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Quintuple Helix Synergy Driving Palm Sugar MSMES' Competitiveness for Sustainable Development Goals (SDGS)

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Abstrak

Studi ini meneliti kontribusi kolaborasi lima pilar (quintuple helix)—yang terdiri dari akademisi, industri, pemerintah, masyarakat, dan media—dalam meningkatkan daya saing usaha mikro, kecil, dan menengah (UMKM) gula kelapa dan memajukan Tujuan Pembangunan Berkelanjutan (SDGs). Penelitian ini mengembangkan kerangka kerja kolaborasi berorientasi inovasi yang dirancang untuk memperkuat kapasitas daya saing UMKM dan mendorong transformasi pedesaan yang berkelanjutan. Dengan menggunakan pendekatan metode campuran sekuensial, analisis kuantitatif dilakukan pada 100 UMKM gula kelapa di Tapanuli Selatan menggunakan Pemodelan Persamaan Struktural (SEM-AMOS), dilengkapi dengan wawasan kualitatif dari wawancara mendalam dengan aktor-aktor kunci dalam kolaborasi tersebut. Hasil penelitian menunjukkan bahwa interaksi quintuple helix memiliki pengaruh langsung yang signifikan terhadap keunggulan kompetitif ($\beta = 0{,}412$, $p < 0{,}05$) dan pengaruh tidak langsung melalui kemampuan inovasi yang memungkinkan untuk merasakan, memanfaatkan, dan mentransformasikan peluang pasar. Kebaruan penelitian ini terletak pada pengintegrasian perspektif quintuple helix dengan strategi inovasi untuk membangun model inklusif dan berorientasi keberlanjutan bagi UMKM yang berorientasi ekspor. Temuan ini memberikan implikasi strategis untuk desain kebijakan, menekankan integrasi rantai pasokan, pembangunan kapasitas kelembagaan, dan strategi pemasaran digital untuk meningkatkan kinerja UMKM dan mempercepat kemajuan menuju SDG 8: Pekerjaan Layak dan Pertumbuhan Ekonomi.

Kata kunci: *Strategi Inovasi, Keunggulan Kompetitif, UMKM Gula Kelapa, Pembangunan Pedesaan*

Abstract

This study investigates the contribution of the quintuple helix collaboration—comprising academia, industry, government, communities, and media—in enhancing the competitiveness of coconut sugar micro, small, and medium enterprises (MSMEs) and advancing the Sustainable Development Goals (SDGs). The research develops an innovation-oriented collaboration framework designed to strengthen MSME competitive capacity and promote sustainable rural transformation. Employing a sequential mixed-methods approach, quantitative analysis was conducted on 100 coconut sugar MSMEs in South Tapanuli using Structural Equation Modelling (SEM-AMOS), complemented by qualitative insights from in-depth interviews with key helix actors. The results demonstrate that quintuple-helix interactions have a significant direct effect on competitive advantage ($\beta = 0.412$, $p < 0.05$) and an indirect effect through innovation capabilities that enable sensing, seizing, and transforming market opportunities. The study's novelty lies in integrating the quintuple helix perspective with innovation strategy to construct an inclusive, sustainability-oriented model for export-driven MSMEs. The findings provide strategic implications for policy design, emphasizing supply-chain integration, institutional capacity building, and digital marketing strategies to enhance MSME performance and accelerate progress toward SDG 8: Decent Work and Economic Growth.

Keyword: Innovation Strategy, Competitive Advantage, Coconut Sugar MSMEs, Rural Development

INTRODUCTION

Indonesia possesses extensive palm sugar plantations, indicating considerable economic potential, especially within the commercial agribusiness sector. Palm sugar, derived from the sap of palm trees, stands out as a significant local product characterized by its considerable market value and promising sustainability potential. North Sumatra Province stands out as the second largest producer of palm sugar in Indonesia, with South Tapanuli Regency identified as the primary hub for palm sugar production and development on a national scale (Rosadi, 2024; Netti Herlina et al., 2021).

Table 1. Palm Sugar Production in Indonesia in 2023-2024

Province	Production/Ton
West Java	64.710
North Sumatra	8.045
Bengkulu	5.975
South Sulawesi	5.323
Banten	4.054
Central Java	3.548
South Kalimantan	1.633
West Sumatra	1.485
North Maluku	1.337
Southeast Sulawesi	1.319
North Sulawesi	1.192
Bangka Belitung Islands	949
Aceh	915
Lampung	915
West Sulawesi	738
East Kalimantan	504
Gorontalo	425
East Java	416
West Nusa Tenggara	386
South Sumatra	309
Jambi	103
West Kalimantan	90
Central Sulawesi	69
Bali	54
D.I Yogyakarta	52
Riau	14
Central Kalimantan	11

Source: Directorate General of Plantations, Ministry of Agriculture, Republic of Indonesia (Director General Of Estate Crops, 2024)

Table 2. Palm Sugar Production in North Sumatra Province 2023-2024

Regency	Production / Ton
South Tapanuli Regency	1438
Simalungun Regency	1301
Karo Regency	882
Mandailing Natal Regency	813
Deli Serdang Regency	654
North Tapanuli Regency	567
Toba Samosir Regency	544
North Padang Lawas Regency	304
Humbang Hasundutan Regency	302

Regency	Production / Ton
Samosir Regency	299
Langkat Regency	267
Padang Lawas Regency	245
North Nias Regency	136
Dairi Regency	112
Central Tapanuli Regency	78
Labuhan Batu Regency	41
Nias Regency	39
Serdang Bedagai Regency	16
West Nias Regency	7

Source: Directorate General of Plantations, Ministry of Agriculture, Republic of Indonesia (Director General Of Estate Crops, 2024)

In 2024, Indonesian palm sugar exports experienced a notable increase of 9.79%, reaching a total value of USD 58.01 million. This growth was further supported by a 3.38% rise in export volume, amounting to 31.41 thousand tons. This development indicates that palm sugar possesses significant potential to emerge as one of Indonesia's primary export commodities (Indonesian Export Financing Agency (LPEI), 2024). The rise in palm sugar exports indicates the development of a vibrant international niche market, presenting opportunities for MSMEs to concentrate on high-quality palm sugar products. This includes pursuing international organic certification and fair trade, enabling them to achieve higher selling prices and enhance their competitiveness in the global market (Suwannarat, 2016; Serrano et al., 2018; Wanyonyi et al., 2021). It is important to highlight that merely 15.7% of MSMEs are currently involved in export activities. The significant global demand for palm sugar presents a strategic opportunity for Indonesia to enhance its international market presence and align with the government's objective of achieving approximately 9% export growth over the next five years (Ministry of Coordinating Economic Affairs, 2025) through improved competitiveness.

In addition, the considerable export potential of palm sugar aligns with Indonesia's overarching national development objectives, which encompass enhancing innovation quality, generating productive employment, fostering entrepreneurship, and advancing economic equality in rural regions (Radio Republik Indonesia, 2024; National Research and Innovation Agency, 2025). Additionally, the export of palm sugar significantly contributes to the realization of the United Nations Sustainable Development Goals, especially Goal 8, which emphasizes inclusive and sustainable economic growth, the generation of productive employment, and the provision of decent work for everyone (Dewi et al., 2025). Consequently, the rise in palm sugar exports is anticipated to enhance economic activity in key producing areas, generate new employment opportunities, elevate community income, and ultimately expedite overall economic growth.

Source: www.sdgs.un.org/goals (2024)
Figure 1. Sustainable Development Goals (SDGs)

Although South Tapanuli Regency achieving the highest palm sugar production in North Sumatra Province for the 2023–2024 period, the growth of palm sugar MSMEs in this area remains constrained and operates on a small scale (Directorate General of Plantations, 2024).

Many traditional enterprises involved in palm sugar production primarily concentrate on satisfying the needs of the domestic market. Globally, the demand for natural sweeteners is on the rise, reflecting an increasing consumer preference for healthy and nutritious products (Indonesian Export Financing Agency (LPEI), 2024).

While there is significant potential, MSMEs in South Tapanuli encounter numerous obstacles that hinder their ability to enhance competitiveness and broaden access to export markets. The challenges encompass restricted access to external funding, which limits production capacity and hinders investment in innovation. Furthermore, MSMEs must focus on the production of standardized palm sugar to enhance the competitiveness of their products. The lack of universally accepted international standards for palm sugar presents a significant barrier to accessing export markets that require uniform product quality. The lack of comprehensive data regarding global market opportunities, coupled with the underutilization of digital promotion platforms, significantly contributes to the diminished visibility of palm sugar products in international markets.

The majority of palm sugar MSMEs in South Tapanuli continue to concentrate on traditional solid brown sugar production, exhibiting minimal innovation regarding product form and variety. This strategy leads to a diminished competitive edge for local palm sugar products, as marketing efforts remain confined to local and regional markets. To establish palm sugar as a prominent export commodity, it is essential to execute thorough innovation strategies that engage multiple actors and involve diverse stakeholders (Heredia et al., 2019; Wach, 2015; Paul & Dhiman, 2021). An extensive and cooperative strategy for innovation development is essential for addressing these challenges.

METHODOLOGY

Collaboration in the quintuple helix in improving competitive advantage through product innovation is illustrated in the research concept as follows:

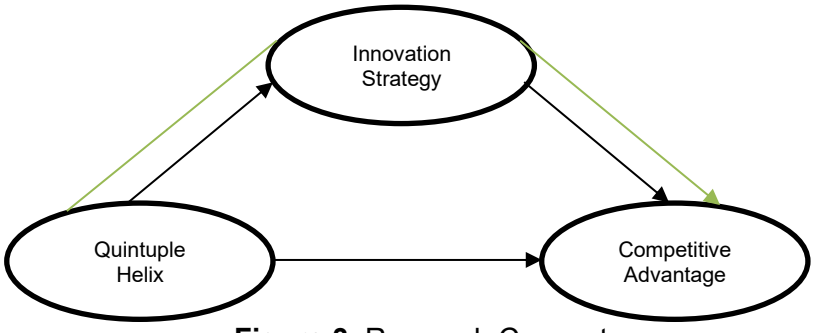

Figure 3. Research Concept

Competitive Advantage

Competitive advantage is limited to cost leadership, differentiation, and focus. The indicators are production cost efficiency. Competitive pricing, High productivity, Product quality, Brand image, Value-Added Services, Market segmentation, Dominance in a specific market (Zahara et al., 2024; Heredia et al., 2019; Paul & Dhiman, 2021).

Innovation Strategy

Innovation strategies can be executed via the dynamic capabilities of MSMEs in three primary stages: sensing, which involves identifying opportunities and threats; seizing, which focuses on optimally exploiting opportunities; and transforming, which entails dynamically reconfiguring resources. The strategy is characterized by several key indicators: responsiveness to market demands, the regularity of new product introductions, the rapidity with which new products are launched, adaptability in production for product modifications, the market share captured by new products, and the sales growth rate associated with innovative offerings (Verhees & Meulenberg, 2004; Etzkowitz & Klofsten, 2005; Wolf et al., 2012; Distanont & Khongmalai,

2020). By implementing innovation strategies that align with market dynamics and global consumer needs, MSMEs can enhance their adaptability, bolster their competitiveness, and sustainably broaden their export market reach.

Quintuple Helix

The Quintuple Helix model highlights the interconnected contributions of academia, industry, government, community, and media in fostering a sustainable innovation ecosystem. Indicators that reflect the roles of these five elements encompass managerial literacy, management practice training, access to distribution network information, idea sharing, the creation of synergies between MSMEs, mentorship, financial support, policy formulation and implementation, information publication, audience reach, media message effectiveness, increased public support following media campaigns, the number of interactions with audiences, media-facilitated collaboration among stakeholders, and the intensity of communication between actors through the media (Kholiavko et al., 2021; Carayannis et al., 2012; Wahdiniwaty et al., 2022; Rodrigues-Ferreira et al., 2023; Harwiki & Malet, 2020). This model enhances intersectoral connectivity, facilitating the development of innovation-driven and export-focused MSMEs.

This study employs a mixed-methods approach featuring a sequential explanatory design. The quantitative phase is executed first, succeeded by the qualitative phase to enhance the understanding of the preliminary statistical findings. The research procedure commenced with the deliberate selection of South Tapanuli Regency in North Sumatra Province as the research location. This choice was made due to its status as the region with the highest palm sugar production and its significant potential for the development of export-oriented MSMEs. This method facilitates the combination of empirical data with contextual insights, leading to a thorough comprehension of innovation strategies and multi-actor collaboration aimed at enhancing the competitiveness of palm sugar MSMEs in the global market.

Figure 4. Research Concept

Quantitative

The study, scheduled for implementation in 2025, adopts a case study approach involving direct observation of palm sugar MSMEs located in South Tapanuli Regency, North Sumatra Province. The research aims to explore and assess how key stakeholders—academia, industry, government, communities, and media—contribute to enhancing the competitiveness of MSMEs. The sampling process applies a purposive selection technique, focusing on the regency with the highest palm sugar production in North Sumatra. The sample size is determined using Lemeshow's formula, which is appropriate when the population size cannot be precisely estimated or is considered infinite. The formula is presented as follows:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

$n = \frac{1{,}962^2 x\ 0{,}5\ (1-0{,}5)}{0{,}1^2} = \frac{3{,}8416\ x\ 0{,}5\ (0{,}5)}{0{,}01}$ = 96,15 (dibulatkan 100)

In accordance with Government Regulation No. 7 of 2021, Indonesia categorizes Micro, Small, and Medium Enterprises (MSMEs) based on their total capital and annual revenue. Micro enterprises are defined as businesses with capital assets of up to IDR 1 billion and annual turnover not exceeding IDR 2 billion. Small enterprises maintain capital between IDR 1 billion and IDR 5 billion with annual turnover ranging from IDR 2 billion to IDR 15 billion. Medium enterprises, meanwhile, operate with capital investments between IDR 5 billion and IDR 10 billion and generate annual sales between IDR 15 billion and IDR 50 billion.

This study examined 100 MSMEs that met the following criteria:

1. MSME actors who had participated in training, seminars, mentoring, or workshops from public or private universities.
2. MSME operators who are members of a community (e.g., farmer groups or cooperatives).
3. MSME operators with social media accounts (at least WhatsApp and Facebook).
4. The MSMEs that are the subject of this study have characteristics that align with Government Regulation (PP) 2021, Article 35, Paragraph 3, based on capital and sales turnover.

Quantitative data were collected from 100 MSME respondents selected based on Lemeshow's formula, which is suitable for determining sample size when the overall population cannot be precisely estimated. Respondents were selected based on specific criteria, including: having participated in training, mentoring, or workshops organised by universities or the government; being members of MSMEs communities (farmer groups, cooperatives); and owning and using social media, at least WhatsApp or Facebook, in their business activities.

Qualitative

The subsequent phase focused on gathering qualitative insights through in-depth interviews with key informants representing the five pillars as conceptualized in the Quintuple Helix model, which integrates five spheres of interaction—academic and research institutions, industrial actors, governmental agencies, community stakeholders, and media organizations—forming an innovation ecosystem that connects knowledge, economy, and society. These interviews aimed to explore in depth the dynamics of collaboration, knowledge exchange, and strategic innovation practices in the context of strengthening MSMEs competitiveness. Qualitative information was interpreted through the interactive analytical framework formulated by Miles and Huberman, which emphasizes iterative processes of data condensation, display, and conclusion verification.

The interviews in this study were structured to gain a deeper understanding of the four main groups involved in the development of palm sugar commodities, namely academics, industry players, local government, and farmer communities. This analytical approach draws on the Quadruple Helix concept, which underscores collaborative interactions among academia, industry, government, and society as critical drivers of innovation and regional competitiveness

Each interview was initiated with open-ended prompts, enabling participants to articulate their experiences, perceptions, and roles in the development of palm sugar enterprises. Subsequently, the interviews focused on exploratory and specific questions to explore the forms of collaboration between actors, the obstacles faced, and the opportunities for building a sustainable local innovation system. The question format was tailored to the background of each group:

1. Academics were asked to explain the research they had conducted, the application of technology to farmers, and their contributions to improving the competitiveness of palm sugar products.
2. Industry players explained the raw material supply chain, challenges in procuring palm sap, product quality standards, and forms of partnership with farmers and the government.
3. Local governments outlined policies supporting the development of palm sugar MSMEs, including training programmes, infrastructure assistance, and regulatory support.

4. Communities or farmer groups described real-world conditions on the ground, such as the palm sap production process, distribution challenges, and types of assistance received or not yet available.

The interview technique refers to four main types of questions (Kvale & Brinkmann, 2015):

1. Follow-up questions to clarify previous answers,
2. Exploratory questions to broaden the respondent's understanding,
3. Specific questions to delve into technical or policy aspects in more detail, and
4. Direct questions to assess the consistency of views among respondents, especially when differences of opinion arise.

The qualitative interviews were administered through in-person sessions, allowing researchers to capture participants' verbal and non-verbal expressions in a natural context, by the principal investigator at a location agreed upon with the informants, such as an agency office, production site, campus, or farmers' group secretariat. The selection of this location aimed to create a comfortable and familiar atmosphere so that respondents could express their opinions openly without social pressure.

Data Validity

The first step is to analyse quantitative data (survey or questionnaire results) as soon as possible before conducting the interviews. The results of this analysis are used to formulate relevant questions during the interviews, so that the interviews are more focused and in-depth. The second step is to provide contextual guidance to respondents during the interview. For example, respondents are shown the documents they previously filled out, including handwritten notes or arguments they wrote about palm sugar conditions. This helps respondents recall their previous views or decisions more accurately.

In addition, the researchers were aware that their position as lecturers or academics could Influence the attitudes of respondents, especially those from farming communities or small businesses. Therefore, the interviews were conducted using a non-formal and empathetic approach, such as in palm gardens, community houses, or village offices places that were considered familiar and comfortable for respondents. From the outset, the researchers also sought to build positive interpersonal relationships with the respondents, including through light discussions before the interviews began and open explanations of the research objectives. All participation was voluntary, with verbal or written consent, by research ethics principles (Creswell & Clark, 2018).

RESULTS AND DISCUSSION

Quantitative Results

The study applies a quantitative–explanatory design grounded in Structural Equation Modeling (SEM), with AMOS serving as the principal analytical platform. SEM was employed for its capacity to estimate measurement and structural relationships simultaneously. Specifically, Confirmatory Factor Analysis (CFA) was conducted to assess the validity of the measurement model, while the structural component was analyzed to examine the hypothesized causal paths in accordance with the methodological procedures outlined by Hair et al. (2014). The research procedure began with the preparation of instruments derived from theoretical constructs of the Quintuple Helix (QH) framework (Carayannis et al., 2018), Innovation Strategy (SI) (Teece et al., 1997), and Competitive Advantage (KB) (Barney, 1991). Data collection was conducted through a structured survey using Likert-scale items (1–5), distributed to respondents representing actors in academia, industry, government, community, and media.

A total of N = 100 valid responses were obtained and further processed. The analysis procedures followed
these steps:

1. Preliminary Data Screening: Normality, outliers, multicollinearity, and residual tests were performed to ensure data quality.

2. Measurement Model Evaluation (CFA): Each latent construct was assessed to determine convergent validity and reliability through the examination of standardized factor loadings (SLF), Composite Reliability (CR), and Average Variance Extracted (AVE). Collectively, these statistical indicators confirmed that the measurement items exhibited satisfactory internal consistency and convergent validity across constructs. Structural Model Testing: Full SEM was estimated to assess Goodness of Fit (GoF) and test direct and indirect hypotheses.
3. Bootstrap Procedure: To confirm the stability of path estimates and significance levels.

Confirmatory Factor Analysis (CFA)

Results from the Confirmatory Factor Analysis (CFA) demonstrated that all constructs exhibited satisfactory levels of convergent validity (SLF ≥ 0.50, CR ≥ 0.70, AVE ≥ 0.50), with only the Media dimension of the QH construct showing a marginal deviation—its AVE value was slightly below 0.50, while the CR remained above 0.70, indicating acceptable reliability. This condition is theoretically acceptable since CR demonstrates construct reliability, and Media remains conceptually relevant in the quintuple helix model (Carayannis et al., 2018)

Table 3. **Confirmatory Factor Analysis (CFA)**

Construct / Variabel	Dimensi	Indicator	SLF	SLF²	Notes
Quintuple Helix (QH)	Academy	A2	0,919	0,845	Valid
	Academy	A3	0,875	0,766	Valid
	Industry	I2	0,830	0,689	Valid
	Industry	I3	0,821	0,674	Valid
	Government	Pe1	0,827	0,684	Valid
	Government	Pe2	0,766	0,587	Valid
	Community	Kom3	0,897	0,805	Valid
	Community	Kom1	0,680	0,462	Marginal (≥ 0,50)
	Media	Me3	0,883	0,780	Valid
	Media	Me2	0,811	0,658	Valid
CR = 0,961 ; AVE = 0,693 → Reliabel & Valid (Hair et al., 2019)					
Innovation Strategy (SI)	Sensing	Sen1	0,813	0,661	Valid
	Sensing	Sen2	0,829	0,687	Valid
	Sensing	Sen3	0,865	0,748	Valid
	Seizing	Se1	0,868	0,753	Valid
	Seizing	Se3	0,772	0,596	Valid
	Transformasi	Tr3	0,659	0,434	Marginal
	Transformasi	Tr4	0,969	0,939	Valid
	Transformasi	Tr5	0,780	0,608	Valid
CR = 0,944 ; AVE = 0,678 → Reliabel & Valid					
Competitive Advantage (CA)	Competitive Price	CP1	0,841	0,707	Valid
	Competitive Price	CP2	0,640	0,410	Marginal
	Produktivitas Tinggi	PT1	0,816	0,666	Valid
	Produktivitas Tinggi	PT2	0,869	0,755	Valid
	Kualitas Produk	KP1	0,814	0,663	Valid
	Kualitas Produk	KP2	0,583	0,340	Marginal
	Kualitas Produk	KP3	0,755	0,570	Valid
	Value-added Service	VaS1	0,721	0,520	Valid
	Value-added Service	VaS2	0,754	0,569	Valid
	Market Segmentation	MS1	0,741	0,549	Valid
	Market Segmentation	MS2	0,939	0,882	Valid
	Niche Dominant Market	NMD1	0,735	0,540	Valid

	Niche Dominant Market	NMD2	0,758	0,575	Valid
	Cost Efficiency	CE1	0,822	0,676	Valid
	Cost Efficiency	CE2	0,798	0,637	Valid
	Cost Efficiency	CE3	0,778	0,605	Valid
CR = 0,960 ; AVE = 0,604 → Reliabel & Valid					

Goodness of Fit (GoF) of Full Model

The full SEM model shows an acceptable fit with indices meeting cut-off criteria (Hair et al., 2014)

- Chi-Square/df (CMIN/DF) < 3.00
- RMSEA < 0.08
- CFI, TLI, NFI > 0.90

The overall results confirm that the structural model achieves an acceptable level of fit with the observed data, indicating that it is statistically sound and suitable for testing the proposed hypotheses.

The results affirm the statistical robustness of the overall model, establishing a basis for a more profound analysis of the structural relationships among the fundamental constructs. The following examination delves into both numerical and descriptive findings to elucidate the interplay between the Quintuple Helix, Innovation Strategy, and Competitive Advantage within the palm-sugar MSME ecosystem of South Tapanuli.

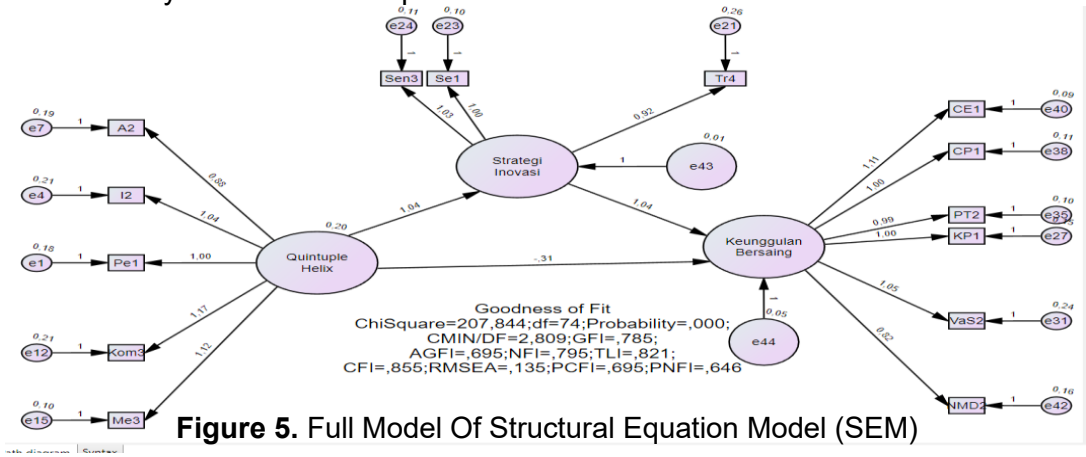

Figure 5. Full Model Of Structural Equation Model (SEM)

Hypotheses Testing

The structural path analysis produced the following results:

1. Direct Effect (QH → KB): Significant with β = 0.412 (p < 0.05).
2. Indirect Effect (QH → SI → KB): Significant with β = 0.032 (p < 0.05).

The analysis confirms a partial mediation pattern in which Strategy Innovation partially transmits the influence of the Quintuple Helix on Competitive Advantage. While the mediating effect is evident, the Quintuple Helix exhibits a more substantial direct impact on Competitive Advantage than the indirect pathway mediated through Strategy Innovation. This suggests that collaborative engagement among academia, industry, government, community, and media provides immediate benefits for strengthening competitive position. This aligns with the innovation ecosystem theory (Carayannis et al., 2018) and resource-based view (Barney, 1991) which argue that networked resources and legitimacy drive competitiveness. Meanwhile, the indirect effect mediated by Innovation Strategy, though comparatively modest, reinforces the applicability of the dynamic capabilities framework (Teece et al., 1997). The innovation mechanism complements the direct influence of the Quintuple Helix by sustaining competitiveness through firms' ability to sense, seize, and transform emerging market opportunities.

In conclusion, the model emphasizes that organizations should not only leverage direct synergies of the helix actors but also invest in long-term innovation strategies to maintain

sustainable competitive advantage. The statistical outcomes are further substantiated by qualitative findings that elucidate the real-world dynamics underlying these relationships.

Qualitative Results

In-depth interviews with scholars, industry stakeholders, government representatives, and individuals from the palm-sugar farming community have substantiated that South Tapanuli Regency yields palm sugar of remarkable quality, esteemed nationally for its purity, fragrance, and potential for export. Nonetheless, the prevailing limitation continues to be supply shortages: the quantity of palm sap is inadequate to satisfy either local or industrial requirements. Participants consistently highlighted the challenges of low farmer engagement stemming from arduous access routes, the nature of perishable raw materials, and insufficient incentives.

> "The demand for palm sugar in South Tapanuli is exceptionally robust, extending even to international markets. Nonetheless, we encounter challenges in acquiring raw materials, as farmers infrequently provide them... Farmers exhibit hesitance in the transportation of substantial quantities of palm sap, leading many to transition to alternative occupations." *(Interview with the industry stakeholder, South Tapanuli)*
>
> "We are prepared to increase output, but government backing is still inadequate. There are no partnering initiatives or logistical support. It feels like we're battling alone." *(Interview with the industry representative, South Tapanuli)*

Several key factors were identified from the interviews, including:

1. Reliance on traditional business models: Farmers exhibit a preference for processing and marketing their own brown sugar instead of engaging in collaboration with the industry.
2. Lack of solid farmer institutions: The lack of cooperatives leads to a disjointed supply chain and diminished negotiating strength.
3. Unattractive industrial purchase price schemes: Industrial purchase prices are perceived to yield lower profitability compared to independent processing.
4. Lack of business assistance and export literacy: The limited engagement in training and academic pursuits constrains the potential for enduring collaborations.

Conceptually, the results emphasize that the dynamic capabilities of MSMEs—particularly within the sensing dimension—are still underdeveloped. Business owners and smallholder farmers have not yet demonstrated the full capacity to recognize and exploit potential opportunities in export markets. From the perspective of the Quintuple Helix framework, the interactions among community actors (farmers), academia, industry, media, and government remain fragmented, preventing the comprehensive synergy required to shift MSME business models from traditional practices toward innovation-oriented and scalable enterprises. Regionally driven innovation, therefore, demands active participation and integration among all ecosystem stakeholders to foster sustainable competitiveness (Etzkowitz & Klofsten, 2005). Moreover, cultivating an innovation culture within small businesses depends heavily on their openness to change, collaborative engagement, and adaptive production systems (Wolf et al., 2012; Distanont & Khongmalai, 2020).

Therefore, the limited availability of raw materials (palm sap) should not be viewed solely as a technical constraint but as an indication of insufficient collaborative integration among stakeholders within the regional innovation ecosystem. A strategic approach and integrated policies are needed to encourage active farmer participation in the value chain system, as well as institutional transformation through the formation of palm sugar farmer cooperatives, increased price incentives, and Education through the active involvement of academics and local media. In addition to challenges in terms of supply quantity and production processes, the interviews also revealed that industry players and MSMEs have identified and sought to capitalize on the huge market opportunities for palm sugar from South Tapanuli. High demand from the national and international markets is a clear signal of opportunity (sensing). However, its utilisation (seizing) has not been optimal due to structural limitations and a lack of support.

"Foreign buyers approach us on a daily basis, but we are unable to meet their demands due to raw material constraints. Regular exports might be feasible with adequate government assistance for supply-chain development." *(Interview with a palm sugar export industry player)*

"We understand the vast prospects, but we lack the necessary equipment and staff. Guidance and resources are critical for expansion." (*Interview with a palm sugar processing MSMEs operator)*

Some MSMEs have capitalised on opportunities by participating in bazaars, selling through e-commerce, or collaborating with cooperatives. However, limitations in access to capital, skilled labour, and the absence of a strong partnership ecosystem have prevented these strategies from being developed sustainably. In addition to the issue of raw material supply quantity, in-depth interviews also revealed that the palm sugar production process itself is highly complex and is one of the reasons for the low involvement of farmers in selling palm sap to the industry. Informants stated that processing palm sap into palm sugar is not a routine process but requires specialised skills and strict timelines.

Palm sap is a liquid that is highly sensitive to time and temperature. Based on the respondents' experience, palm sap only has a shelf life of around 4–5 hours after tapping before it can be processed into palm sugar. If this time limit is exceeded, the sap will undergo natural fermentation, which causes a decline in quality, makes it impossible to crystallise, and ultimately results in it being wasted. The processing also requires careful monitoring of the cooking temperature, constant stirring, and expertise in determining the right time to mould or crystallise the sugar.

"The problem is not only the small amount of sap, but also the very difficult production process. Palm sap must be processed in a very short time, no more than a few hours, because it can spoil. Not everyone can do it correctly; it requires special skills and experience. Even a small mistake can ruin the quality of the sugar. This is why many farmers are reluctant to tap the sap because if it's not processed quickly, it's all for nothing. We in the industry want to help, but skilled labour is also limited." *(Interview with a palm sugar processing industry practitioner, South Tapanuli)*

"Making palm sugar isn't like regular cooking. We have to start very early in the morning; the sap must be cooked immediately before four hours pass. If it's even a little late, the sugar becomes sour or can't be made at all. This isn't an easy job. You have to know the measurements, the heat, and the condition of the sap. That's why many farmers are now reluctant to make sugar, especially if there's no assistance or training from the government." *(Interview with a small-scale palm sugar processor, South Tapanuli)*

This situation has caused most farmers to be reluctant to supply palm sap to the industry, because:

1. Not all farmers have access to or the ability to immediately process palm sap directly,
2. No transportation or storage system for palm sap guarantees freshness and timely distribution to industrial processors,
3. Concerns about losses due to delays in processing or crop failures due to weather factors.

Thus, technical processing difficulties are the main obstacles to establishing a stable and sustainable palm sap supply system. Although palm sap from South Tapanuli is of superior quality, limitations in human resources and production support systems mean that this potential has not been fully capitalised on to strengthen the competitive advantage of MSMEs in the export market. These findings support the analysis that the transformation of the business model from subsistence to industrial has not been fully achieved, as there is still a lack of appropriate technology support, intensive technical training, and an integrated logistics system between farmers, business actors, and processing industries. From a dynamic capability perspective, this issue indicates that the transforming dimension has not been effectively implemented.

Interviews conducted with palm sugar processing industry players in South Tapanuli revealed that market demand for palm sugar products from this region is very high, both from the domestic and international markets. The industry stated that the quality and unique characteristics of South Tapanuli palm sugar are widely known, and several overseas buyers have even expressed interest in establishing long-term partnerships. However, despite high demand and wide-open market opportunities, the industry admits that it is unable to meet the volume of demand consistently. The gap between limited production capacity and sharply increasing market demand is a fundamental problem. This is not solely due to weaknesses on the part of the industry, but also because of the lack of government support and involvement in promoting an adequate upstream-downstream support system.

The industry has identified several forms of government absence that affect their competitiveness and capacity to respond to the market:

1. The absence of a government-facilitated logistics and sap collection system forces the industry to approach farmers directly, which is often inefficient and unsustainable.
2. There are no incentive programmes or partnership policies to facilitate relations between the industry and farmers, such as through production contracts or government-assisted cooperatives.
3. There is a lack of investment incentive programmes to strengthen processing infrastructure and increase production capacity, such as crystallisation equipment, cooling systems, or storage for fresh palm sap.
4. Minimal export facilitation by relevant agencies, especially in terms of opening access to foreign markets, international exhibitions, or negotiations for palm sugar export agreements as a regional flagship product.

This finding clarifies that the imbalance between demand and production is not only a technical issue at the industry and farmer level, but is also closely related to the government's failure to build an industrial ecosystem based on village commodity specialities optimally. Within the Quintuple Helix framework, the government plays a pivotal role as a facilitator that promotes collaboration among MSMEs, academia, communities, and the media to develop an adaptive production and distribution system responsive to market dynamics. This situation indicates that collective innovation capabilities in the region remain suboptimal, as production system transformation cannot be achieved by industry alone. Public policies are needed to encourage cross-actor collaboration and design structural interventions based on real needs on the ground. The success of a helix-based innovation system depends on government coordination and commitment to creating policies responsive to the realities of the local industry (Carayannis et al., 2012)

In addition to technical issues in the production process and the lack of incentives from the industry, in-depth interviews also revealed that geographical accessibility is a major factor hindering farmers from selling palm sap to the industry. Most palm sugar plantations in South Tapanuli Regency are located in remote or hilly areas that are difficult to access by motor vehicle. In these conditions, farmers must travel along footpaths, even crossing rivers or climbing hills, to transport palm sap within a very limited time before fermentation occurs. Some farmers stated that transporting palm sap from the plantation to the main road alone takes up to 1–2 hours on foot, let alone if it has to be transported to industries located in the village or sub-district centre. This results in a high potential for sap damage, especially if there are no cooling facilities or special vehicles for transporting sap. The lack of infrastructure, such as farm roads, portable sap containers, and transport vehicles, is a real obstacle faced daily.

This situation reinforces why most farmers prefer to process palm sap into solid brown sugar on-site rather than selling it to the industry. Independent processing provides flexibility in terms of time and avoids the risk of damage due to delays in distribution. In the context of the Quintuple Helix model, this access issue highlights the critical role of the government as a facilitator of infrastructure development. However, this role has not been optimally fulfilled. The government should be present through the provision of supporting infrastructure for production

and distribution, such as the procurement of palm sap transport vehicles, the construction of access roads to plantations, and community-based logistics assistance.

This issue is also closely related to the transforming dimension of MSMEs' dynamic capabilities, namely the ability to reconfigure production and distribution systems to be more efficient and market-oriented. Without transformation in logistics and upstream–downstream connectivity, competitive advantages based on palm oil quality will be difficult to achieve on a sustainable scale. The success of innovation and competitiveness is not only determined by product quality but also by the supporting systems that enable innovation to reach the market (Verhees & Meulenberg, 2004;Distanont & Khongmalai, 2020). Therefore, without solutions to these accessibility constraints, the palm sugar innovation ecosystem in South Tapanuli will remain fragmented and unable to address the challenges of increasing market demand.

Based on in-depth interviews with local government representatives, the government has expressed a strong commitment to supporting the development of palm sugar production as a regional flagship commodity. Through relevant agencies, such as the Agriculture Department and the Industry and Trade Department of South Tapanuli District, the government has emphasised that the development of local products based on village potential is one of the priorities of regional development, including strengthening the palm sugar plantation sub-sector. Informants from the government stated that support has been prepared in the form of training programmes, production equipment assistance, institutional facilitation for farmer groups, and even export promotion opportunities, as long as there is seriousness and initiative from farmers and industry players. The government is also open to establishing partnership schemes with cooperatives and MSMEs if there is unity of direction in development from the grassroots level.

> "The local government heavily encourages palm sugar growth. We are ready to provide training and equipment if farmers and industry take the initiative." *(Interview with the South Tapanuli Regency Government)*
>
> "We have seen the export potential of palm sugar, and it can indeed become a regional flagship product. However, we also need support from all parties, especially farmers who need to be more disciplined in tapping sap and managing their production. The government will be very open to cooperatives or farmer groups that wish to partner with us." *(Interview with the South Tapanuli Regency Government)*

However, the government also highlighted internal challenges within the farmer community, such as a lack of discipline in tapping palm sap and limited collective initiative in forming specialised palm sugar farmer groups. This has prevented the government's designed programmes from running optimally due to the lack of readiness among field actors.Thus, from the government's perspective, structural and programmatic support is available, but it cannot be implemented maximally due to the lack of cross-actor collaboration. This highlights the importance of a Quadruple Helix approach that brings together the government, farmers/communities, academics, and industry in a synergistic and structured manner to optimise the significant potential of Tapanuli Selatan palm sugar, both for the local market and exports.

From the farmers' and the community's perspective, it was found that no specific farmer groups for palm sugar have been formed. Farmer communities remain general and are not specifically organised to support palm sugar-based initiatives. This hinders coordination, production standardisation, and knowledge transfer among farmers. The low collective spirit has led to insufficient palm sap supply to the industry, despite the market price being highly promising. Meanwhile, the local government has expressed support for the development of the palm sugar sector as a flagship village commodity, but its implementation has not been optimal. The government has prepared various training programmes, equipment assistance, and facilitation of local product promotion, but has not yet found common ground with the readiness and motivation of actors in the field. The government also notes that farmers' discipline and consistency are major challenges and recognises that cross-actor collaboration needs to be strengthened structurally.

The role of higher Education institutions can be directed towards enhancing product innovation, marketing digitalisation, supply chain management, and market-oriented vocational Education.

Overall, collaboration within the quintuple helix model has not been optimal. Each actor is still operating independently, and there is no solid coordination system in place. However, if this synergy is managed with a strategic approach through institutional development, capacity building for stakeholders, and affirmative policies then palm sugar MSMEs have the potential to become a driving force for rural economies, create decent jobs, and strengthen export competitiveness. The empirical evidence reinforces the pivotal function of dynamic capabilities as a strategic mechanism that enables firms to integrate, renew, and reconfigure resources to sustain competitiveness in changing environmentsCombining quantitative and qualitative research suggests that enhancing the competitive advantage of palm-sugar MSMEs necessitates an integrated, systemic strategy.

The findings suggest that initiatives aimed at enhancing the competitive advantage of palm sugar MSMEs in South Tapanuli cannot be carried out partially or sectorally. The complexity of the challenges faced such as limited supply of palm sap, low farmer productivity, limited production skills, and inadequate market access requires collaboration across actors through a quintuple helix approach that includes academics, industry, government, community, and media.

1. **Academics** serve as a source of knowledge and technology. However, academic involvement in palm sugar development is still very limited. Local universities and research institutions have not been actively providing training, applied research, or innovation in the production process or product diversification. Strengthening the dynamic capabilities of MSMEs in terms of sensing and transforming requires science-based assistance.
2. **Industry** states that the demand for South Tapanuli palm sugar is very high, both from local and foreign markets. However, industry players face serious obstacles in obtaining a consistent supply of raw materials because the supply of palm sap from farmers is very limited. The main factors causing this are difficult access from plantations to industry, as well as low interest among farmers in tapping and selling palm sap regularly.
3. The local government has shown a concrete policy commitment toward advancing priority commodities, including palm sugar. The government has prepared facilitation programmes, training, and incentives for production equipment. However, limited implementation capacity and a lack of coordination across the helix have resulted in many programmes not being optimally absorbed. The government has also emphasised the need for discipline and willingness on the part of farmers to participate more actively.
4. **Communities,** in this case, farmer groups, are not yet specifically organised based on commodity type. Existing farmer groups are still general and include various types of farmers. As a result, there are no specific palm sugar communities or cooperatives that can serve as a means of strengthening institutions, transferring technology, or improving the bargaining position of farmers vis-à-vis industry and markets.
5. **Media,** as the fifth dimension, plays an important role in building narratives, disseminating information, and increasing the visibility of local products such as palm sugar. Unfortunately, to date, the use of media—both conventional and digital—remains very limited. Product branding, promotion of SMEs, and public Education about the potential of palm sugar have not received sufficient attention. However, with media support, strengthening brand image, increasing market awareness, and disseminating government policies can be done more widely and quickly.

Through the **quintuple helix** approach, this study confirms that competitive advantage is not only determined by cost efficiency and product quality, but also by the systemic ability to integrate innovation, collaboration, and cross-sector communication. Each helix must have a balanced commitment and active role in order to create a highly competitive local innovation ecosystem. The integrated collaboration among the five key stakeholders provides substantial opportunities for palm sugar MSMEs in South Tapanuli to drive inclusive and sustainable rural

economic transformation, foster productive employment, and enhance local economic resilience in alignment with Sustainable Development Goal (SDG) 8. Overall, these findings underscore that both quantitative data and qualitative observations consistently illustrate the pivotal role of the Quintuple Helix synergy as a transformative framework for fostering sustainable competitiveness within Indonesia's palm-sugar industry.

Although this study boasts a comprehensive mixed-methods design, it is imperative to recognize several limitations that warrant attention. The sample size employed, while sufficient for SEM analysis, *remains* confined to 100 respondents within a single district, thus potentially limiting the generalizability of the findings. Furthermore, the qualitative findings were derived from a specific local context that may not align with other palm sugar-producing regions in Indonesia. Future investigations ought to adopt a longitudinal or comparative framework to examine the evolution of the Quintuple Helix dynamic across diverse industries or geographical areas. The incorporation of digital innovation and sustainability metrics into the model will yield a more profound comprehension of how technology-driven competencies can enhance the competitive edge of MSMEs in rural regions.

CONCLUSIONS AND SUGGESTIONS

Based on field findings and analysis using the Quintuple Helix approach, the following practical conclusions can be used as a basis for policy and collaborative action across sectors: *Academics: Enhancing the Role of Innovation and Mentoring;* Higher Education institutions need to take an active role in applied research, processing technology training, and capability-based mentoring (sensing, seizing, transforming). The establishment of village-based MSME study centres and *community service-learning* programmes specifically targeting the palm sugar sector should be encouraged.

1. ***Industry: Establishing Partnerships and Increasing Incentives for Farmers;*** Industry players must build long-term partnerships with farmers through production contracts, price icentives, and the provision of transportation facilities for palm sap. Investment is needed in environmentally friendly production technologies and capacity building for local human resources to address the gap between market demand and raw material supply.
2. **Government: Improving Facilitation and Infrastructure;** Local governments need to strengthen regulations and affirmative policies for strategic commodities such as palm sugar, including through village funds, farmer group-based training, and production equipment incentives. The government also needs to improve farm road infrastructure and logistics systems from plantations to production centres to enhance the efficiency of raw material distribution.
3. **Community: Strengthening Specialised Palm Sugar Institutions;** Specialised palm sugar farmer groups or commodity-based cooperatives need to be formed to strengthen farmers' bargaining power and facilitate access to government and industry assistance. Training in organisation, farm management, and the establishment of networks between palm sugar farming communities in South Tapanuli is needed.
4. **Media: Improving Branding and Public Education;** Local and digital media should be strategically involved in building the brand image of palm sugar products, including introducing MSMEs to wider markets (national and export). Educational campaigns on the socioeconomic benefits of palm sugar need to be expanded to increase interest among young people and social investors in this sector.

Policy Directions and Development impact

The collaborative integration of these five helices is expected to accelerate the realization of Sustainable Development Goal (SDG) 8—Decent Work and Economic Growth—by stimulating employment creation, expanding village-based MSME development, and enhancing the value-added potential of local leading commodities. With the collaborative *Quintuple Helix* model, palm sugar MSMEs are not only the backbone of the local economy but also a strategic tool in building resilient, self-reliant, and sustainable villages.

REFERENCES

AlMalki, H. A., & Durugbo, C. M. (2023). Systematic review of institutional innovation literature: towards a multi-level management model. *Management Review Quarterly*, *73*(2), 731–785. https://doi.org/10.1007/s11301-022-00259-8

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. https://doi.org/10.1177/014920639101700108

Carayannis, E. G., Barth, T. D., & Campbell, D. F. (2012). The Quintuple Helix innovation model: global warming as a challenge and driver for innovation. *Journal of Innovation and Entrepreneurship*, *1*(1), 2. https://doi.org/10.1186/2192-5372-1-2

Carayannis, E. G., Grigoroudis, E., Campbell, D. F. J., Meissner, D., & Stamati, D. (2018). The ecosystem as helix: an exploratory theory-building study of regional co-opetitive entrepreneurial ecosystems as Quadruple/Quintuple Helix Innovation Models. *R&D Management*, *48*(1), 148–162. https://doi.org/10.1111/radm.12300

Creswell, J. W., & Clark, V. L. P. (2018). *Designing and Conducting Mixed Methods Research (3rd ed.)*. SAGE Publications.

Debackere, K., & Veugelers, R. (2005). The role of academic technology transfer organizations in improving industry science links. *Research Policy*, *34*(3), 321–342. https://doi.org/10.1016/j.respol.2004.12.003

Dewi, M., Lubis, S., & Sofiyan. (2025). Quadruple Helix Collaboration in Improving Competitive Advantage to Support the Achievement of Sustainable Development Goals (SDG) Based on Critical Success Factors in MSMES. *Journal of Lifestyle and SDGs Review*, *5*(1), e04001. https://doi.org/10.47172/2965-730X.SDGsReview.v5.n01.pe04001

DIRECTOR GENERAL OF ESTATE CROPS. (2024). *Directorate General of Plantations, Ministry of Agriculture, Republic of Indonesia*. www.ditjenbun.per

Directorate General of Plantations. (2024). *STATISTIK P E R K E B U N A N JILID 2 2 0 2 3 - 2 0 2 5*. Sekretariat Direktorat Jenderal Perkebunan. www.ditjenbun.pertanian.go.id

Distanont, A., & Khongmalai, O. (2020). The role of innovation in creating a competitive advantage. *Kasetsart Journal of Social Sciences*, *41*(1), 15–21. https://doi.org/10.1016/j.kjss.2018.07.009

Dolmans, S. A. M., Walrave, B., Read, S., & van Stijn, N. (2022). Knowledge transfer to industry: how academic researchers learn to become boundary spanners during academic engagement. *The Journal of Technology Transfer*, *47*(5), 1422–1450. https://doi.org/10.1007/s10961-021-09882-1

Etzkowitz, H., & Klofsten, M. (2005a). The innovating region: toward a theory of knowledge-based regional development. *R&D Management*, *35*(3), 243–255. https://doi.org/10.1111/j.1467-9310.2005.00387.x

Etzkowitz, H., & Klofsten, M. (2005b). The innovating region: toward a theory of knowledge-based regional development. *R&D Management*, *35*(3), 243–255. https://doi.org/10.1111/j.1467-9310.2005.00387.x

Fabrizio, C. M., Kaczam, F., de Moura, G. L., da Silva, L. S. C. V., da Silva, W. V., & da Veiga, C. P. (2021). Competitive advantage and dynamic capability in small and medium-sized enterprises: a systematic literature review and future research directions. *Review of Managerial Science*, *16*, 617–648. https://api.semanticscholar.org/CorpusID:233695109

Fernandes, C. I., Ferreira, J. J. M., Veiga, P. M., Hu, Q., & Hughes, M. (2025). Dynamic capabilities as a moderator: enhancing the international performance of SMEs with international entrepreneurial orientation. *Review of Managerial Science*, *19*(4), 1073–1094. https://doi.org/10.1007/s11846-024-00784-8

Hair, J., Gabriel, M., & Patel, V. (2014). AMOS Covariance-Based Structural Equation Modeling (CB-SEM): Guidelines on its Application as a Marketing Research Tool. *Revista Brasileira de Marketing*, *13*, 44–55. https://doi.org/10.5585/remark.v13i2.2718

Harwiki, W., & Malet, C. (2020). Quintuple helix and innovation on performance of SMEs within ability of SMEs as a mediator variable: A comparative study of creative industry in

Indonesia and Spain. *Management Science Letters*, *10*(6), 1389–1400. https://doi.org/10.5267/j.msl.2019.11.018

Heredia, J., Flores, A., Heredia, W., Arango, R., & Medina, L. (2019). How Innovation Influences on Export Performance: A Configuration Approach for Emerging Economies. *Journal of Technology Management & Innovation*, *14*(4), 54–65. https://doi.org/10.4067/S0718-27242019000400054

Humas BSIP Sumatera Utara. (2024, August 15). *BSIP SUMUT Siap Mendampingi UMK dan Lembaga Penerap SIP di Kabupaten Tapanuli Selatan*. North Sumatera Agricultural Instrument Standards Implementation Center. https://sumut.bsip.pertanian.go.id/berita/bsip-sumut-siap-mendampingi-umk-dan-lembaga-penerap-sip-di-kabupaten-tapanuli-selatan

Indonesian Export Financing Agency (LPEI). (2024, December 24). Boosting the Competitiveness of Banten Palm Sugar to Break Through Exports Through the LPEI Foreign Exchange Village Program. *Lembaga Pembiayaan Ekspor Indonesia (LPEI)*. https://www.indonesiaeximbank.go.id/public-information/meningkatkan-daya-saing-gula-aren-banten-tembus-ekspor-melalui-program-desa-devisa-lpei

Ivanova, I. A., & Leydesdorff, L. (2014). Rotational symmetry and the transformation of innovation systems in a Triple Helix of university-industry-government relations. *Technological Forecasting and Social Change*, *86*, 143–156. https://doi.org/10.1016/j.techfore.2013.08.022

Kholiavko, N., Grosu, V., Safonov, Y., Zhavoronok, A., & Cosmulese, C. G. (2021). Quintuple Helix Model: Investment Aspects of Higher Education Impact on Sustainability. *Management Theory and Studies for Rural Business and Infrastructure Development*, *43*(1), 111–128. https://doi.org/10.15544/mts.2021.10

Kitsios, F., Kamariotou, M., & Grigoroudis, E. (2021). Digital Entrepreneurship Services Evolution: Analysis of Quadruple and Quintuple Helix Innovation Models for Open Data Ecosystems. *Sustainability*, *13*(21), 12183. https://doi.org/10.3390/su132112183

Kvale, Steinar., & Brinkmann, Svend. (2015). *InterViews : learning the craft of qualitative research interviewing*. Sage Publications.

Kyal, H., Mandal, A., Kujur, F., & Guha, S. (2022). Individual entrepreneurial orientation on MSME's performance: the mediating effect of employee motivation and the moderating effect of government intervention. *IIM Ranchi Journal of Management Studies*, *1*(1), 21–37. https://doi.org/10.1108/IRJMS-07-2021-0041

Najib, M., Rahman, A. A. A., & Fahma, F. (2021). Business survival of small and medium-sized restaurants through a crisis: The role of government support and innovation. *Sustainability (Switzerland)*, *13*(19), 10535. https://doi.org/10.3390/su131910535

National Research and Innovation Agency. (2025). *BRIDA as a Driver of Regional Innovation to Realize Asta Cita*. https://brin.go.id/drid/posts/kabar/brida-sebagai-penggerak-inovasi-daerah-untuk-mewujudkan-asta-cita

Netti Herlina, Amir Husin, Meutia Nurfahasdi, & Isra' Suryati. (2021). Strategy for improving the quality of palm sugar into cane sugar in the Lomban Lobu Area, Arse Subdistrict, South Tapanuli Regency. *Talenta Conference Series: Local Wisdom, Social, and Arts (LWSA)*, *4*(1). https://doi.org/10.32734/lwsa.v4i1.1182

Noya, S., Taneo, S. Y. M., & Melany. (2023). Triple Helix Innovation Ecosystem: The Role of Small and Medium Enterprises Community in Enhancing Performance. *Quality Innovation Prosperity*, *27*(1), 46–61. https://doi.org/10.12776/QIP.V27I1.1759

Nurhidayah, N., Rukiah, R., & Harahap, D. (2024). Business Development Model For Small-Scale Sipirok Palm Sugar Production Using The Analytical Network Process Approach. *Jurnal GeoEkonomi*, *15*(1), 52–64. https://doi.org/10.36277/geoekonomi.v15i1.376

Osiobe, E. U., & Winingham, K. (2020). Why Universities Create and Foster Business Incubators? *Journal Of Small Business And Entrepreneurship Development*. https://api.semanticscholar.org/CorpusID:226553829

Paul, J., & Dhiman, R. (2021). Three decades of export competitiveness literature: systematic review, synthesis and future research agenda. *International Marketing Review*, *38*(5), 1082–1111. https://doi.org/10.1108/IMR-12-2020-0295

Porter, M. E. (1985). *Competitive advantage : creating and sustaining superior performance*. Free Press ; Collier Macmillan.

Radio Republik Indonesia. (2024). *Getting to know the eight missions of the Prabowo-Gibran administration "Asta Cita" program*. https://www.rri.co.id/lain-lain/1103608/mengenal-delapan-misi-asta-cita-pemerintahan-prabowo-gibran

Ranga, M., & Etzkowitz, H. (2013). Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education*, *27*(4), 237–262. https://doi.org/10.5367/ihe.2013.0165

Rodrigues-Ferreira, A., Afonso, H., André Mello, J., & Amaral, R. (2023). Creative Economy And The Quintuple Helix Innovation Model: A Critical Factors Study In The Context Of Regional Development. *Creativity Studies*, *16*(1), 158–177. https://doi.org/10.3846/cs.2023.15709

Rosadi. (2024, June 26). *Mengenal Kelompok Usaha Bersama "Maradu Miduk" Desa Aek Nabara Tapanuli Selatan*. https://prcfindonesia.org/mengenal-kelompok-usaha-bersama-maradu-miduk-desa-aek-nabara-tapanuli-selatan/#:~:text=yang%20bergerak%20dalam%20bisnis%20pengolahan,di%20pasar%20nasional%20maupun%20internasional

Said, M. (2023, March 10). *Nine MSME products from Medan City penetrate the export market*. https://sumut.antaranews.com/berita/522342/sembilan-produk-umkm-kota-medan-tembus-pasar-ekspor

Serrano, R., Fernández-Olmos, M., & Pinilla, V. (2018). Internationalization and performance in agri-food firms. *Spanish Journal of Agricultural Research*, *16*(2), e0107. https://doi.org/10.5424/sjar/2018162-12206

Suwannarat, P. (2016). The study of export intermediary performance determinants. *Multinational Business Review*, *24*(2), 123–143. https://doi.org/10.1108/MBR-10-2015-0050

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Verhees, F. J. H. M., & Meulenberg, M. T. G. (2004). Market Orientation, Innovativeness, Product Innovation, and Performance in Small Firms. *Journal of Small Business Management*, *42*(2), 134–154. https://doi.org/10.1111/j.1540-627X.2004.00102.x

Wach, K. (2015). Editorial: International Entrepreneurial Orientation. *Entrepreneurial Business and Economics Review*, *3*(2), 7–8. https://doi.org/10.15678/EBER.2015.030201

Wahdiniwaty, R., Firmansyah, D., Dede, D., Suryana, A., & Rifa'i, A. A. (2022). The Concept of Quadruple Helix Collaboration and Quintuple Helix Innovation as Solutions for Post Covid 19 Economic Recovery. *Mix: Jurnal Ilmiah Manajemen*, *12*(3), 418. https://doi.org/10.22441/jurnal_mix.2022.v12i3.005

Wanyonyi, E. I., Gathungu, E. W., Bett, H. K., & Okello, D. O. (2021). Determinants of Porter's competitive strategy utilization among agro-dealers in Kenya. *Cogent Food & Agriculture*, *7*(1). https://doi.org/10.1080/23311932.2020.1865595

Wolf, P., Kaudela-Baum, S., & Meissner, J. O. (2012). Exploring innovating cultures in small and medium-sized enterprises: Findings from Central Switzerland. *International Small Business Journal*, *30*(3), 242–274. https://doi.org/10.1177/0266242610386666

Yuniarta, G. A., Diatmika, I. P. G., & Cipta, W. (2019). The Role of Government, Entrepreneurship, and Business Competence In Order To Improve The Competitiveness of Micro, Small, and Medium Enterprises (MSMEs). *Proceedings of the International Conference on Tourism, Economics, Accounting, Management, and Social Science (TEAMS 2018)*. https://doi.org/10.2991/teams-18.2019.49

Zahara, Z., Muslimin, M., Rumijati, A., & Rony, Z. T. (2024). Competitive Advantage as Mediating Role to Enhance MSMES Performance. *Journal of Small Business Strategy*, *34*(2).

https://doi.org/10.53703/001c.121131

Zdenek, R. O., & Walsh, D. (2017). Community Development Core Competencies. In R. O. Zdenek & D. Walsh (Eds.), *Navigating Community Development: Harnessing Comparative Advantages to Create Strategic Partnerships* (pp. 75–102). Palgrave Macmillan US. https://doi.org/10.1057/978-1-137-47701-9_5

Zhang, J., Esangbedo, M., Kone, S., & Xu, L. (2023). The role of industry-academia collaboration in enhancing educational opportunities and outcomes under the digital driven Industry 4.0. *Journal of Infrastructure, Policy and Development*, *8*(1). https://doi.org/10.24294/jipd.v8i1.2569