soebiato, 2014).

RESULTS AND DISCUSSION

1. Baseline Condition of Galo-galo Honey MSMEs

Before implementation, galo-galo honey at KTH Sungai Gariang was managed through experience-based practices and local sales networks. The group cultivated stingless bees and produced approximately 10 kg of honey per harvest, but it lacked a moisture meter, standardized weighing, a consistent brand, multiple packaging sizes, systematic financial records, active digital sales channels, and completed product certification. This baseline made the enterprise vulnerable to variable quality, limited production continuity, weak consumer recognition, and dependence on direct local buyers.

The absence of a moisture meter was the most important baseline quality problem. Without an instrument, the group could not determine the actual moisture content or use a numeric threshold in production decisions. The baseline challenge was therefore not only to increase output, but also to establish a repeatable measurement practice.

The baseline condition also showed that production capacity was still limited. Before the program, farmers produced approximately 10 kg of galo-galo honey per harvest. This production level was related to the limited number of productive colonies and the need for better colony management. In addition, the product was still marketed with simple packaging and without a strong brand identity. These conditions limited the product's ability to compete in broader markets, especially because local honey products increasingly

require quality assurance, attractive packaging, and clear product information to build consumer trust.

2. Strengthening Honey Quality Control through Moisture Measurement

The first major achievement was the shift from experience-based quality assessment to measurable quality control. The moisture meter was important because visual observation, taste, and viscosity could not determine whether the product approached the recommended moisture range. After hands-on practice, members could operate the instrument, read the result, and use the reading to identify the need for improved post-harvest handling. This changed the partner's capacity from being unable to diagnose moisture risk to being able to monitor it as a routine production parameter.



Figure 2. Handover of a moisture meter to KTH Sungai Gariang for honey quality control

As shown in Table 1, the initial measurement using the moisture meter showed a moisture content of approximately 30%, exceeding the recommended range of 22–25%. The program, therefore, did not classify the honey as compliant. Its immediate result was diagnostic capacity: the group could identify a previously invisible quality problem and use the result to plan corrective action. This distinction prevents the transfer of a measuring device from being misrepresented as an automatic improvement in product quality.

Moisture remained high because the intervention supplied diagnostic equipment but not a dehumidifier or other controlled moisture-reduction system. The humid production environment, the hygroscopic nature of honey, variation in harvest maturity, and open handling during extraction may also contribute to elevated readings. These factors explain why awareness and measurement improved before the product itself reached the target range. Future assistance should therefore pair routine measurement with closed handling, controlled storage, harvest-maturity guidance, and an appropriate dehumidification process that preserves sensory quality.

3. Increasing Production Capacity through Colony Addition

The second important result of the program was the increase in production capacity through the provision of 10 additional stingless bee colonies. Before the program, farmers produced approximately 10 kg of galo-galo honey per harvest. After the additional colonies were provided, production increased to approximately 12 kg per harvest. This means that honey production increased by 2 kg, or 20% compared to the initial condition.

The 20% increase is an early indicator that additional colonies expanded production capacity, but it should not be interpreted as proof of long-term growth. The increase was

smaller than the proportional rise in colony numbers because newly introduced colonies require adaptation and not all colonies produce equal harvest volumes. Productivity also remained constrained by colony health, seasonal flowering, forage availability, labor for maintenance, and harvesting intervals. Continued records across several harvest cycles are needed to distinguish sustained improvement from seasonal variation.

The result indicates that production support was most effective when it combined physical inputs with consultation and repeated field validation. Colonies provided productive assets, while mentoring helped the group discuss placement, maintenance, harvesting, and production planning. The practical fit between the intervention and the group's existing forest-based livelihood increased the likelihood of adoption because the program extended skills and resources already present in KTH Sungai Gariang.

Table 1. Verified organizational indicators before and after the program

No.	Indicator	Baseline	Post-intervention evidence	Descriptive change
1	Moisture control	No measuring instrument; moisture unknown	Meter used; initial reading approximately 30%	Measurement adopted; quality gap identified
2	Production per harvest	10 kg	12 kg	+2 kg (+20%)
3	Productive assets	Limited colonies and weighing equipment	10 colonies, digital scale, and power support provided	Production infrastructure expanded
4	Brand and packaging	No consistent brand; simple packaging	Lomin brand and three bottle formats used	1 brand and 3 formats adopted
5	Product diversification	Honey sold mainly in one form	Red-ginger infused honey and sachet/stick packs trialed	2 diversification options introduced
6	Digital channels	No active marketplace or short-video channel	TikTok and Shopee activated	2 digital channels activated
7	Sales	Baseline group sales record	Three-month post-intervention sales record	Approximately +20–25%
8	Business administration	Records limited and unsystematic	Basic production, cost, inventory, and sales records used	Organizational recording initiated
9	Product legality	Halal and PIRT credentials unavailable	Halal certificate and PIRT permit obtained	2 product credentials secured

4. Branding, Packaging, and Product Diversification

Product identity was strengthened through adoption of the Lomin: Madu Galo-Galo brand, clearer labeling, and three bottle formats suited to different purchase needs. The group also obtained halal certification and a PIRT permit, allowing branding claims to be supported by formal product credentials. These changes were important because they transformed the honey from an informally presented commodity into a more recognizable and market-ready product, thereby improving consumer trust and the group's capacity to approach wider sales channels.

Branding allowed consumers to recognize the product's origin and distinguish it from similar commodities. In this case, the brand worked together with labels, packaging sizes, and certification to communicate professionalism and traceability rather than functioning as a logo alone.

Product diversification included a red-ginger-infused honey trial and sachet or stick-pack formats. The activities were important because they gave the partner alternatives for differentiating the product and reaching consumers seeking functional or smaller-portion products. The immediate capacity change was the group's ability to prepare and present more than one product format; however, wider commercialization still requires consistency testing, shelf-life assessment, food-safety verification, and consumer acceptance data.



Figure 3. Socialization of red ginger-infused galo-galo honey as a product diversification strategy

Diversification should therefore be interpreted as a product-development outcome rather than as a fully validated commercial product. Its value lies in expanding the partner's innovation repertoire and creating a basis for subsequent testing. This cautious interpretation separates demonstrated capacity from claims that would require laboratory and consumer evidence.

5. Digital Marketing and Market Access Expansion

Marketing practices changed from predominantly direct local sales to a combination of offline sales and digital promotion. Training and mentoring activated TikTok and Shopee, supported product photography and short-form content preparation, and linked online presentation to the Lomin identity and standardized packaging. Three-month sales records indicated an increase of approximately 20–25% after digital promotion began. Because absolute customer and engagement counts were not recorded consistently, the sales range is the principal quantitative market indicator reported in this study.

Digital channels expanded the partner's points of contact with consumers and reduced exclusive reliance on intermediaries. The increase in recorded sales suggests that channel activation, clearer product identity, and more consistent packaging worked together. The intervention succeeded because consumers encountered a product that was both more visible and easier to recognize, while KTH members had practical tools to produce and publish promotional material.

The results also show that channel activation alone is insufficient. Posting must be regular, messages must remain credible, inquiries require timely responses, and digital activity must be connected to available stock. The absence of systematic data on posting frequency, reach, engagement, and new-customer counts limits attribution of the sales increase specifically to digital marketing; these indicators should be incorporated into future monitoring.

6. Business Management and Financial Recording

Business management was strengthened through simple records of production costs, sales, income, and inventory. The digital scale and standardized bottle formats made quantities easier to record, while the sales log provided the basis for calculating the 20–25% increase. Although the recording system remained basic, it enabled the group to connect production decisions with commercial outcomes rather than relying solely on memory.

The main change was the creation of a repeatable administrative routine. Members could document inputs and outputs, compare periods, and identify stock and sales movements. Its sustainability depends on assigning responsibility for record keeping and maintaining the routine after external mentoring ends.

Institutional assistance resulted in halal certification and a PIRT permit for Lomin products. These outcomes strengthened formal market readiness and consumer assurance. They also show that empowerment extended beyond skills training to the institutional requirements that determine whether a community product can enter more regulated sales channels.

7. Integrated Impact and Sustainability Challenges

The results show that no single intervention could address the enterprise's constraints. Colony addition supported output, but its commercial value depended on quality diagnosis, standardized weighing and packaging, legal readiness, and market access. Similarly, digital promotion was more credible after the product had a stable identity and certification. The value of the integrated model therefore lies in sequencing mutually dependent changes across the enterprise.

Across the verified indicators, the program established moisture measurement, added 10 colonies, increased production by 20%, introduced one brand and three bottle formats, activated two digital channels, increased recorded sales by approximately 20–25% in the first three months, initiated financial records, and secured two product credentials. These changes strengthened technical, production, product-development, managerial, institutional, and marketing capacity at the organizational level.

The intervention succeeded because it was co-designed around the partner's stated problems, combined tangible tools with repeated practice, and connected production improvements to product and market readiness. Nevertheless, four challenges remain. First, moisture stayed above the target because no controlled reduction technology was available. Second, production growth remained limited by colony adaptation, seasonality, forage, labor, and variable colony productivity. Third, product variants require safety, shelf-life, and acceptance testing. Fourth, digital sales require regular content, customer response, stock coordination, and better analytics. The evaluation also lacked participant demographics, individual pre-test and post-test scores, satisfaction data, posting frequency, engagement statistics, and customer counts. These limitations mean the reported changes describe organizational progress during a relatively short follow-up period and should not be generalized as causal effects.

CONCLUSION

This community service program demonstrates that strengthening a forest-based galo-galo honey enterprise requires a sequenced approach linking diagnosis, production assets, product development, administration, certification, and market access. At KTH Sungai Gariang, The moisture meter enabled an initial moisture measurement of approximately 30%, identifying the need for moisture-reduction technology. Ten

additional colonies increased production from 10 kg to 12 kg per harvest, or 20%. The Lomin brand, three bottle formats, product-diversification trials, simple financial records, TikTok and Shopee activation, halal certification, and a PIRT permit improved organizational and market readiness, while recorded sales rose by approximately 20–25% during the first three months. The contribution of the program lies in demonstrating how mutually dependent interventions can build technical, managerial, institutional, and marketing capacity. Future work should prioritize controlled moisture reduction, multi-harvest production monitoring, laboratory and consumer testing, standardized participant data, individual competency assessment, and digital analytics.

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