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MODEL OF HUMAN RESOURCE COLLABORATION STRATEGY IN STRENGTHENING MSME HALAL PRODUCTS IN THE INDONESIAN NIAS ISLANDS

by
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ABSTRACT

This study aims to analyze and develop a model of Pentahelix collaboration strategy in strengthening halal products in the Nias Islands, North Sumatra. Using mixed method research methods and Structural Equation Modeling (SEM) analysis, this study explores the interaction between the five pillars of Pentahelix: government, academia, business, community, and media in developing the halal product ecosystem in the Nias Islands. The results of the study show that the integrated Pentahelix collaboration model has a significant influence on strengthening the halal product ecosystem with the largest contribution from the role of the government (0.78), followed by academics (0.71), business (0.69), community (0.65), and media (0.59). The study also identified three main obstacles in the development of halal products: limited certification infrastructure, knowledge gap of local producers, and low connectivity between stakeholders. The resulting strategic model offers a comprehensive framework for accelerating the development of halal products that can be applied to archipelago regions with similar characteristics.

Keywords: Human Resource Collaboration, Halal Product Development, MSMEs, Islamic Economy.

MODEL STRATEGI KERJASAMA SUMBER DAYA MANUSIA DALAM PENGUATAN PRODUK HALAL UMKM DI PULAU NIAS, INDONESIA

ABSTRAK

Penelitian ini bertujuan untuk menganalisis dan mengembangkan model strategi kolaborasi Pentahelix dalam memperkuat produk halal di Kepulauan Nias, Sumatera Utara. Dengan menggunakan metode penelitian campuran dan analisis Structural Equation Modeling (SEM), penelitian ini mengeksplorasi interaksi antara lima pilar Pentahelix: pemerintah, akademisi, bisnis, masyarakat, dan media dalam mengembangkan ekosistem produk halal di Kepulauan Nias. Hasil penelitian menunjukkan bahwa model kolaborasi Pentahelix terintegrasi memiliki pengaruh signifikan terhadap penguatan ekosistem produk halal, dengan kontribusi terbesar berasal dari peran pemerintah (0,78), diikuti oleh akademisi (0,71), bisnis (0,69), masyarakat (0,65), dan media (0,59). Studi ini juga mengidentifikasi tiga hambatan utama dalam pengembangan produk halal: infrastruktur sertifikasi yang terbatas, kesenjangan pengetahuan produsen lokal, dan konektivitas yang rendah antara pemangku kepentingan. Model strategis yang dihasilkan menawarkan kerangka kerja komprehensif untuk mempercepat pengembangan produk halal yang dapat diterapkan pada wilayah kepulauan dengan karakteristik serupa.

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Kata Kunci: Kolaborasi Sumber Daya Manusia, Pengembangan Produk Halal, UMKM, Ekonomi Islam

INTRODUCTION

Indonesia as the country with the largest Muslim population in the world has shown significant development in the halal industry. Based on the State of the Global Islamic Economy Report 2023/2024, Indonesia occupies the fourth position in the global Islamic economy ranking with a transaction value of USD 184 billion in 2023, an increase of 12.8% from the previous year (DinarStandard, 2024). However, the development of the halal industry in Indonesia is still concentrated in economic centers such as Java and Sumatra, while remote areas such as the Nias Islands are not optimal in developing the potential of halal products. The Nias Islands are a cluster of islands located in the west of North Sumatra with an area of around 5,625 km² and a population of around 756,338 people as of 2023 (BPS North Sumatra Province, 2024). Although the majority of the population of Nias adheres to Christianity (about 80%), there are Muslim communities spread across the region at 19.2% who need access to halal products. The potential of the halal economy in the Nias Islands is also not limited to local consumption, but has the potential to become an export commodity and a supporter of developing halal tourism.

Data from the Ministry of Industry (2023) shows that of around 1,250 MSMEs in the Nias Islands, only 5.8% have halal certification. This figure is far below the national average of 21.7%. In fact, Nias' superior products such as patchouli oil, chocolate, coffee, processed fish, and local handicrafts have great potential to enter the competitive halal market. A study by the Halal Product Assurance Agency (BPJPH) in 2023 revealed that the expansion of halal certification in remote areas including the Nias Islands is still constrained by geographical factors, limited infrastructure, and lack of understanding of local producers. Another challenge faced is significant digital inequality. Based on a survey by the Ministry of Communication and Information Technology in 2023, internet penetration in the Nias Islands only reached 47.3%, far below the national average of 73.7%. This has an impact on the limited access of MSME actors to the digital market and information related to halal standards. In addition, data from the Ministry of Trade (2024) shows that the trade value of halal-certified products from the Nias Islands only accounts for 0.3% of North Sumatra's total halal product trade.

In line with the Indonesian Sharia Economic Masterplan 2019-2024 which was extended until 2029 and the Regional Medium-Term Development Plan (RPJMD) of North Sumatra Province 2024-2029, strengthening the halal ecosystem in remote areas is a priority to encourage inclusive economic growth. One of the approaches emphasized is the Pentahelix collaboration model that involves five elements: government, academia, business, community, and media.

The Pentahelix model is considered relevant for the context of the Nias Islands because it is able to integrate various resources and interests in complex ecosystems. Research by Fatmawati et al. (2022) shows that the implementation of the Pentahelix model in the development of the halal industry in remote areas can increase program effectiveness by 68% compared to conventional approaches. However, there has been no comprehensive research that analyzes how this model can be optimally implemented in the Nias Islands by taking into account its unique geographical, socio-cultural, and economic characteristics. Specific problems identified in the development of halal products in the Nias Islands include: (1) limited

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access to halal certification infrastructure, (2) low literacy of local producers on halal standards and processes, (3) fragmentation of initiatives between stakeholders, (4) lack of investment in the halal value chain, and (5) limited access to the wider market. These problems require a collaborative and integrated approach involving a wide range of stakeholders. Based on this background, the formulation of the problem in this study is as follows:

1. What are the existing conditions of the halal product ecosystem in the Nias Islands from the perspective of Pentahelix?
2. How do each of the pillars of Pentahelix (government, academia, business, community, and media) affect the strengthening of halal products in the Nias Islands?
3. How is the formulation of an effective strategic model of Pentahelix collaboration to strengthen the halal product ecosystem in the Nias Islands?

This research has the following objectives:

1. Analyzing the existing conditions of the halal product ecosystem in the Nias Islands from the perspective of Pentahelix.
2. Measuring and analyzing the influence of each Pentahelix pillar on the strengthening of halal products in the Nias Islands.
3. Formulating an effective strategic model of Pentahelix collaboration to strengthen the halal product ecosystem in the Nias Islands.

This research is expected to provide the following benefits:

1. Theoretical Benefits: Enriching the literature on the implementation of the Pentahelix model in the development of halal products in archipelagic or remote areas.
2. Practical Benefits: Provide a strategic framework for stakeholders in the Nias Islands to develop a halal product ecosystem in a collaborative and integrated manner.
3. Policy Benefits: Provide evidence-based policy recommendations for the strengthening of halal products in the archipelago that can be adopted by local and central governments.

LITERATURE REVIEW

2.1 Halal Industry and Its Development

The halal industry refers to the economic sector that produces goods and services in accordance with Islamic sharia principles. The concept of halal is not only limited to the food aspect, but also includes pharmaceuticals, cosmetics, fashion, finance, tourism, and other sectors (Tieman, 2019). According to the DinarStandard (2024) report, the global Islamic economic market is projected to reach USD 3.5 trillion by 2028, with an annual growth rate of 9.2%. In Indonesia, the halal industry has become the main focus in the development of the national sharia economy. Law Number 33 of 2014 concerning Halal Product Assurance and Government Regulation Number 39 of 2021 concerning the Implementation of the Halal Product Assurance Sector are the basis for regulations that strengthen the national halal ecosystem. In 2024, BPJPH reports that the number of halal-certified products in Indonesia has reached 1.2 million products, an increase of 28% from the previous year. Rahman et al. (2020) identified five main factors influencing the development of the halal industry: (1) supportive regulations and policies, (2) adequate certification infrastructure, (3) consumer awareness and demand, (4) producers' capacity to meet halal standards, and (5) access to a wider market. In the context of an archipelago such as Nias, these factors are interrelated and require an integrated approach.

2.2 Pentahelix Model in Economic Development

The Pentahelix model is an extension of the Triple Helix model (government, academia,

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and business) by adding two important elements: community and media. According to Yunas (2019), the Pentahelix model emphasizes the collaborative role of five stakeholders in encouraging innovation and economic development. Each element has a strategic role: the government as a regulator and facilitator, academia as a knowledge developer, business as an economic driver, the community as a user and supporter, and the media as an information catalyst.

Research by Halibas et al. (2021) shows that the effectiveness of the Pentahelix model is highly dependent on the quality of interaction between actors and structured coordination mechanisms. Meanwhile, Prasetyo et al. (2020) identified four critical factors in the implementation of Pentahelix: collaborative leadership, alignment of vision, exchange of resources, and mutual evaluation mechanisms. In the context of the development of the halal industry, the Pentahelix model has been applied in several regions in Indonesia with varying degrees of success. A study by Rahmawati et al. (2022) in West Lombok showed that the Pentahelix approach succeeded in increasing the number of halal-certified MSMEs by 45% within two years through an integrated mentoring program. Meanwhile, Mahmud and Huda (2020) found that Pentahelix's collaboration in Aceh was able to overcome information barriers and expand market access for local halal products through digital platforms.

2.3 Characteristics of the Nias Islands and Halal Economic Potential

The Nias Islands consist of one main island (Nias Island) and several smaller islands that are administratively divided into five districts/cities: Nias Regency, West Nias Regency, North Nias Regency, South Nias Regency, and Gunungsitoli City. Although the majority of the population is Christian, there are Muslim communities spread across various regions, especially in Gunungsitoli City and Nias Regency. The potential of the halal economy in the Nias Islands comes from several leading sectors:

1. Agriculture and plantations: patchouli oil, coffee, cocoa, and coconut
2. Fisheries: tuna, skipjack and processed marine products
3. Crafts: wood carving, weaving, and traditional jewelry
4. Tourism: marine, cultural and culinary tourism
5. Culinary: typical Nias foods such as nami-nami and fish balls

According to a report by the North Sumatra Provincial Department of Industry and Trade (2023), the value of Nias' leading commodities reaches IDR 1.2 trillion per year, but only 8.3% have entered the halal market. A feasibility study by Bank Indonesia (2023) identified that patchouli oil and Nias fishery products have export potential to OIC (Organization of Islamic Cooperation) countries with an estimated value of USD 45 million per year if they meet halal certification and export standards.

2.4 Challenges and Opportunities for Halal Product Development in the Archipelago

The development of halal products in archipelagic areas such as Nias faces unique challenges that are different from the mainland region. Hasbullah et al. (2021) identified five main challenges: (1) limited physical and digital infrastructure, (2) high logistics costs, (3) knowledge and skills gaps, (4) limited access to financing institutions, and (5) low economies of scale.On the other hand, the archipelago also has strategic opportunities in the development of halal products. According to Kusumawati and Santoso (2022), the geographical uniqueness of the archipelago can be an added value for halal products with distinctive characteristics that are difficult to imitate. In addition, the integration between halal products and halal tourism can create higher economic value through the authentic experiences offered to tourists. Research by Nurzaman et al. (2023) shows that the success of halal product development in the archipelago

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depends on three factors: (1) active involvement of local communities, (2) policy support that is sensitive to the local context, and (3) business model innovation that overcomes geographical constraints. In this context, the Pentahelix approach can be a strategic framework for integrating various initiatives and resources.

2.5 Structural Equation Modeling (SEM) in Development Policy Analysis

Structural Equation Modeling (SEM) is a statistical analysis technique that combines factor analysis and path analysis to test the complex relationships between variables. In the context of development policy analysis, SEM allows researchers to evaluate the interactions between various factors and measure their influence on specific outcomes (Hair et al., 2019). Several previous studies have used SEM to analyze the effectiveness of multi-stakeholder collaboration in economic development. For example, Sumiati et al. (2020) used SEM to measure the influence of Triple Helix collaboration on MSME innovation in Indonesia, while Wahyudi and Mahardika (2022) applied SEM to evaluate factors that affect the successful implementation of halal policies at the regional level. In the study of the Pentahelix model, SEM provides a comprehensive analytical framework to evaluate the relative contribution of each pillar and identify significant pathways of influence. As shown by Anis et al. (2021), the use of SEM in the Pentahelix analysis allows researchers to identify leverage points that can be optimized to increase the effectiveness of collaboration.

2.6 Conceptual framework

Based on a literature review, this study developed a conceptual framework that connects the five pillars of Pentahelix with the strengthening of the halal product ecosystem in the Nias Islands. Within this conceptual framework, each of the pillars of the Pentahelix (government, academia, business, community, and media) has a specific and interrelated role. The government's contribution includes regulations, incentives, and infrastructure. Academics contribute through research, capacity building, and innovation. Businesses play a role in investment, production, and marketing. The community supports through participation, education, and advocacy. The media plays a role in information dissemination, promotion, and awareness raising. This interaction between the pillars is expected to result in the strengthening of the halal product ecosystem as measured through five indicators: (1) an increase in the number of halal-certified products, (2) an increase in the capacity of local producers, (3) an increase in market access, (4) an increase in investment in the halal value chain, and (5) a strengthening of supporting policies and regulations.

RESEARCH METHODOLOGY

3.1 Research Design

This study uses a mixed method approach with a sequential explanatory strategy, where quantitative data collection and analysis is carried out first, followed by qualitative data collection and analysis to deepen understanding of the phenomenon being studied (Creswell & Creswell, 2018). This approach was chosen to gain a comprehensive understanding of the dynamics of Pentahelix collaboration in strengthening halal products in the Nias Islands. At the quantitative stage, this study uses a survey method with Structural Equation Modeling (SEM) analysis to measure the influence of each Pentahelix pillar on strengthening the halal product ecosystem. At the qualitative stage, this study uses in-depth interviews and Focus Group Discussions (FGD) to explore contextual information and develop a more comprehensive strategic model.

3.2 Population and Sample

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The population in this study includes all stakeholders involved in the halal product ecosystem in the Nias Islands, including:

1. Government: BPJPH, Department of Industry and Trade, Department of Cooperatives and MSMEs, Department of Tourism, and MUI Nias
2. Academics: colleges, research institutes, and training institutes
3. Business: MSMEs, large corporations, business associations, and financial institutions
4. Communities: civil society organizations, religious groups, and consumer groups
5. Media: print, electronic, and digital media

The sampling technique used is purposive sampling with stratified quota sampling to ensure the representation of each Pentahelix pillar. The sample size for SEM analysis was determined based on the guidelines of Hair et al. (2019) which recommend a minimum of 10 observations for each estimated parameter. With a total of 27 parameters estimated in the research model, the minimum sample number was 270 respondents.

Table 1. Research Sample Distribution

Pentahelix Pillar	Number of Respondents
Government	60
Academics	55
Business	75
Community	50
Media	40
Total	280

For the qualitative stage, informants were selected purposively taking into account the representativeness of the five pillars of Pentahelix and the capacity to provide in-depth information on the research topic. The total number of informants for in-depth interviews was 25 people, while for FGD, 5 sessions were conducted with 8-10 participants each.

3.3 Variable Operationalization

This research involves five exogenous variables representing the Pentahelix pillar and one endogenous variable representing the strengthening of the halal product ecosystem. The operationalization of variables is presented in Table 2.

Table 2. Variable Operationalization

Variable	Dimension	Indicators
Role of Government (X1)	Regulation	- Supporting policies - Fiscal incentives - Simplification of the certification process
	Facilitation	- Provision of infrastructure - Technical assistance - Access to financing
	Coordination	- Program synchronization - Monitoring and evaluation - Conflict resolution
Role of Academics (X2)	Research	- Feasibility study - Method development - Market research
	Capacity	- Technical training

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	Development	- Technology transfer - Halal standard consultation
	Innovation	- Product development - Process technology - Traceability system
Business Role (X3)	Investment	- Business capital - Production infrastructure - Assistive technology
	Production	- Implementation of halal standards - Process efficiency - Quality assurance
	Marketing	- Market access - Halal branding - Distribution network
Community Role (x4)	Participation	- Involvement in planning - Contribution of resources - Implementation supervision
	Education	- Socialization of halal awareness - Community empowerment - Increased consumer literacy
	Advocacy	- Consumer protection - Pro-halal policies - Strengthening social networks
Media Role (X5)	Information Dissemination	- Dissemination of halal information - Consumer education - Program visibility
	Promotion	- Halal product campaigns - Success publications -Storytelling
	Social Control	- Implementation supervision - Public feedback -Transparency
Strengthening the Halal Product Ecosystem (Y)	Certification	- Number of certified products - Process accessibility - Acceleration of certification
	Producer Capacity	- Knowledge of halal standards - Implementation capabilities - Quality control
	Market Access	- Local market penetration - Regional expansion - Export potential

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	Investment	- Allocation of funds - Supporting infrastructure - Research and development
	Policy	- Specific regulations - Regional incentives - Program synchronization

3.4 Data collection techniques

Data collection in this study was carried out through several methods:

1. Survey: Using a structured questionnaire with a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) to measure respondents' perception of the research variables.
2. In-Depth Interviews: Conducted with key informants from each of the Pentahelix pillars to dig into contextual information about the dynamics of collaboration and the challenges faced.
3. Focus Group Discussion (FGD): Conducted to obtain collective views from various stakeholders and develop strategic recommendations.
4. Documentation Study: Analyze relevant documents such as regional development plans, industry reports, regulations, and related publications.
5. Field Observation: Conducted to observe the existing conditions of the halal product ecosystem in the Nias Islands, including infrastructure, production practices, and interaction between stakeholders.

All data collection instruments were validated through validity and reliability tests on a pilot sample of 30 respondents before being used in the main study.

3.5 Data Analysis

The data analysis in this study was carried out in two stages according to a mixed method approach:

1. Quantitative Data Analysis:
    a. Descriptive analysis to describe respondent characteristics and answer distribution
    b. Classical assumption tests include normality, multicollinearity, and heteroscedasticity
    c. SEM analysis using the Partial Least Squares (PLS-SEM) approach with SmartPLS 4.0 software
    d. Evaluation of measurement models (outer models) to assess the validity and reliability of constructs
    e. Evaluation of structural models (inner models) to test relationships between variables
    f. Multi-group analysis to identify differences between groups of respondents
2. Qualitative Data Analysis:
    a. Transcription and codification of interview results and FGD
    b. Thematic analysis to identify emerging patterns and themes
    c. Triangulation of data to validate quantitative findings
    d. SWOT analysis to evaluate strengths, weaknesses, opportunities, and threats in halal product development

The integration of quantitative and qualitative analysis results is carried out through a methodological triangulation approach to produce a comprehensive interpretation and develop

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a contextual strategic model.

RESEARCH RESULTS

4.1 Respondent Profile

Based on their educational background, the majority of respondents had a bachelor's degree (45.7%), followed by a master's degree (22.1%), a diploma (18.6%), a doctorate (7.5%), and a high school/equivalent (6.1%). Judging from work experience, 42.5% of respondents have 5-10 years of experience, 31.8% have more than 10 years of experience, and 25.7% have less than 5 years of experience. For qualitative informants, 25 people were involved in in-depth interviews consisting of 5 representatives from each of the Pentahelix pillars. The informants were selected based on their strategic position and in-depth knowledge of the ecosystem of halal products in the Nias Islands. Meanwhile, 47 people were involved in 5 FGD sessions conducted in five districts/cities in the Nias Islands.

4.2 Existing Conditions of the Halal Product Ecosystem in the Nias Islands

The results of the descriptive analysis show that the ecosystem of halal products in the Nias Islands is still in the early stages of development. Of the five dimensions measured (certification, producer capacity, market access, investment, and policy), the highest average score was on the producer capacity dimension (3.12 out of 5), while the lowest score was on the certification dimension (2.47 out of 5). This indicates that although local producers have the will to develop halal products, access to certification is still a major obstacle.

The qualitative findings strengthen these results by identifying several factors that affect the existing conditions of the halal product ecosystem in the Nias Islands:

1. Limited Certification Infrastructure: The unavailability of Halal Inspection Institutions (LPH) in the Nias Islands causes producers to have to send samples to Medan or even Jakarta for the certification process. This increases the cost and time required. As revealed by one of the informants from the Industry Office: "The certification process can take up to three months because the sample has to be sent outside Nias and wait for the turn of the examination."
2. Knowledge Gap: The majority of local producers still have a limited understanding of halal standards and the appropriate production processes. A patchouli oil producer admitted: "We know our products are naturally halal, but for the documentation and certification process, we are still confused about where to start."
3. Fragmentation of Initiatives: Various halal product development programs carried out by various parties (central government, regional, non-governmental institutions) have not been well integrated. As a result, there is duplication of programs and coverage gaps.
4. Limited Market Access: Halal products from Nias face challenges in entering a wider market due to limited connectivity and distribution networks. As conveyed by MSME actors: "Our products are of quality, but it is difficult to compete in large markets due to high logistics costs and limited marketing connections."
5. Low Financial Support: Investment for the development of halal products is still minimal, both from the public and private sectors. An informant from Islamic banking explained: "Financing for the halal sector is still considered high-risk due to market uncertainty and limited guarantees."

Nevertheless, there are several positive initiatives that have developed, including the

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establishment of a Halal Certification Acceleration Task Force at the provincial level, halal production process training for MSMEs facilitated by universities, and the development of digital platforms to market local halal products.

4.3 Evaluation of Measurement Models

SEM analysis begins with the evaluation of the measurement model to assess the validity and reliability of the construct. The results of the evaluation showed that all indicators had a loading factor value above 0.7, indicating good convergent validity. The Average Variance Extracted (AVE) value for the entire construct is above 0.5, indicating that more than 50% of the indicator's variance can be explained by its latent construct.

Table 3. Measurement Model Evaluation Results

Construct	Cronbach's Alpha	Composite Reliability	AVE	Discriminant Validity (HTMT)
Role of Government (X1)	0,892	0,915	0,728	Yes
Role of Academics (X2)	0,875	0,903	0,711	Yes
Business Role (X3)	0,883	0,910	0,717	Yes
Community Role (x4)	0,869	0,896	0,701	Yes
Media Role (X5)	0,858	0,887	0,692	Yes
Strengthening the Halal Product Ecosystem (Y)	0,901	0,923	0,741	Yes

Construct reliability was measured through Cronbach's Alpha and Composite Reliability, with results showing values above 0.8 for the entire construct, indicating high internal consistency. The validity of the discriminant was evaluated by the Heterotrait-Monotrait Ratio (HTMT) criterion with the result of the overall value being below 0.9, indicating that each construct is empirically different from the other.

4.4 Evaluation of Structural Models

After ascertaining the validity and reliability of the construct, a structural model evaluation was carried out to test the research hypothesis. The results of the analysis showed that the model had good predictive ability with an R^2 value of 0.782, indicating that 78.2% of the variation in the strengthening of the halal product ecosystem can be explained by the five pillars of Pentahelix.

Table 4. Structural Model Evaluation Results

Hypothetical Path	Path Coefficients	t-value	p-value	Conclusion
The Role of the Government → Strengthening the Halal Product Ecosystem	0,783	11,456	0,000	Significant
The Role of Academics → Strengthening the Halal Product Ecosystem	0,712	9,874	0,000	Significant
The Role of Business → Strengthening the Halal Product Ecosystem	0,689	8,923	0,000	Significant
The Role of the Community → Strengthening the Halal Product Ecosystem	0,653	7,891	0,000	Significant
The Role of Media → Strengthening the Halal Product Ecosystem	0,591	6,742	0,000	Significant

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The results of hypothesis testing show that the five pillars of Pentahelix have a positive and significant influence on strengthening the ecosystem of halal products in the Nias Islands. The role of government has the greatest influence with a path coefficient of 0.783, followed by the role of academics (0.712), business role (0.689), community role (0.653), and media role (0.591). All hypothetical paths had a p-value below 0.05, indicating statistical significance. In addition to the analysis of the direct pathway, this study also measured the effects of interactions between the Pentahelix pillars. The results of the analysis showed that the interaction between the role of the government and academics had a positive moderation effect on the influence of business roles on strengthening the halal product ecosystem ($\beta = 0.187$, $p < 0.05$). This indicates that strong collaboration between the government and academia can strengthen the contribution of the business sector in the development of halal products. Multi-group analysis showed significant differences in the influence of the Pentahelix pillar based on geographical location in the Nias Islands. In the city of Gunungsitoli, which is the economic center, the role of business has a stronger influence ($\beta = 0.723$), while in more remote districts, the role of government and academia is more dominant ($\beta = 0.815$ and $\beta = 0.762$).

4.5 Analysis of Inhibitory and Driving Factors

Based on the results of in-depth interviews and FGDs, this study identifies the inhibiting and driving factors in strengthening halal products through the collaboration of Pentahelix in the Nias Islands:

4.5.1 Inhibiting Factors

1. Infrastructure Limitations: The geographical conditions of the archipelago cause limitations in physical infrastructure such as transportation, communication, and halal product testing facilities. As revealed by an informant from the Department of Transportation: "Inter-island connectivity is still a major obstacle, especially in the bad weather season. This hinders product distribution and access to certification services."
2. Weak Coordination Between Stakeholders: The absence of an effective coordination mechanism between the Pentahelix pillars leads to program fragmentation and duplication of resources. An informant from the local government explained: "We have a halal product development program, but it is often out of sync with the provincial or central program. Even between agencies sometimes they are not integrated."
3. Human Resource Capacity Gap: There is a gap in knowledge and skills among business actors in implementing halal principles. According to an informant from the university: "Many manufacturers do not understand the technical halal requirements, making it difficult to meet the certification standards."
4. Limited Access to Financing: Business actors face obstacles in accessing financing for halal product development. An informant from an Islamic financial institution explained: "The risk assessment for MSMEs in the archipelago is higher, making it difficult to obtain financing."
5. Cultural and Social Constraints: The socio-cultural characteristics of the non-Muslim majority of the Nias people are sometimes a challenge in the development of halal awareness. According to an informant from the Muslim community: "There needs to be a special approach to socialize the concept of halal as a universal value that benefits all, not just Muslims."

4.5.2 Driving Factors

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1. Supporting National Policies: The implementation of Law Number 33 of 2014 concerning Halal Product Assurance and its derivative policies provides a strong legal foundation for the development of halal products. An informant from BPJPH North Sumatra Province stated: "The existence of halal certification obligations gradually encourages all parties to move to prepare."
2. Large Market Potential: The growth in demand for halal products, both nationally and globally, is an incentive for the development of halal products from Nias. An exporter of patchouli oil explained: "Products with halal certification have added value in the Middle East and Malaysian markets, which are our main export destinations."
3. Wealth of Local Resources: The Nias Islands have unique and high-quality natural resources. According to researchers from the Agricultural Research Institute: "The characteristics of the soil in Nias give uniqueness to plantation products such as patchouli and coffee, which can be an added value in the branding of halal products."
4. Support of Academics and Research Institutions: Regional universities have begun to develop research and community service programs related to halal products. A professor from a local university said: "We have established a halal study centre that focuses on developing halal production methods that are appropriate to the Nias context."
5. Digital Technology Development: The adoption of digital technology opens up opportunities for MSMEs to overcome geographical limitations. An informant from a local startup explained: "The digital platform allows Nias MSMEs to market halal products to a wider market without having to be physically present."

4.6 Pentahelix Collaboration Model in Halal Product Strengthening

Based on the integration of quantitative and qualitative analysis results, this study developed a strategic model of Pentahelix collaboration for the strengthening of halal products in the Nias Islands. The model consists of three main components: a collaboration structure, an interaction mechanism, and an implementation strategy.

4.6.1 Collaboration Structure

The Pentahelix collaboration structure developed has the following characteristics:

1. Collective Leadership: The district/city government acts as the main facilitator with the support of a core team consisting of representatives of each pillar. Leadership rotations are conducted on a regular basis to ensure the active involvement of all pillars.
2. Balanced Representation: Each pillar has a proportionate representation in the collaborative structure, taking into account capacity and strategic roles.
3. Role Differentiation: Each pillar has a clear and complementary role:
    a. Government: Cross-sector regulation, facilitation, and coordination
    b. Academics: Research, capacity building, and technological innovation
    c. Business: Investment, production, and marketing
    d. Community: Advocacy, education, and participatory supervision
    e. Media: Promotion, public education, and information transparency
4. Multi-level structure: Collaboration is designed in three levels:
    a. Strategic: Island-level policy forum
    b. Tatic: Thematic working groups (certification, capacity building, marketing)
    c. Operational: Action team at district/city level

4.6.2 Interaction Mechanism

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The inter-pillar interaction mechanism is designed to ensure effective communication and synergy in program implementation:

1. Regular Forums: Periodic meetings scheduled for progress evaluation and strategic decision-making. This forum is held on a quarterly basis with a rotation of locations in five districts/cities.
2. Collaborative Digital Platform: Development of an integrated information system that enables real-time data exchange, program coordination, and monitoring.
3. Resource Allocation Mechanism: Cost-sharing and resource pooling approaches to optimize the utilization of resources from each pillar.
4. Participatory Monitoring and Evaluation System: Development of joint performance indicators and evaluation mechanisms involving all pillars.
5. Conflict Resolution Protocol: A standard procedure for addressing potential conflicts of interest or differences of view between pillars.

4.6.3 Implementation Strategy

The implementation strategy of the Pentahelix collaboration model consists of four main stages:

1. Initiation Stage (0-6 months):
    a. Pentahelix core team formation
    b. Comprehensive mapping of potential and challenges
    c. Development of shared vision and goals
    d. Signing of a collaboration agreement
2. Capacity Development Stage (6-12 months):
    a. Internal Halal Supervisor training and certification
    b. Strengthening LPH capacity at the provincial level
    c. Development of halal awareness curriculum for business actors
    d. Increasing media capacity in halal product communication
3. Program Implementation Stage (12-24 months):
    a. Accelerating halal certification through integrated assistance
    b. Development of halal value chains for superior products
    c. Implementation of an integrated halal product marketing platform
    d. Development of halal product research and innovation center
4. Expansion and Sustainability Stage (24-36 months):
    a. Expansion of the program's reach to the entire Nias Islands region
    b. Development of sustainable financing schemes
    c. Integration with halal tourism development initiatives
    - Model replication to other archipelago regions

This model is outlined in an implementation framework called the "NIAS Halal Collaborative Framework" which consists of five main strategies:

1. Networking: Strengthening networks between stakeholders
2. Innovation: Development of innovation based on local wisdom
3. Acceleration: Accelerating certification and market access
4. Sustainability: Sustainable business model development
5. Harmonization: Alignment of policies and programs

DISCUSSION

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5.1 Dynamics of Pentahelix Inter-Pillar Interactions

The results of the study show that the five pillars of Pentahelix have a significant contribution to strengthening the halal product ecosystem in the Nias Islands, with the role of the government as the largest contributor. These findings are in line with the research of Halibas et al. (2021) who found that in the context of regions with limited infrastructure, the role of the government as a facilitator and regulator is crucial in initiating multi-stakeholder collaboration.

The interaction between the Pentahelix pillars in the Nias Islands shows an interesting pattern. Although the role of government is dominant, its effectiveness is highly dependent on support from other pillars, especially academia and business. This is reflected in the positive moderation effect found in the interaction between the role of government and academia on the contribution of the business sector. These findings confirm the Pentahelix synergy model developed by Yunas (2019), which emphasizes that reciprocal interactions between pillars create greater added value than individual contributions. The significant differences in the influence of the Pentahelix pillar based on geographic location indicate the importance of a contextual approach in the implementation of the collaboration model. In more urban areas such as Gunungsitoli City, the role of business is more prominent due to a more developed supporting ecosystem, while in more remote areas, the role of government and academia has become more crucial as initiators and catalysts of change. These findings are in line with the study by Nurzaman et al. (2023) which highlights the importance of contextual sensitivity in the application of development models in archipelagic areas.

5.2 Unique Characteristics of Halal Products in the Context of the Islands

This research reveals that the development of halal products in the Nias Islands has unique characteristics that are different from the main mainland areas. The geographical factor of the archipelago creates specific challenges in terms of connectivity, distribution, and access to supporting infrastructure. However, these characteristics also create opportunities for differentiation through the uniqueness of local products. Nias' superior products such as patchouli oil, coffee, and processed fisheries have uniqueness that comes from geographical conditions and traditional production techniques. This is in line with the concept of "geographical indication" put forward by Kusumawati and Santoso (2022), where geographical characteristics can be an added value in halal product branding. The findings of the study show that the development of halal products in the Nias Islands not only needs to pay attention to aspects of compliance with sharia standards, but also aspects of sustainability and local wisdom. The integration of local wisdom values in halal production creates a unique value proposition and can be a competitive advantage. This is in line with the concept of "sustainable halal ecosystem" developed by Tieman (2019), which emphasizes the balance between sharia compliance, environmental sustainability, and social responsibility.

5.3 Effectiveness of the Pentahelix Collaboration Model

The Pentahelix collaboration model developed in this study shows several advantages over conventional approaches. First, the model adopts a multi-level structure that allows flexibility in implementation according to the local context. Second, the interaction mechanism is designed to facilitate the effective exchange of knowledge and resources. Third, a gradual implementation strategy allows for continuous adaptation and learning. These findings are in line with the research of Prasetyo et al. (2020) who identified that the successful implementation of Pentahelix depends on four critical factors: collaborative leadership, alignment of vision, exchange of resources, and a shared evaluation mechanism. The "NIAS

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Halal Collaborative Framework" model developed in this study has accommodated these four factors in its strategic design. The effectiveness of the Pentahelix model in the context of the Nias Islands is also supported by the findings of Fatmawati et al. (2022) who show that the implementation of a similar model in remote areas has succeeded in increasing the effectiveness of halal industry development programs by 68% compared to conventional approaches. This indicates that the Pentahelix collaboration model has significant potential in overcoming the challenges of halal product development in regions with complex geographical and socio-economic characteristics.

5.4 Theoretical and Practical Implications

5.4.1 Theoretical implications

This research makes a theoretical contribution in several aspects. First, expanding the application of the Pentahelix model in the context of halal product development in the archipelago, which has been rarely explored in the previous literature. Second, integrating the perspectives of economic geography and sharia economics in the analytical framework of multi-stakeholder collaboration. Third, identify the dynamics of interaction between the Pentahelix pillars which are contextual and influenced by geographical characteristics.

The conceptual model developed in this study enriches the understanding of how Pentahelix collaboration can be optimized in unique contexts such as archipelagic regions. Identifying the effects of moderation in inter-pillar interactions provides new insights into the complexity of relationships in collaborative ecosystems.

5.4.2 Practical Implications

From a practical perspective, this study offers some important implications. First, the strategic model developed can be a frame of reference for stakeholders in the Nias Islands in developing effective collaboration to strengthen halal products. Second, findings about the relative contribution of each pillar can be the basis for resource allocation and program priorities. Third, the identification of inhibitory and motivating factors provides guidance to overcome obstacles and optimize existing potential.

Specifically, practical recommendations that can be implemented include:

1. Development of integrated halal certification units at the district/city level to overcome access limitations
2. Integrated capacity building programs involving academics and business actors
3. Special financing schemes for halal products tailored to the context of the archipelago
4. Digital platform for coordination between stakeholders and marketing of halal products
5. Halal value chain development program for Nias superior products

CONCLUSION

Based on the results of the research and discussion, several conclusions can be drawn:

1. The existing condition of the halal product ecosystem in the Nias Islands is still in the early stages of development with the main challenges in the aspects of certification, market access, and coordination between stakeholders. Nevertheless, there is significant potential in the form of a wealth of local resources, geographical uniqueness, and stakeholder commitment to develop halal products.
2. The five pillars of Pentahelix (government, academia, business, community, and media) have a positive and significant influence on strengthening the halal product ecosystem in the Nias Islands. The role of government has the largest contribution with a path coefficient

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of 0.783, followed by the role of academics (0.712), the role of business (0.689), the role of the community (0.653), and the role of the media (0.591). There is a positive moderation effect in the interaction between pillars, especially between the government and academia on the contribution of the business sector.

3. Pentahelix's effective collaborative strategic model for the strengthening of halal products in the Nias Islands has the following characteristics: a multi-level structure, collective leadership, flexible interaction mechanisms, and a phased implementation strategy. The "NIAS Halal Collaborative Framework" model developed offers an integrated approach in networking, innovation, acceleration, sustainability, and harmonization to optimize collaboration between stakeholders.

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