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Empowering Local Communities Through a Sustainable Agribusiness Model Oriented to Local Wisdom: A Meta-Synthesis of the Toba Frankincense Literature

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Abstract
Toba frankincense (Styrax spp.) is a non-timber forest product with economic, social, cultural, and ecological value for local communities in North Sumatra. However, its development still faces various challenges, such as limited access to customary forests, low product added value, weak bargaining power of farmers, and suboptimal utilization of technology and innovation. This study aims to map and synthesize literature findings regarding the practices, challenges, and potential of Toba frankincense agribusiness, identify elements of local wisdom that support ecological, social, and economic sustainability, and formulate a conceptual model for community empowerment based on sustainable agribusiness. The study used a literature meta-synthesis approach by reviewing relevant scientific publications in the 2018–2026 period. The synthesis results indicate that Toba frankincense development has potential through agroforestry systems, business diversification, strengthening community institutions, and value chain development. Local wisdom in the form of traditional knowledge, customary rules, cooperation, and intergenerational knowledge transfer is an important foundation in maintaining the sustainability of frankincense forest management. Based on these findings, an empowerment model was formulated that integrates four main components: human resource development, sustainable production, technology and innovation, and value chain strengthening. This model is expected to encourage increased income, economic independence, social justice, and the sustainability of the Toba frankincense forests.

Keywords: Agribusiness; Community Empowerment; Local Wisdom; Meta-Synthesis; Toba Frankincense

Introduction

The global agricultural sector faces interconnected pressures: food security, rural poverty, and environmental degradation. A recent report by the FAO and UN agencies estimates that approximately 673 million people, or 8.2% of the world's population, will experience hunger by 2024. Furthermore, approximately 2.3 billion people still experience moderate or severe food insecurity (FAO, IFAD, UNICEF, WFP, 2025). The same report noted that 2.6 billion people lack access to a healthy diet. These figures demonstrate that agricultural issues are no longer limited to increasing production. They also concern the fair distribution of value, the resilience of smallholder farmers' livelihoods, and the sustainability of natural resources. The concept of sustainable development, which integrates the needs of the present generation with the capabilities of future generations, demands an agribusiness model that does not sacrifice ecosystems or local communities as primary producers (Sitompul et al., 2024).

This problem is also evident in non-timber forest products (NTFPs). Frankincense (Styrax spp.) from North Sumatra is an example. The government stated that Indonesia exported 43,000 tons

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of frankincense worth over US$52 million the previous year, and approximately 30% of the population of North Tapanuli and Humbang Hasundutan depend on this commodity for their livelihood (Tasyarani, 2025). However, the added value enjoyed by farmers remains low. Several studies have identified obstacles such as limited access to processing technology, price fluctuations, and a lack of downstream infrastructure (Simbolon et al., 2025). This pattern has long been apparent. A study in Sampean Village, Humbang Hasundutan, found that farmers' profits dropped dramatically when their own labor was included in the cost, far below those from rice or coffee (Gaol & Simangunsong, 2012). This value gap is also illustrated by BRIN, namely that raw resin is sold for around Rp. 200,000 per kilogram, while styrax oil can reach at least Rp. 5 million per kilogram (Sofia, 2026).

Specifically, Toba frankincense (Styrax sumatrana), which in the Toba Batak language is called haminjon, is a typical plant that only grows in areas such as North Tapanuli, Humbang Hasundutan, and Toba (Wulandari et al., 2023). Frankincense is managed in an agroforestry system based on frankincense gardens that are passed down across generations. Harada et al (2022), This study shows that communities harvest resin in ancestral frankincense forests and have a strong sense of responsibility to preserve it as a tradition. Thus, frankincense is both an economic resource and the basis of local wisdom in forest management. However, the sustainability of this resource is threatened. Distribution modeling indicates that suitable habitat for S. sumatrana is predicted to shrink between 2050 and 2070 under climate change scenarios (Saputra & Lee, 2021). Land suitability evaluation in Humbang Hasundutan also shows that the land is classified as moderately suitable in the three villages studied, so that cultivation development requires sustainable land use practices (Rahmawaty, Ismail et al., 2023).

To analyze this issue, an integrated theoretical framework is required. First, the sustainable livelihoods approach views livelihoods as a system of capabilities, assets, and activities that must be resilient to pressures while not destroying the resource base (Chambers & Conway, 1992). Second, community empowerment is understood as a process of increasing community control over decisions and resources that affect their lives (Zimmerman, 2000). Third, traditional ecological knowledge is seen as the basis for adaptive management that develops through local practices and institutions (Berkes, 2012; Berkes et al., 2000). Fourth, the value chain concept explains that competitive advantage and value distribution are determined by a series of activities from production to marketing.(Porter, 1985)The combination of these four forms the basis for a sustainable agribusiness model oriented toward local wisdom. Meta-synthesis was chosen as the method because it is able to integrate findings from many separate studies into a new conceptual understanding (Noblit & Hare, 1988; Sandelowski & Barroso, 2007).

Previous research has touched on various aspects, but is still fragmented. Harada et al (2022) They examined customary management systems, production, and commercialization of frankincense resin in North Sumatra. They emphasized the value of frankincense for local livelihoods and the importance of maintaining customary practices. Saputra & Lee (2021) shows the threat of climate change and land conversion to the distribution of S. sumatrana.Rahmawaty, Ismail et al (2023) evaluate the characteristics and suitability of Styrax land in Humbang Hasundutan as a basis for sustainable cultivation. Wulandari et al (2023) documenting frankincense agroforestry as local wisdom that supports livelihoods and the environment.Ridwansyah (2025) examines the chemical content and development prospects of North Sumatran frankincense through a literature review. Finally,Simbolon et al (2025) analyzed the downstreaming of frankincense as a strategy to increase farmers' income. These studies encompass ecological, cultural, technical, and economic aspects, but each proceeded independently. Based on the author's research, a systematic synthesis that integrates these findings into an agribusiness and empowerment model rooted in the local wisdom of Toba

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frankincense is still limited.

Therefore, this research is urgent. First, the policy of frankincense downstreaming is gaining momentum, and without a strong conceptual foundation, there is concern that its benefits will not reach farmers and may even erode traditional practices. Second, climate pressures and land conversion demand a model that simultaneously maintains the sustainability of frankincense plantations. Third, scattered evidence across various disciplines needs to be synthesized to inform policy formulation. Theoretically, this research enriches the study of sustainable agribusiness with a local wisdom and empowerment perspective through cross-study synthesis. Practically, the results can serve as a reference for farmers, farmer groups, cooperatives, local governments, and industry players in designing equitable and environmentally friendly value chains. Policy-wise, this research can support the strengthening of frankincense forest protection, partnerships, and downstreaming programs that favor local communities.

Based on the description, this study aims to (1) map and synthesize literature findings on the practices, challenges, and potential of Toba frankincense agribusiness; (2) identify elements of local wisdom that play a role in ecological, social, and economic sustainability; and (3) formulate a conceptual model of local community empowerment through local wisdom-oriented sustainable agribusiness based on the results of meta-synthesis.

Literature Review

The development of non-timber forest products (NTFPs), particularly frankincense resin (Styrax sp.), plays a strategic role within the framework of forestry economics and local community empowerment. Historically and sociologically, the use of frankincense is inseparable from the traditional knowledge systems of indigenous communities, where cultivation and tapping practices are passed down through generations based on local wisdom (Harada et al., 2022). Several literatures confirm that this local wisdom-based approach is ecologically capable of minimizing environmental damage, because forest management patterns are carried out in harmony with the rhythms of nature to maintain the sustainability of the life-supporting ecosystems around forest areas.

Despite its high economic value as an export commodity and raw material for the global cosmetics, pharmaceutical, and perfume industries, local frankincense farming often faces various structural challenges. Various studies show that the frankincense trade is still dominated by traditional supply chains involving numerous intermediaries, resulting in unequal profit margins, with farmers often receiving a smaller share of the price (farmer's share) than collectors (Hutapea et al., 2022). In addition, limited post-harvest processing infrastructure and low quality standardization or product grading at the farmer level hinder the optimization of this commodity's added value in both domestic and international markets (Sitompul et al., 2026).

Therefore, a sustainable agribusiness model that integrates community empowerment with forest conservation principles is a crucial solution for bridging economic and ecological boundaries. This approach requires integrated interventions, ranging from strengthening farmer institutional capacity (such as through cooperatives or community-based groups) to cut inefficient supply chains, to adopting environmentally friendly tapping techniques that ensure tree regeneration. Through a sustainable forest management framework oriented toward local wisdom, frankincense farming is expected to not only increase the income and welfare of farmer households equitably but also strengthen conservation incentives for communities within and around forest areas (Ayu et al., 2025).

Research Method

This research uses a qualitative approach with a meta-synthesis design. This design interpretively

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integrates findings from various existing studies, resulting in new conceptual understanding (Noblit & Hare, 1988; Sandelowski & Barroso, 2007). Meta-synthesis was chosen because evidence on Toba frankincense is scattered across ecological, economic, socio-cultural, and technological studies. The research did not involve direct field data collection. The reporting follows PRISMA 2020 and ENTREQ guidelines (Tong et al., 2012).

The data used is secondary. The primary data is qualitative, namely narrative findings, themes, and conclusions from previous studies. Supporting quantitative data, such as production, prices, farmer income, and land area, are used for context and are not meta-analyzed. Data sources include accredited international and national journal articles, proceedings, books or monographs, theses and dissertations, and official institutional reports (e.g., FAO, BPS, ICRAF, and BRIN). Searches were conducted through Scopus, ScienceDirect, Google Scholar, Garuda, and university institutional repositories.

The study sample was selected purposively based on criteria, as meta-synthesis aims to obtain depth of meaning rather than statistical generalization. The search used a combination of keywords with Boolean operators, for example, "frankincense" OR "haminjon" OR "Styrax sumatrana" AND "local wisdom" OR "agroforestry" OR "agribusiness" OR "empowerment" OR "downstream".

The inclusion criteria are as follows.

1. The study discusses frankincense or Styrax in North Sumatra (North Tapanuli, Humbang Hasundutan, Toba, Pakpak Bharat, and Dairi).
2. The study includes aspects of cultivation, institutions, local wisdom, value chains, or empowerment.
3. Published in 2018–2026, in Indonesian or English, and full text available.

Exclusion criteria included studies focused solely on the chemical or physical properties of wood without socioeconomic relevance, duplicate publications, and opinions lacking clear methodology. Older studies could still be retained as contextual references if they were fundamental. The selection process followed the four PRISMA stages: identification, title and abstract screening, full-text eligibility assessment, and inclusion.

Study quality was assessed using the Critical Appraisal Skills Programme (CASP) for qualitative research. For institutional reports and gray literature, the assessment used simple credibility criteria: clarity of data sources, methods, and publisher accountability. Each study was categorized as high, medium, or low quality. Low-quality studies were not automatically discarded but were tested through sensitivity analysis. Data were then extracted into a matrix containing author, year, location, design, focus, key findings, elements of local wisdom, barriers, and recommendations.

The analysis follows seven stages of meta-ethnography. Noblit & Hare (1988) starting, determining focus, reading studies, determining relationships between studies, translating studies to each other, synthesizing translations, and expressing the synthesis. Operationally, the analysis is carried out through thematic synthesis Thomas & Harden (2008) with the following steps Braun & Clarke (2006).

1. Findings were coded inductively and deductively. The initial coding framework included ecological, socio-cultural, economic or value chain, and institutional dimensions.
2. Grouping codes into descriptive themes.

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3. Development of analytical themes that go beyond the findings of individual studies.

Relationships between studies were examined through reciprocal translation when findings were consistent and refutational translation when they were contradictory. The results were integrated into a line-of-argument that formed the basis of the conceptual model. Interpretations were conducted by linking themes to theories of sustainable livelihoods, community empowerment, traditional ecological knowledge, and value chains.

Validity was maintained through source triangulation (journals, institutional reports, and books) and study type triangulation (ecological, economic, socio-cultural). Study selection and coding were carried out by two independent reviewers, and discrepancies were resolved through discussion. The researchers also maintained an audit trail in the form of a search log, a list of excluded studies and their reasons, and a record of analytical decisions. The research flow from problem formulation to recommendations is presented in Figure 1.

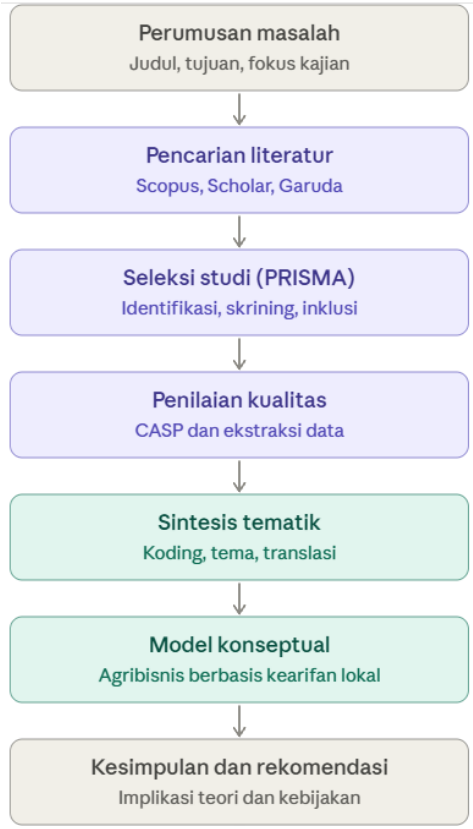


Figure 1. Framework and flow of meta-synthesis research

Results and Discussion

Characteristics and Development of Toba Frankincense Research 2018–2026

A significant trend in frankincense research is the shift in attention from production aspects to broader issues, namely community access to forest resources, institutional relationships, the distribution of economic benefits, and the strengthening of indigenous peoples' rights. A study of frankincense resin production and commercialization in North Sumatra, for example, demonstrates the importance of the relationship between commodity management, trade activities, and local livelihoods. Furthermore, research on conflicts over access to frankincense and eucalyptus forest resources in Ahmad et al (2025) broadens the study's perspective by positioning resource control and community rights as crucial to the sustainability of frankincense

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management. Table 1 summarizes the key studies that form the basis of the synthesis.

Table 1. Characteristics of the Analyzed Articles

No	Author and Year	Article Title	Journal/ Publication	Focus of Study	Study Location	Research methods
1	Aswandi, Kholibrina, and Iswanto (2019)	Integrating Styrax-Coffee Agroforestry System and Apiculture as Alternative Source of Livelihood for Communities in Lake Toba Catchment Area, North Sumatra	Proceedings of the International Conference on Natural Resources and Technology (ICONART), p. 252–260. DOI: 10.5220/0008552602520260	Integration of frankincense-coffee agroforestry with bee cultivation as an alternative source of income for the community and an effort to increase land productivity.	Aek Nauli, Simalungun, Humbang Hasundutan, and Pakpak Bharat, North Sumatra	Field study and analysis of productivity and economic potential of agroforestry and beekeeping integration
2	Harada, Wiyono, and Munthe (2022)	Production and Commercialization of Benzoin Resin: Exploring the Value of Benzoin Resin for Local Livelihoods in North Sumatra, Indonesia	Trees, Forests and People, 7, 100174. DOI: 10.1016/j.tfp.2021.100174	Traditional management of frankincense forests, contribution of resin to community livelihoods, and the frankincense marketing chain	North Sumatra, Indonesia	An empirical study on traditional management systems and commercialization of frankincense resin
3	Ahmad, Mardiana, and Wahyuni (2025; published online 2025, entered Vol. 12 No. 3 in 2024)	Frankincense Versus Eucalyptus: A Struggle for Forest Resources Access in Pandumaan-Sipituhuta, North Sumatra	Sodality: Journal of Rural Sociology, 12(3), 264–282. DOI: 10.22500/12202459651	Contestation over access to forest resources between indigenous communities, the state and companies and the struggle for recognition of community rights to frankincense forests.	Pandumaan-Sipituhuta, Humbang Hasunduta Regency, North Sumatra	Qualitative; in-depth interviews with 10 key informants
4	Roswaldy (2025)	Mending the Broken Clock: Gender and Socioecological Changes in Postconflict North Sumatra	Journal of Agrarian Change, 25(4), e70017. DOI: 10.1111/joac.70017	Post-conflict socio-ecological changes, gender-based division of labor, women's livelihood conditions, and	Pandumaan-Sipituhuta, North Sumatra	Ethnography, interviews, time recording, and soil sampling

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		the impact of environmental change on farming households

Based on these developments, research on Toba frankincense can be grouped into several key trends: socio-cultural aspects, forest resource management, economics and commercialization, community institutions, and environmental sustainability. However, the interrelationships between these aspects still require a more integrative analysis, particularly in formulating an agribusiness model that positions local communities as key actors in the entire frankincense value chain.

Thus, the synthesis results indicate that the development of Toba frankincense requires a multidimensional approach. This approach is not simply focused on increasing resin production but also needs to integrate community economic interests, the preservation of local wisdom, institutional strengthening, technology development, and forest conservation.

Local Wisdom and Frankincense Forest Management System

The results of the literature synthesis show that local wisdom is a crucial foundation for the sustainable management of Toba frankincense. For the Toba Batak people, frankincense not only has commercial value but also has historical, social, and cultural connections to community life. The existence of frankincense forests is linked to traditional knowledge regarding land use, tree maintenance, tapping techniques, and the intergenerational transmission of resource management skills.

However, socioeconomic changes and pressure on forest resources can impact the sustainability of these traditional practices. Issues with access to forest areas, land-use changes, and limited regeneration among frankincense farmers pose challenges to maintaining local knowledge. A study of forest access conflicts involving frankincense and eucalyptus in Pandumaan-Sipituhuta shows that the sustainability of these commodities is also linked to the community's guaranteed access to forest resources.

Thus, local wisdom in the frankincense agribusiness has three main functions: as a guideline for ecosystem management, as a socio-cultural identity for the community, and as a source of knowledge for local economic development. These three functions demonstrate that preserving local wisdom must be an integral part of community empowerment strategies.

Community Empowerment and the Socio-Economic Dynamics of Frankincense Farmers

The synthesis results indicate that community empowerment is a crucial factor in the development of the Toba frankincense agribusiness. Local communities, particularly frankincense farmers, hold a strategic position due to their direct involvement in production and forest resource management. However, involvement as producers does not automatically guarantee improved welfare if communities still face limited access to capital, technology, market information, and economic institutions.

A study of frankincense resin production and commercialization in North Sumatra demonstrates the relevance of the relationship between production, trade, and local livelihoods. This demonstrates that frankincense plays a role in supporting household economies, but the economic benefits received by communities are also influenced by marketing structures and farmers' ability to access markets.

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In addition to economic aspects, community empowerment also needs to consider social dynamics and the division of roles in forest management. Roswaldy (2025) Research on socio-ecological and gender change in North Sumatra provides perspective on how changes in forest resource management influence the division of labor and women's experiences in local communities. These findings provide an important basis for developing inclusive empowerment, ensuring women are not only involved in supporting activities but also have opportunities in decision-making and business development.

Based on these results, community empowerment in the development of Toba frankincense needs to be understood as a process of increasing community capacity and independence, not simply providing assistance or training. The success of empowerment is determined by the community's ability to access resources, manage institutions, make decisions, and obtain economic benefits equitably.

Customary Forests, Community Rights, and Institutional Strengthening

Research on the conflict between frankincense and eucalyptus forests in Ahmad et al (2025) shows that changes in access to forest resources can create social and economic problems for communities. This situation demonstrates that the sustainability of frankincense commodities is determined not only by the technical capabilities of farmers but also by the certainty of community rights to manage forest areas.

Furthermore, research on the model for resolving customary frankincense forest conflicts through social forestry schemes illustrates the importance of strengthening institutions and mechanisms for recognizing community rights. In this context, social forestry can be an approach to strengthening community access to forest management in accordance with applicable laws and regulations.

From an agribusiness perspective, secure access to forest resources is a prerequisite for sustainable investment and community business development. Farmers with secure management are more motivated to maintain crops, cultivate nurseries, regenerate trees, and develop long-term businesses. Therefore, developing the frankincense agribusiness requires two complementary forms of institutional strengthening: forest resource management institutions and community economic institutions. Integrating the two is crucial to ensure management certainty while enhancing communities' ability to derive economic benefits from frankincense.

Value Chain and Sustainable Agribusiness Model Development

The synthesis results show that one of the challenges in developing the Toba frankincense agribusiness is the suboptimal involvement of the community throughout the value chain. Community economic activity remains heavily dependent on the production and sale of resin, while opportunities for processing, product diversification, and market development have not been fully utilized.

Problems arise when farmers act solely as raw material suppliers, while processing and marketing activities are largely handled by other business actors. This situation potentially limits farmers' ability to capture a greater share of added value. Therefore, frankincense agribusiness development needs to be directed at strengthening the value chain, involving communities from production to marketing. Developing joint venture groups and cooperatives can be a strategy to increase harvesting capacity, maintain quality consistency, and strengthen farmers' bargaining power.

From a processing perspective, the development of frankincense derivative products can be

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directed towards utilizing raw materials for the perfume, cosmetics, and natural product industries. However, such product development requires research support, quality testing, standardization, and product safety assurance. Strengthening product identity is also a crucial part of value chain development. Toba frankincense can be developed as a superior local product that highlights the geographical characteristics, history, and local wisdom of the Toba Batak people. This approach can be implemented through brand development, packaging, relevant certification, and a narrative of product origin.

The Role of Technology and Innovation in the Development of Toba Frankincense Commodities

The synthesis results show that technology plays a significant role in improving production efficiency, yield quality, added value, and the competitiveness of Toba frankincense. However, technology implementation needs to consider ecological characteristics, the socio-economic conditions of farmers, and the community's ability to adopt innovation (Sitompul et al., 2026). In terms of production, technology can be directed towards nursery development, selection of superior plant material, stand maintenance, and improvement of tapping techniques. The use of appropriate technology is expected to increase productivity without compromising tree health and sustainable plant regeneration. In terms of post-harvest, innovation can be developed through sorting, cleaning, drying, storage, and packaging technologies. Implementing quality standards is necessary to ensure products have more consistent characteristics and meet market requirements. In terms of downstream processing, universities and research institutions can play a role in developing technologies for processing frankincense resin into value-added products. Research on the chemical characteristics of raw materials, product formulation, and quality testing can form the basis for developing a frankincense-based industry.

Meanwhile, digital technology can be leveraged to expand access to information and marketing. The use of social media, e-commerce platforms, and pricing information systems allows farmers to introduce their products more widely and build relationships with consumers and business partners. However, digital marketing cannot stand alone without the availability of quality products, adequate production capacity, packaging systems, and business management capabilities. Therefore, technology implementation needs to be carried out gradually through training, mentoring, and partnerships with universities and the private sector.

Formulation of a Community Empowerment Model through Sustainable Agribusiness Oriented to Local Wisdom

The developed model positions local communities as key actors in resource management and agribusiness development. Local wisdom serves as the foundation for management, while strengthening technology, institutions, and value chains serve as instruments for increasing productivity and community well-being. This model consists of five interconnected components. First, strengthening local resources and local wisdom. This component encompasses frankincense forest protection, strengthening traditional knowledge, maintaining community culture, and sustaining resource management practices. Second, developing a sustainable production system.This component focuses on strengthening nurseries, tree maintenance, agroforestry management, commodity diversification, and environmental conservation. Third, strengthening community and institutional capacity. This includes improving farmer skills, strengthening farmer groups, establishing cooperatives, empowering women, and enhancing community business management capabilities. Fourth, developing technology and value chains. This component encompasses cultivation innovation, post-harvest technology, product processing, quality standardization, local brand development, and digital marketing. Fifth, strengthening agribusiness partnerships and governance. This component involves local governments, universities, research

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institutions, financial institutions, the private sector, and community organizations in supporting the development of the frankincense business.

These five components are expected to produce an agribusiness system that is able to provide economic, social, cultural and ecological benefits in a sustainable manner.

Conceptually, the interrelationships between these components indicate that the success of the frankincense agribusiness cannot be determined solely by increased production. Success also depends on secure community access to forest resources, institutional strength, the ability to develop added value, and the sustainability of local knowledge.

Research Novelty and Implications for Model Development

The novelty of this research lies in the development of an integrative framework for empowering local communities through a sustainable agribusiness model oriented toward the local wisdom of Toba frankincense. A literature synthesis shows that forest management, resource conflicts, community livelihoods, gender, and commercialization have been addressed in previous research. However, these aspects need to be integrated into an agribusiness development framework that places local communities at the center of decision-making and value-added creation.

The practical implications of this research are the need to develop empowerment programs that are not partial. Local governments need to strengthen policies on frankincense forest management and the development of superior local commodities. Universities should develop research and community service oriented towards technological innovation, product quality improvement, and strengthening farmer institutions. Meanwhile, the private sector can play a role in developing processing industries, business partnerships, and expanding market access.

Thus, a sustainable agribusiness model oriented toward local wisdom can be an alternative approach to community economic development based on local resources. The success of this model is measured not only by increased production and income, but also by strengthening community independence, equitable distribution of benefits, cultural preservation, and the sustainability of the Toba frankincense forest ecosystem.

Table 2. Research Findings Synthesis Matrix

No	Synthesis Theme	Literature Synthesis Results	Supporting Articles	Implications for Community Empowerment Models
1	Local Wisdom in Frankincense Forest Management	Frankincense forest management is not solely focused on the utilization of forest products, but also relates to land inheritance, customary rules, intergenerational responsibility, and forest preservation. Customary practices form the basis for sustainable frankincense production and the protection of local resources.	Harada et al. (2022)	The empowerment model needs to place local wisdom as the basis for agribusiness management, including strengthening customary rules, traditional knowledge, and regeneration of frankincense farmers.

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2	Economic Empowerment and Income Diversification	Dependence on a single commodity can increase the economic vulnerability of farming households. Integrating frankincense with coffee and beekeeping activities presents opportunities for diversifying income sources, increasing land productivity, and utilizing non-timber forest products.	Aswandi et al. (2019); Harada et al. (2022)	Economic empowerment needs to be directed at diversifying businesses based on local potential, developing derivative products, and strengthening productive community businesses.
3	Customary Institutions and Forest Management Rights	Community access to frankincense forests is influenced by power relations, recognition of customary rights, government policies, and corporate interests. Social capital, community networks, and organizational support are crucial factors in fighting for access and recognition of forest rights.	Ahmad et al. (2025)	Sustainable agribusiness models must strengthen indigenous community institutions, ensure access to resources, and foster collaboration between communities, government, universities, and supporting institutions.
4	Frankincense Value Chain and Commercialization	Frankincense resin has marketing channels ranging from local to domestic and international markets through intermediaries. This demonstrates that frankincense has broader economic value, but developing its economic benefits requires attention to the position of farmers in the marketing chain.	Harada et al. (2022)	It is necessary to strengthen farmers' bargaining position through marketing institutions, access to price information, business partnerships, improving product quality, and developing added value.
5	Gender Equality in Community Empowerment	Changing socio-ecological conditions and declining income from frankincense have impacted the division of labor and women's economic contributions. Women play a crucial role in maintaining household livelihoods, but the increased workload has not always been accompanied by equitable recognition and compensation.	Roswaldy (2025)	Empowerment programs must involve women in decision-making, access to economic resources, product processing training, and home-based business development.

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6	Ecological Sustainability and Agroforestry Management	An agroforestry system integrating frankincense and coffee has the potential to support ecological functions while increasing land productivity. Integration with beekeeping also opens up opportunities for exploiting bee food sources and developing non-timber forest products.	Aswandi et al. (2019); Harada et al. (2022)	The agribusiness model needs to integrate economic and ecological aspects through agroforestry, frankincense tree conservation, crop diversification, and sustainable use of forest products.
7	Product Development Technology and Innovation	The identified literature demonstrates opportunities for developing frankincense-based products through diversification of non-timber forest products and integration of business activities. However, empirical evidence regarding the use of digital technology, modern processing, quality standardization, and digital marketing specifically applied to Toba frankincense still needs to be strengthened.	Aswandi et al. (2019); Harada et al. (2022)	Model development needs to incorporate post-harvest technological innovation, processing of derivative products, packaging, quality standardization, and the use of digital platforms for promotion and marketing.
8	Formulating a Sustainable Agribusiness Model Oriented to Local Wisdom	Cross-literature findings show that frankincense sustainability cannot rely solely on increased production. Aspects of recognizing customary rights, strengthening institutions, economic diversification, gender equality, ecological sustainability, and market development need to be integrated.	Synthesis of Harada et al. (2022); Ahmad et al. (2025); Roswaldy (2025); and Aswandi et al. (2019) as supporting literature	The empowerment model needs to be built in an integrated manner through five components: strengthening local wisdom and institutions, increasing community capacity, developing production and business diversification, strengthening value chains and marketing, and conserving forest resources.

The synthesis results in Table 2 show that empowering local communities through the development of Toba frankincense is linked to various dimensions, namely social, economic, institutional, cultural, technological, and ecological. Each of these dimensions influences each other, so that frankincense development cannot be achieved solely through increasing resin production but must be accompanied by strengthening resource management systems and

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increasing community capacity.

In social and cultural aspects, local wisdom is an important foundation in maintaining the sustainability of frankincense forests. Harada et al (2022) This study demonstrates that traditional ownership and management of frankincense forests are linked to intergenerational inheritance and community responsibility for forest preservation. This demonstrates that local knowledge and customary rules play a strategic role in maintaining resource sustainability while preserving community identity.

From an economic aspect, the development of an integrated frankincense-coffee agroforestry system with beekeeping provides an overview of the opportunities for diversifying community income.Aswandi, Kholibrina & Iswanto (2019) This integration has the potential to produce additional products in the form of honey and propolis, while also supporting land productivity.Harada et al (2022) explained that frankincense resin has a marketing network that reaches both domestic and international markets. These two findings demonstrate the importance of developing an agribusiness that relies not only on raw material sales but also encourages product diversification and increased added value.

In the institutional dimension, researchAhmad et al (2025) shows that indigenous peoples' access to frankincense forests is influenced by contested interests between the community, the state, and companies. Recognizing community rights to customary forests is a crucial aspect in ensuring the sustainability of frankincense management.Roswaldy (2025) Studies show that changes in socio-ecological conditions also influence the division of labor and women's economic contributions in farming households. Therefore, community empowerment needs to address women's involvement and a more equitable distribution of economic benefits.

Based on these findings, a sustainable agribusiness model oriented toward local wisdom needs to integrate strengthening traditional institutions, increasing human resource capacity, business diversification, developing value chains, utilizing technology, and environmental conservation. This integration of components forms the basis for formulating a local community empowerment model that focuses not only on increasing income but also on maintaining the sustainability of the frankincense forests and the cultural values of the Toba people.

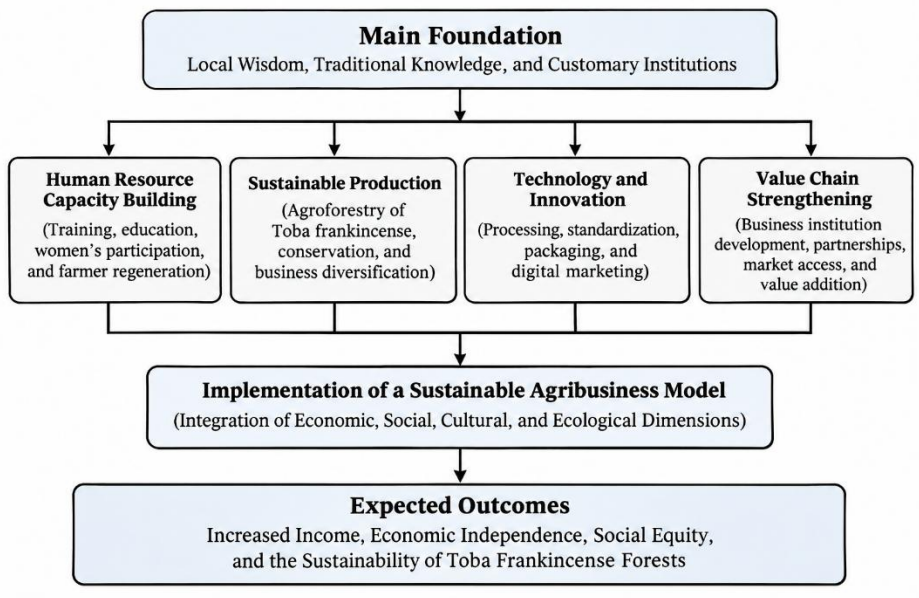


Figure 2. Formulation of the Synthesis Model

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Conclusion

Based on the results of a literature meta-synthesis, the Toba frankincense agribusiness has great potential to support the economic development of local communities through agroforestry-based forest management, business diversification, and the development of value-added products. However, its development still faces various challenges, including limited access and recognition of community rights to customary forests, the weak bargaining position of farmers in the marketing chain, and the suboptimal use of technology and innovation. Local wisdom, which includes traditional knowledge, customary rules, community institutions, and the inheritance of knowledge between generations, plays a crucial role in maintaining ecological, social, and economic sustainability. Based on these findings, a conceptual model for community empowerment through sustainable agribusiness is formulated that places local wisdom as the main foundation and integrates four components: strengthening human resources, sustainable production, technology and innovation, and strengthening the value chain.This model is expected to encourage increased income, economic independence, social justice, and the sustainability of the Toba frankincense forests. Validation through further empirical research is needed to test the model's effectiveness and applicability in the local community context.

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