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Stakeholder analysis and development strategy for the cocoa processing agroindustry in North Luwu District, South Sulawesi, Indonesia

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Abstract. *Thalib, Salengke, Achmad M, Zaenuddin K, Arsyad AT, Saputra SW. 2026. Stakeholder analysis and development strategy for the cocoa processing agroindustry in North Luwu District, South Sulawesi, Indonesia. Asian J Agric 10 (1): g100113. https://doi.org/10.13057/asianjagric/g100113.* Indonesia is one of the world's leading cocoa producers, playing an important role in the national economy. However, its production continues to decline due to climate change, land use change, pest and disease attacks, and limitations in farm management. This study aims to formulate an integrated development strategy for the cocoa processing agroindustry in North Luwu District, South Sulawesi, Indonesia, an area with production potential and favorable agroecological conditions. The research used a mixed-methods approach, including stakeholder analysis, SWOT analysis, and the Analytical Hierarchy Process (AHP). The analysis shows that government actors and the private sector play a dominant role in developing the cocoa agroindustry, while farmer and support institutions serve as system-reinforcing mechanisms. The SWOT analysis placed the cocoa agroindustry in the growth quadrant (S-O), indicating the need for a development strategy that leverages internal strengths to capture external opportunities. Furthermore, the AHP analysis identified investment, raw material quality, and human resource capacity building as priority factors in agroindustry development. The main strategy recommended is to improve product quality and innovation, supported by investment, technology, and strengthening farmer capacity. The implementation of this strategy is expected to sustainably increase productivity, competitiveness, and farmer welfare.

Keywords: Agroindustrial strategy, AHP, cocoa, government actors, institutional role

INTRODUCTION

Indonesia is one of the leading producers of cocoa (*Theobroma cacao* L.), a high-value agricultural commodity that contributes substantially to foreign exchange earnings, farmer income, employment, and the development of the agricultural and agroindustrial sectors (Effendy et al. 2019; Nurhadi et al. 2019; Asrul et al. 2021; Izzatin et al. 2023). Globally, cocoa demand continues to increase, while the gap between production and consumption is widening, indicating strong market potential (Placencia et al. 2025). Historically, Indonesia ranked as the third-largest cocoa producer after Côte d'Ivoire and Ghana, contributing approximately 13.6% of global production between 1995 and 2015 (Trimo et al. 2019; Leksono et al. 2021). However, this position has declined since 2016, reflecting a weakening role in the international cocoa market (Leksono et al. 2021; Silalahi et al. 2024).

According to ICCO data (Figure 1), global cocoa production declined by 7.99% in 2022 to 3.67 million tons, with Côte d'Ivoire, Ghana, and Ecuador as the main producers, while Indonesia ranked seventh with 180,000 tons. On the other hand, national statistics from the Ministry of Agriculture and the Indonesian Central Statistics Agency report an average annual production level of 600,000-700,000 tons, indicating a discrepancy between international and domestic data. Table 1 shows that at the national level, cocoa production is on a downward trend, from 734,800 tons in 2019 to 632,120 tons in 2023. This decline is mainly due to reduced plantation area, the impact of climate change, land conversion, switching to other commodities, inadequate land maintenance, and increased pest and disease pressure.

The graph shows that Côte d'Ivoire is the world's highest cocoa producer, reaching around 2.2 million tons, followed by Ghana and Ecuador. Indonesia ranks sixth with a production of around 180,000 tons, far below the West African countries that dominate the global market. Meanwhile, Papua New Guinea has the lowest production at only around 42 thousand tons. This data illustrates that although Indonesia is among the cocoa-producing

countries, its contribution to world production is still relatively small compared to other major producing countries.

More than half of the national cocoa production comes from small farmers in Sulawesi, Indonesia, with North Luwu District as the largest contributor because it has 61.4% of the national cocoa land area and ideal geographical conditions for cultivation (Hati et al. 2023; Idawati et al. 2024; Dröge et al. 2025). Despite its great potential, Table 1 shows that production in this region has declined from 28,102 tons (2019) to 22,710 tons (2023) due to minimal maintenance, limited capital, and the old age of the plants (Ningsih 2023). In fact, the agro-processing sector has grown by 7.18 million/year and could increase further if cocoa potential is optimized. The cocoa agroindustry provides added value through bean processing, supply chain management, marketing, and job creation (Nurhadi et al. 2019; Guirlanda et al. 2021; Ali et al. 2023; Sahruni and Achmad 2023). However, observations show that there are still obstacles such as limited access to capital, low bean quality, productivity <800 kg/ha/year, and weak partnerships and incentives (Zulfiandri 2023).

Previous studies on cocoa agroindustry development have highlighted the importance of increasing production and quality, strengthening institutions, improving marketing, and enhancing government and institutional support, as reflected in various regional and national analyses using approaches such as SWOT, QSPM, or ISM (Astuti 2021; Indrawanto et al. 2021; Barmawi 2022; Septeri 2022; Khaerati et al. 2024). While these studies confirm the significant potential of the cocoa agroindustry and identify key constraints, most of them remain focused on primary production or partial institutional aspects and do not explicitly address the integrated dynamics between stakeholder roles, internal-external conditions, and strategic prioritization. Moreover, research that specifically examines the cocoa processing agroindustry at the district level is still limited, particularly in high-potential regions such as North Luwu District.

To fill this gap, this study applies an integrated Stakeholder-SWOT-AHP approach to formulate a more participatory, systematic, and decision-oriented development strategy for the cocoa processing agroindustry at the district level. The scientific value of this integrated approach lies in its ability to combine stakeholder analysis for identifying key actors and power-interest dynamics, SWOT analysis for assessing internal and external strategic conditions, and AHP for quantitatively prioritizing development strategies. By linking qualitative stakeholder and situational assessments with a structured multi-criteria decision-making method, this framework enhances the robustness and transparency of strategy formulation and provides stronger decision-support for regional agroindustry planning and policy development. Consequently, this study offers a more comprehensive and applicable strategic framework to support the sustainable development of the cocoa agroindustry in North Luwu District.

Table 1. Indonesian and North Luwu, South Sulawesi, cocoa production data (in tons)

Year	National area (Ha)	National production (Tons)	North Luwu area (Ha)	North Luwu production (Tons)
2019	1,560.95	734.80	40,007.56	28,102
2020	1,508.96	720.66	40,814.56	30,854
2021	1,460.40	668.21	38,367.04	28,573
2022	1,421.01	650.61	36,032.24	26,468
2023	1,393.39	632.12	34,022.86	22,710

Source: Indonesian and North Luwu Central Statistics Agency (Badan Pusat Statistik Kabupaten Luwu Utara (BPS) 2023)

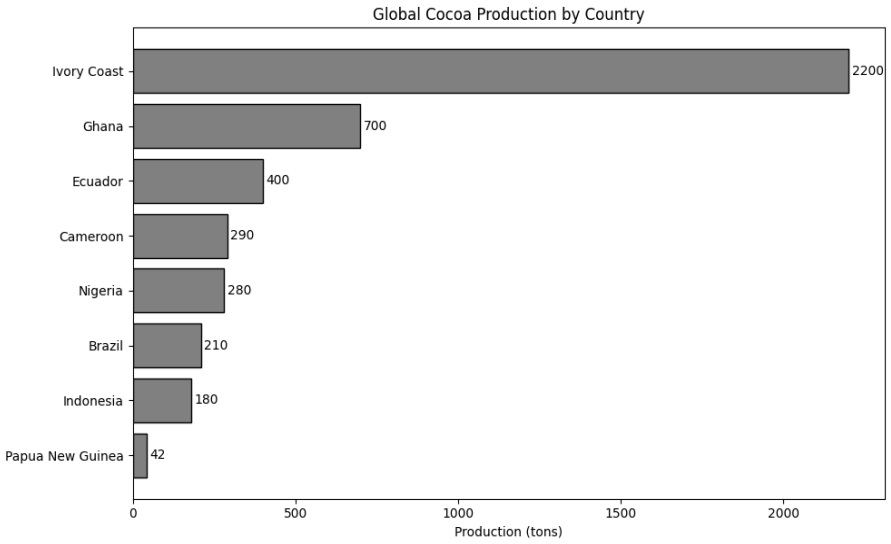

Figure 1. World cocoa production data 2021-2022 (in tons). Source: International Cocoa Organization (Data processed)

Based on the background description, the objectives of this study are to: (i) identify and analyze the roles, levels of importance, and influence of stakeholders in the development of the cocoa processing agroindustry in North Luwu District; (ii) formulate positions and alternative strategies for the development of the cocoa agroindustry based on an analysis of internal and external factors; and (iii) determine the most effective and sustainable priority strategies for the development of the cocoa agroindustry. The results of this study are expected to form the basis for policy formulation and strategic decision-making in the development of the cocoa agroindustry at the regional level.

MATERIALS AND METHODS

Study area

As shown in Figure 2, this area is North Luwu District, South Sulawesi Province, Indonesia, which is the focus of the research area. North Luwu is a key area for cocoa production and agroindustry development in the region. This regency was chosen because of its high cocoa production potential and favorable agroecological conditions. The research focused on four sub-districts-Sabbang, Baebunta, Masamba, and Bone-Bone-which were selected proportionally based on cocoa production levels and their ability to represent variations in farmer characteristics relevant to agroindustry development and stakeholder involvement in North Luwu District.

Research design and data collection

This study employed a descriptive research design using an integrated Stakeholder-SWOT-AHP approach to formulate development strategies for the cocoa processing agroindustry in North Luwu District. The analytical process was conducted sequentially, beginning with stakeholder analysis to map key actors based on their roles, interests, and influence. This was followed by an assessment of internal and external conditions using SWOT analysis to identify strategic factors affecting agroindustry development. Finally, the Analytical Hierarchy Process (AHP) was applied to prioritize feasible and effective development strategies aimed at enhancing the competitiveness of the regional cocoa agroindustry.

This study uses a mixed methods approach, which combines qualitative descriptive analysis with quantitative data support. This approach was chosen to gain a comprehensive understanding of the roles of stakeholders and to formulate a strategy for developing the cocoa processing agroindustry in North Luwu District, which was selected purposively, with data collection and research compilation scheduled to take place from April 2025 until completion.

This study uses quantitative data, namely numerical data analyzed using statistical techniques, such as score ranges or weights from questionnaires (Wira 2023). The data sources consist of: (i) Primary data obtained directly from primary sources at the research location, including farmers, government officials, academics, and farmer groups; (ii) Secondary data previously available from indirect sources, such as government documents, the Central Statistics Agency, and various other literature.

Population and research sample

The study population consisted of cocoa farmers and cocoa processing agroindustry actors in North Luwu District, with a total of 7,896 individuals as listed in Table 2. The sample size was determined using the Slovin formula to ensure proportional representation across the four Sub-districts. Based on this approach, 99 respondents were selected as research samples.

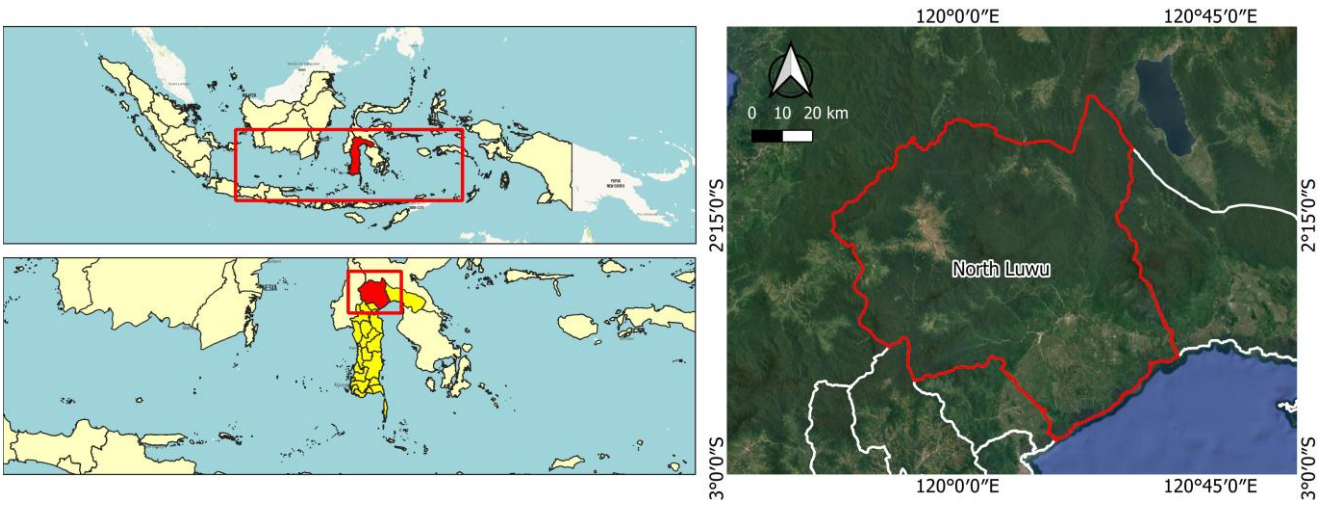

Figure 2. Map of research locations

Table 2. Number of cocoa farmers in North Luwu District, South Sulawesi Province, Indonesia, in 2023

Sub-district	Cocoa production (Tons)	Number of cocoa farmers
Sabbang	5,032.26	3,970
Baebunta	3,564.86	1,862
Masamba	1,221.22	1,822
Bone-Bone	108.83	242
Total	9,927.17	7,896

Source: Observation results

The Slovin formula consists of n: Sample size, N: Population size, and e^2: Margin of error 0. In this study, a margin of error of 10% was used. A margin of error (e) of 0.1 or 10% was chosen due to the large population size and limited research resources, so that a precision level of 90% was considered adequate to represent the population statistically. This consideration is also in line with socio-economic field research, where an error tolerance of up to 10% is still acceptable to obtain representative and efficient results.

$$n = \frac{N}{1 + N.e^2} = \frac{7.896}{1 + 7.896\ (0.1)^2} = 98.74 \approx 99$$

Meanwhile, in addition to involving cocoa farmers from four Sub-districts in North Luwu District, this study engaged eight key informants representing cocoa processing agroindustry stakeholders, including local government agencies, regionally-owned enterprises, state-owned enterprises, private companies, university academics, cooperatives, and farmer groups (Table 3). These informants were selected based on their institutional roles and experience in cocoa agroindustry development and served as evaluators in the stakeholder analysis and strategy assessment stages.

Stakeholder identification was conducted through document review and field observation, resulting in 14 stakeholders involved in the development of the cocoa processing industry in North Luwu District (see Table 3). These stakeholders were then classified based on the pentahelix framework, which includes government, business/industry (including state-owned enterprises and regionally-owned enterprises), academia, and the community, in order to support a more structured assessment of the roles and interactions between actors (Hernanda et al. 2018).

Data analysis

This study employed a mixed-methods approach, combining qualitative and quantitative analyses to formulate cocoa agroindustry development strategies in North Luwu District. Qualitative data were collected through interviews with cocoa farmers and agroindustry stakeholders to examine institutional roles and stakeholder interactions, while quantitative data were obtained through structured questionnaires. Stakeholder analysis was used to assess the roles of key actors, followed by the identification of internal and external factors, which were quantitatively evaluated and mapped to determine strategic directions. Alternative development strategies were then formulated using SWOT analysis and prioritized using the Analytical Hierarchy Process (AHP).

Stakeholder interest and influence were assessed using a five-point Likert scale ranging from 1 (very low) to 5 (very high). Evaluations were conducted by a panel of experts consisting of representatives from local government agencies, academic institutions, cocoa processing industries, and farmer groups, selected based on technical competence, practical experience, and direct involvement in the cocoa agroindustry. Scores from all evaluators were aggregated using the arithmetic mean to obtain composite stakeholder values, which were subsequently used for stakeholder classification.

The AHP analysis was structured hierarchically, with the main objective (cocoa agroindustry development strategy), criteria (SWOT factors), sub-criteria (specific indicators), and alternative strategies. Pairwise comparisons were conducted using Saaty's 1-9 scale, and individual judgments were aggregated using the geometric mean. Consistency of the evaluations was tested using the Consistency Ratio (CR), with values of CR≤0.10 indicating acceptable consistency. To enhance objectivity and measurability, the SWOT results were integrated into the AHP framework (A'WOT), enabling the identification of priority strategic factors based on global weights. In addition, a margin of error of 10% was applied for the survey sample, which is commonly used in exploratory socio-economic and field-based studies characterized by population heterogeneity and access constraints (Bartlett et al. 2001; Israel 2013).

RESULTS AND DISCUSSION

This study began with an analysis of respondent characteristics, including demographic aspects, to understand the participants' backgrounds. Next, stakeholders were identified based on the pentahelix theory, which was then analyzed in terms of their level of importance and influence on the development of the cocoa agroindustry in North Luwu District. SWOT analysis was used to map internal and external conditions, which were then formulated into alternative strategies. Strategy priorities were then determined using the A'WOT method with the Analytical Hierarchy Process (AHP) to produce more measurable recommendations.

Characteristics of research respondents in North Luwu District

Respondent characteristics are the attributes and traits of individuals who are the subjects of the study, such as gender, education, and age (Firmansyah et al. 2022). These characteristics influence how respondents understand, respond to, and form their opinions on the questions or topics presented. In this study, the respondents consisted of

stakeholders, farmers, and expert respondents in North Luwu District.

The respondents in this study were mostly male stakeholders (63.64%) and all male farmers (100%), while the expert group consisted of 62.5% men and 37.5% women. In terms of education, stakeholders and experts generally had higher education, with the majority being university graduates, while farmers were predominantly high school graduates and only a few had higher education. In terms of age, stakeholders were mostly in the 30-35 age group, farmers were in the productive age group of 46-55, and experts were fairly evenly distributed between 36-60 years of age. This shows that stakeholders and experts have good academic capacity to support the development of the cocoa agroindustry, while farmers play an important role through their practical experience in the field.

All stakeholders are closely related to the development of the cocoa agroindustry in North Luwu District. Freeman and Reed (1983) explain that stakeholder theory states that every group or individual can influence the achievement of organizational goals or be influenced by the performance of the organization itself. Based on their level of interest, influence, and power, stakeholders can also be divided into various groups. These categories are grouped according to the interest and influence of each stakeholder in an activity (Race and Millar 2008).

The assessment of interests and influence was carried out through interview-based classification of 14 stakeholders involved. The assessment in this study was conducted by eight experts representing various important elements in the development of the cocoa agroindustry in North Luwu District. The assessors came from government agencies, banking institutions, business actors, academics, and farmer groups, including Bapperida, the Agriculture Office, the Trade and Cooperatives Office, Bank BRI, Bank Sulselbar, PT. Chalodo Sibali Resoe, Massagena Cooperative, and Universitas Andi Djemma. They were selected for their competence, experience, and direct involvement in the management, financing, and development of the cocoa processing industry. Thus, the assessment reflects the perspectives of various key stakeholders in the agroindustry system.

Eight raters were used, and this number was considered sufficient to produce valid and representative assessments in the Analytical Hierarchy Process (AHP) method. Agreement among raters was measured using the Consistency Ratio (CR), which is the ratio between the Consistency Index (CI) and the Random Index (RI). The CR value indicates the level of conformity or consistency of assessments among experts regarding the pairwise comparisons they provided. The comparison results are considered consistent if the CR value is ≤ 0.1, which means that the experts have a good level of understanding of the priority factors and strategies for cocoa agroindustry development in North Luwu District.

Stakeholder analysis: Level of interest and influence in the development of the cocoa agroindustry in North Luwu District

Level of stakeholder interest

Table 4 shows that the stakeholders with the highest level of interest are PT. Chalodo Sibali Resoe, the North Luwu District Trade, Industry, Cooperatives, and MSMEs Office, and PT. Olam Indonesia. At the medium level of importance are the Agriculture Office of North Luwu District, the North Luwu District Research and Development Agency, the Masamba Sub-district Agricultural Extension Center, PT. Mars Symbioscience, as well as cooperatives and farmer groups. Meanwhile, the lowest level of importance is held by Bank Sulselbar, Bank Rakyat Indonesia, and academics in the development of the cocoa agroindustry in North Luwu District.

Table 4 also shows that the development of the cocoa agroindustry in North Luwu District is mainly supported by government agencies and private companies as actors with the highest level of interest. Actors at the intermediate level include technical agencies, cooperatives, and farmer groups that play a role in the implementation of programs in the field, while financial institutions and academics have a relatively lower level of interest in the structure of this sector's development.

Table 3. Stakeholder informants

Agency/Stakeholder	Description
North Luwu District Agricultural Office	Government Agency
North Luwu District Regional Development Planning, Research, and Innovation Agency (Bappelitbangda)	Government Agency
Trade, Industry, Cooperatives, and SMEs Agency of North Luwu District	Government Agency
Agricultural Extension Center of Masamba Sub-district	Government Agency
South Sulawesi Regional Bank	Regional Owned Enterprise
Bank Rakyat Indonesia	State-Owned Enterprise
PT. Mars Symbioscience	Private
PT. Olam Indonesia	Private
PT. Chalodo Sibali Resoe	Private
Academic	Higher Education
Massagena Cooperative	Community
Farmers' Group (KT) Tunas Baru	Community
Farmers' Group (KT) Tudang Sipulung	Community
Farmers' Group (KT) Mekar Harapan	Community

Source: Primary data (2025)

Level of stakeholder influence

The influence of stakeholders on cocoa industry development in North Luwu was evaluated based on five aspects (resource provision, reputation, organizational strength, individual benefits, and encouragement of change; maximum score of 25). The highest stakeholder influence is PT. Chalodo Sibali Resoe, followed by the Office of Trade, Industry, Cooperatives, and MSMEs, the Office of Agriculture, the Masamba Sub-district Agricultural Extension Center, and PT. Olam Indonesia. Bappelitbangda and PT. Mars Symbioscience are also included in the relatively high influence category. Conversely, Bank Sulselbar and Bank Rakyat Indonesia show the lowest level of influence, while academics, cooperatives, and farmer groups are at a medium to low level of influence.

Stakeholder importance and influence matrix

The influence and interests of stakeholders are reflected in their roles in policy formation, decision monitoring, program implementation, and handling of negative impacts. Input from each stakeholder forms the basis for policy formation (Asir 2022). The analysis was conducted using an influence-interest matrix that classifies stakeholder positions into four quadrants (Reed et al. 2009; Mulyawan et al. 2022). As shown in Figure 3, stakeholders in cocoa agroindustry development in North Luwu District are grouped into four categories: Subjects, Key Players, Masses, and Context Determiners. Key Players (High Interest-High Power) are the Agriculture Office (1), Bappelitbangda (2), the Office of Trade, Industry, Cooperatives, and MSMEs (3), Masamba Agricultural Extension Center (4), PT Mars Symbioscience (7), PT Olam Indonesia (8), and PT Chalodo Sibali Resoe (9), which have the authority and strategic capacity to drive programs and policies. Subjects (High Interest-Low Power) are Massagena Cooperative (11), Tunas Baru (12), Tudang Sipulung (13), and Mekar Harapan (14), which have a strong interest in cocoa development but limited influence in policy decision-making. The Supporting Group (Low Interest-Low Power) consists of Bank Sulselbar (5) and Bank Rakyat Indonesia (6), whose involvement is limited to general financing without a specific focus on cocoa development. Finally, Context Setters (High Influence-Low Interest) are represented by actor 10, namely academics (10), who contribute through research and innovation, although their direct involvement in cocoa agroindustry development is still relatively limited.

Table 4. Level of interest of cocoa agroindustry stakeholders in North Luwu District, Indonesia

Institution/Stakeholder	Value					Total
	K1	K2	K3	K4	K5	
North Luwu District Agricultural Office	5	4	4	3	3	19
Regional Development Planning, Research, and Innovation Agency of North Luwu District	4	3	4	4	3	18
Trade, Industry, Cooperatives, and SMEs Office of North Luwu District	5	4	5	4	4	22
Masamba Sub-district Agricultural Extension Center	4	3	4	4	3	18
South Sulawesi and West Sulawesi Bank	3	2	3	2	1	11
Bank Rakyat Indonesia	3	3	3	2	1	12
PT. Mars Symbioscience	3	3	4	4	3	17
PT. Olam Indonesia	3	4	5	5	5	22
PT. Chalodo Sibali Resoe	4	4	5	5	5	23
Academics	3	3	1	2	3	12
Massagena Cooperative	3	3	3	4	2	15
Farmers' Group (KT) Tunas Baru	3	3	3	4	2	15
Farmers' Group (KT) Tudang Sipulung	3	3	3	4	2	15
Farmers' Group (KT) Mekar Harapan	3	3	3	4	2	15

Note: K1: Agency Involvement, K2: Benefits of Stakeholder Presence, K3: Stakeholder Authority, K4: Agency Goal Achievement/Success, K5: Risk Reduction

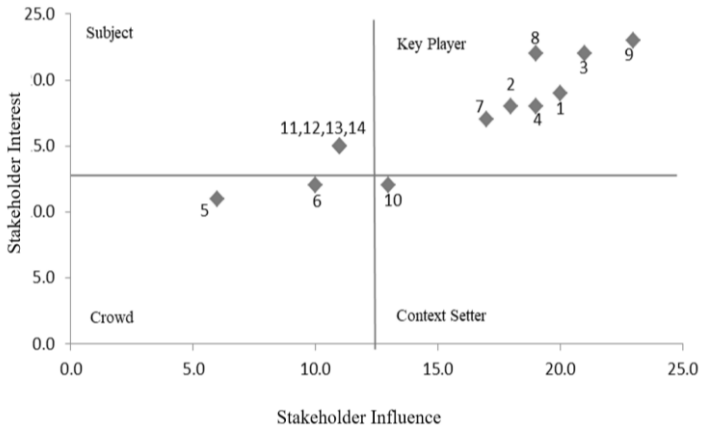

Figure 3. Stakeholder interest and influence matrix in agroindustry in North Luwu District, Indonesia

SWOT analysis: Cocoa agroindustry development strategy in North Luwu District, Indonesia

Table 5 shows a SWOT analysis of cocoa agroindustry development in North Luwu District, covering internal and external factors. Key strengths include potential land, availability of raw materials, adequate infrastructure, local labor, and transportation and energy that support production and distribution. The strategic location facilitates market access, operational efficiency, and expands business targets (Rosiana and Cahyani 2024), while abundant raw materials ensure smooth production (Ristono 2013; Jannah et al. 2024), good infrastructure enhances the competitiveness of SMEs (Perdana et al. 2023), local labor supports community welfare (Tham-Agyekum et al. 2024), and transportation and energy facilitate the production process.

Table 5 shows the weaknesses faced, including pest and disease attacks, limited capital, simple technology, land conversion, and suboptimal production, which are addressed through the W-O and W-T strategies. External opportunities in the form of cooperation with the private sector, increased market demand, government policy support, rising cocoa prices, and product innovation can be utilized through the S-O and W-O strategies. Meanwhile, the threats faced include limited production facilities, suboptimal marketing institutions, varying raw material quality, seasonal productivity declines, and competition from similar businesses, which need to be anticipated through the S-T and W-T strategies. This SWOT strategy is designed to maximize strengths and opportunities while minimizing weaknesses and threats.

The results show that the cocoa plantation industry in North Luwu District is in the Growth quadrant, meaning that this industry has rapid growth prospects. This position arises because the scores for strengths (S) and opportunities (O) are greater than the scores for weaknesses (W) and threats (T). The driving factors are high global market demand, abundant land and human resources, and the use of cocoa for various industrial products. Therefore, the appropriate strategy to implement is the S-O (Strength-Opportunity) strategy, which is to maximize internal strengths to take advantage of external opportunities in developing the cocoa processing industry in North Luwu District.

AHP analysis: Priorities for the development strategy of the cocoa agroindustry in North Luwu District

AHP hierarchy structure

This study uses the A'WOT method to formulate priority strategies for cocoa agroindustry development, with an AHP hierarchy structure as shown in Figure 4. The AHP hierarchy makes it easier for respondents to assign weights (Vera et al. 2014; Safira and Susanty 2022). In this study, there are four levels: main objectives (cocoa agroindustry development strategies), criteria (market, raw materials, processing, policy, and finance), sub-criteria (sub-factors of each criterion), and alternative strategies.

Pairwise comparison of factors and sub-factors

Table 6 shows that finance (0.300) is the most important factor, followed by raw material availability (0.287), market (0.191), policy (0.115), and processing (0.107). The inconsistency ratio value of 0.08 indicates consistent assessment (<0.1).

Table 6 shows the priority sub-factors in cocoa agroindustry development, with the domestic market as the main focus due to the increasing demand for cocoa. The Department of Agriculture (Pusdatin Kementerian Pertanian 2022) noted that consumption of instant chocolate and powder grew by 20.31% and 85.72% per year, respectively, while import volume increased by 29.70% per year, providing opportunities for businesses in North Luwu to develop cocoa products.

Table 5. Strategic factors

Factor	Sub-factor	Weight	Rating	Score	SWOT strategy
Internal - Strengths	S1. Potential land and strategic business location	0.22	4	0.88	S-O: Improving infrastructure with government support (S1, S3, S5, O3); S-T: Digital marketing (S1, S3, S5, T1, T2)
	S2. Sufficient raw materials available	0.22	4	0.88	S-O: Improving product quality through innovation and high-quality raw materials (S2, S4, O1, O2, O4, O5)
	S3. Adequate infrastructure	0.18	3	0.54	S-O: Improving production infrastructure (S1, S3, S5, O3)
	S4. Availability of local labor	0.18	3	0.54	S-O: Improving product quality and innovation (S2, S4, O1, O2, O4, O5)
	S5. Transportation and energy	0.20	3	0.60	S-T: Digital marketing and product characteristics (S1, S3, S5, T1, T2)
Internal - Weaknesses	W1. Pests and diseases	0.16	3	0.48	W-O: Crop maintenance training (W1, W4, W5, O1, O3); W-T: Land maintenance and crop rejuvenation (W1, W4, W5, T3, T4)
	W2. Limited business capital	0.20	3	0.60	W-O: Partnerships and access to capital (W2, W3, W5, O1, O2, O4, O5)
	W3. Simple technology	0.20	3	0.60	W-O: Partnerships & training; W-T: Using modern technology (W5, T1)
	W4. Land conversion	0.21	3	0.63	W-T: Land conservation and crop renewal (W1, W4, W5, T3, T4)

	W5. Production not yet optimal	0.22	3	0.66	W-O: Training, partnerships, production optimization (W2, W3, W5, O1, O2, O4, O5)
External - Opportunities	O1. Cooperation and partnerships	0.20	3	0.60	S-O: Quality improvement & innovation; W-O: Training and partnerships
	O2. Market demand	0.22	3	0.66	S-O: Product quality improvement & innovation; W-O: Partnerships & production optimization
	O3. Government policy support	0.19	3	0.57	S-O: Government infrastructure and development; W-O: Farmer training
	O4. Rising prices	0.23	3	0.69	S-O: Product quality optimization and innovation
	O5. Product innovation	0.17	3	0.51	S-O: Development of new cocoa products
External - Threats	T1. Availability of production facilities	0.17	2	0.34	S-T: Digital marketing (S1, S3, S5, T1, T2); W-T: Modern technology (W5, T1)
	T2. Marketing institutions not yet optimal	0.16	2	0.32	S-T: Product characteristics & quality (S4, S5); W-T: Technology & production optimization
	T3. Raw material quality varies	0.23	3	0.69	W-T: Modern technology & standard processing
	T4. Productivity decreases in certain seasons	0.25	3	0.75	W-T: Crop renewal & production management
	T5. Competition from similar businesses	0.19	3	0.57	S-T: Product characteristics & digital marketing
Total IFAS Score: 6.51 | Total EFAS Score: 5.85					

Source: Data processing of respondents in 2025

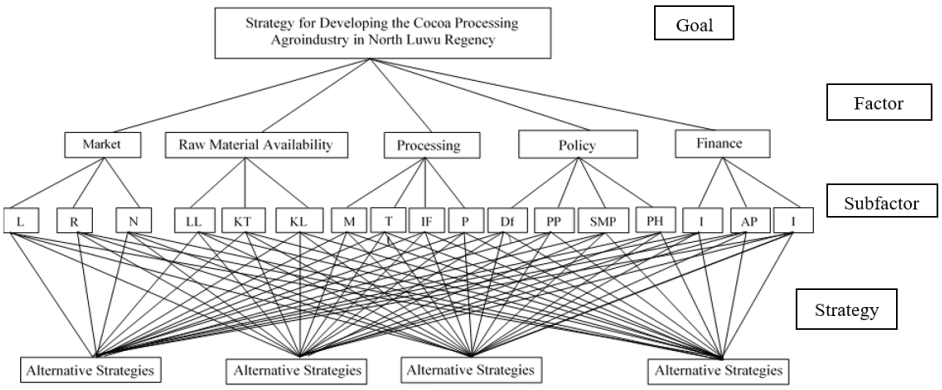

Figure 4. AHP hierarchy structure. Note: L: Local, R: Regional, N: National, LL: Land Area, KT: Quantity, KL: Quality, M: Capital, T: Technology, IF: Infrastructure, P: Product, Df: Financial Support, PP: Education and Training, SMP: Product Quality Standards, PH: Price Protection, I: Investment, AP: Access to Financing, IP: Tax Incentives

Meanwhile, the results of the subfactor pair comparison in Table 7 show that in terms of market factors, the national market received the highest priority score (0.479), followed by the local market (0.323) and the regional market (0.198). For raw material availability, quality was identified as the dominant sub-factor with a priority value of 0.769, exceeding quantity (0.176) and land area (0.055). In the processing factor, technology ranked first (0.297), followed by infrastructure (0.281), capital (0.265), and product (0.156). Within the policy factor, education and training had the highest priority (0.612), followed by product quality standards (0.198), financial support (0.102), and price protection (0.087). For the finance factor, investment emerged as the highest-priority sub-factor (0.673), followed by access to financing (0.218) and tax incentives (0.108).

Comparison of alternative strategies on market factors

Figure 5 shows a pairwise comparison between strategies based on subfactors. In general, the analysis results show that the main priority is focused on the main market strategy at the national level. This consideration is based on wide sales coverage, adequate product quality, and support for the use of digital technology such as social media and online markets. In more detail, the alternative strategy scores show the following order of priority: Alternative strategy 3 received the highest score of 0.300, followed by Alternative strategy 1 with a score of 0.023, Alternative strategy 2 with a score of 0.021, and finally Alternative strategy 4 with a score of 0.017.

Based on Figure 5, the results of pairwise comparisons of alternative strategies in the market factor. In general, it can be seen that strategies focusing on the national market have the highest value compared to local and regional markets. Alternative strategy 3 ranks highest with a score of 0.030, followed by strategy 1 with 0.023, strategy 2 with 0.021, and strategy 4 with 0.017. These results indicate that strengthening marketing strategies at the national level-through expanding sales reach, improving product quality, and utilizing digital technology-is a top priority in developing the cocoa agroindustry to enable it to compete in a broader market.

Table 6. Pairwise comparison of factors

Factor	Inconsistency Ratio	Value	Priority
Market		0.191	3
Raw Material Availability		0.287	2
Processing	0.08	0.107	5
Policy		0.115	4
Finance		0.300	1

Source: Primary Data Processing Results 2025

Table 7. Pairwise comparison of subfactors

Factor	Sub-factor	Value	Priority
Market	Local	0.323	2
	Regional	0.198	3
	National	0.479	1
Raw Material Availability	Land Area	0.055	3
Processing	Quantity	0.176	2
	Quality	0.769	1
	Capital	0.265	3
	Technology	0.297	1
	Infrastructure	0.281	2
	Product	0.156	4
Policy	Financial Support	0.102	3
	Education & Training	0.612	1
	Product Quality Standards	0.198	2
	Price Protection	0.087	4
Finance	Investment	0.673	1
	Access to Financing	0.218	2
	Tax Incentives	0.108	3

Source: Primary Data Processing Results 2025

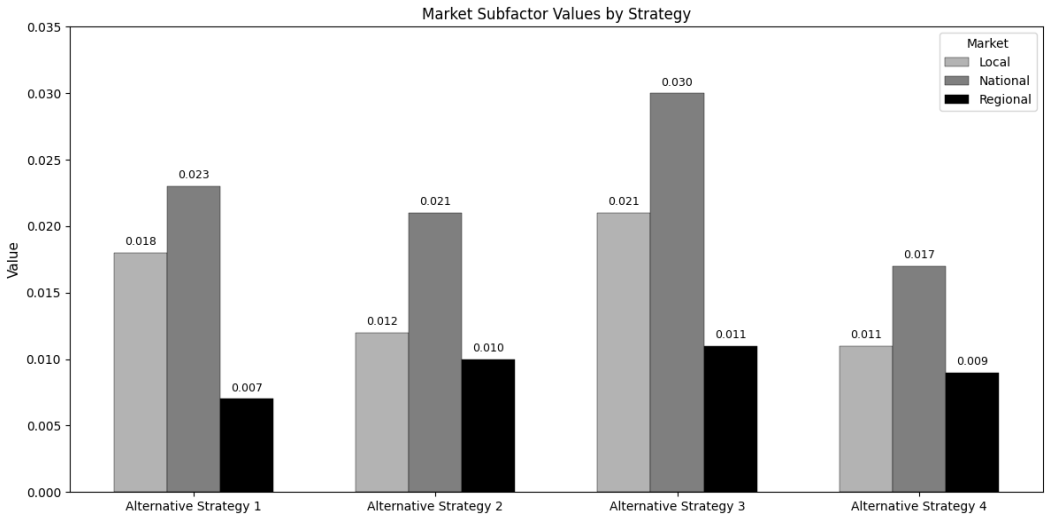

Figure 5. Pairwise comparison of alternative strategies on the market factor

Pairwise comparison of alternative strategies on the raw material availability factor

Figure 6 shows the results of a pairwise comparison between alternative strategies on the factor of raw material availability, where the subfactor of quality is the top priority. This is due to the importance of high-quality raw materials that require processing innovations in order to produce cocoa that meets standards. The scores for each alternative strategy are 0.051 for Alternative 1, 0.052 for Alternative 2, 0.073 for Alternative 3, and 0.045 for Alternative 4.

Figure 6 shows the results of a paired comparison between alternative strategies and raw material availability factors. Based on the graph, it can be seen that the raw material quality subfactor received the highest score compared to other subfactors, indicating that quality is a top priority in cocoa raw material management. Alternative strategy 3 scored the highest at 0.073, followed by strategy 2 with 0.052, strategy 1 with 0.051, and strategy 4 with 0.045. Meanwhile, other subfactors such as quantity and location of raw materials have much lower scores (around 0.003-0.015). This confirms that efforts to improve raw material quality through processing innovation are crucial to producing high-quality cocoa that meets market standards.

Pairwise comparison of alternative strategies on the processing factor

Figure 7 shows that the subfactor with the highest value is technology. This is because the existence of technology and the application of innovation in the processing process can improve the quality of processed cocoa products so that they can compete in the market. In alternative strategy 1, infrastructure received the highest score of 0.008, and the same condition was also shown by alternative strategy 2. Meanwhile, alternative strategy 3 placed capital and technology in the same important position with scores of 0.010 each. As for alternative strategy 4, technology was again the main subfactor with a score of 0.006.

Based on Figure 7, which shows the results of pairwise comparisons of alternative strategies for the processing factor. It can be seen that the sub-factor with the highest value is technology, which confirms the importance of applying innovation in the cocoa processing process to improve product quality in order to be competitive in the market. In Strategies 1 and 2, infrastructure received the highest score (0.008), while Strategy 3 placed capital and technology on an equal footing (0.010). Meanwhile, Strategy 4 again showed technology as the main subfactor with a score of 0.006. Overall, this graph indicates that improvements in technology and infrastructure are key aspects in supporting the effectiveness of cocoa agroindustry development strategies.

Pairwise comparison of alternative strategies on the policy factor

Figure 8 shows that the subfactor with the highest value is education and training. This is because education and training provided to farmers play an important role in improving their understanding, knowledge, and skills regarding the latest innovations in cocoa management and processing. Through these efforts, farmers can more easily adapt to new technologies, understand product quality standards, and strengthen their ability to manage farms professionally. In alternative strategy 1, the education and training subfactor scored 0.015. Similar conditions were also seen in strategies 2, 3, and 4, although each showed different variations. This difference in scores is striking compared to other subfactors, confirming that education and training are a top priority in developing farmers' capacity.

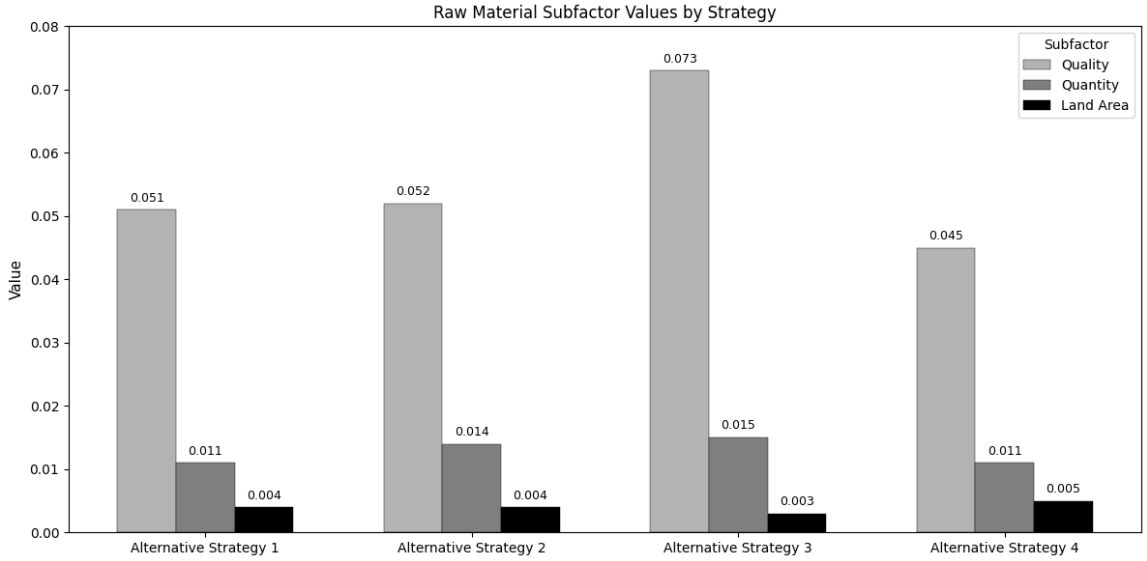

Figure 6. Pairwise comparison of alternative strategies on the factor of raw material availability

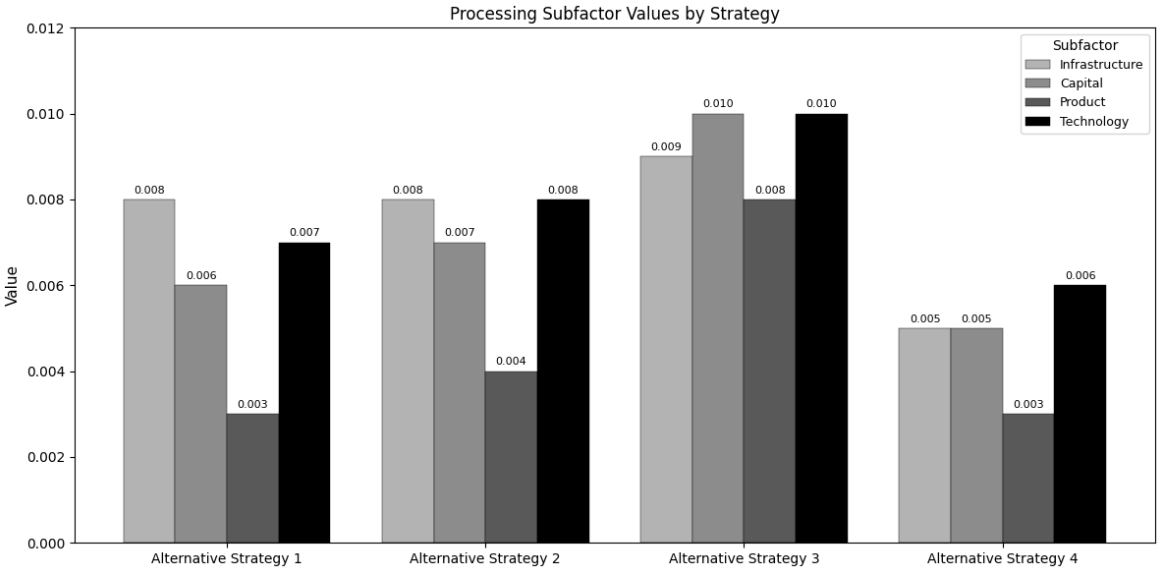

Figure 7. Pairwise comparison of alternative strategies on the processing factor

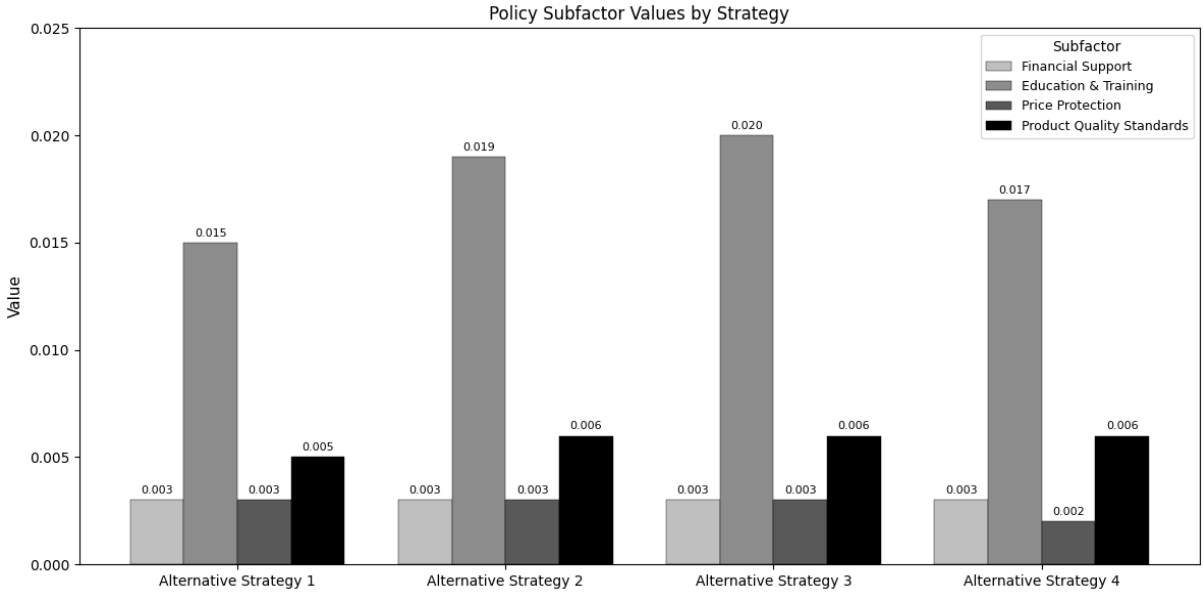

Figure 8. Pairwise comparison of alternative strategies on the policy factor

Figure 8 shows the results of a pairwise comparison of alternative strategies against the policy factor. Based on the graph, the subfactor with the highest value is education and training, which confirms the importance of increasing farmers' capacity by providing them with knowledge, skills, and understanding of technology and cocoa product quality standards. The highest value was obtained in alternative strategy 3 with a score of 0.02, followed by strategy 2 (0.019), strategy 4 (0.017), and strategy 1 (0.015). Meanwhile, other subfactors such as financial support, product quality standards, and field assistance showed lower and relatively uniform values in the range of 0.002-0.006. These findings indicate that education and training are a top priority in improving the capabilities and professionalism of cocoa farmers in each policy strategy reviewed.

Pairwise comparison of alternative strategies on the financial factor

Figure 9 shows that the investment factor is the most dominant, because the cocoa processing industry requires investment support to improve product quality. Investment from the government and large companies is needed to ensure financing and smooth production processes. The dominance of this factor is evident in all strategic alternatives, where the scores obtained for each sub-factor are quite striking, namely 0.043 in Strategic Alternative 1, 0.053 in Strategic Alternative 2, 0.062 in Strategic Alternative 3, and 0.043 in Strategic Alternative 4.

Figure 9 shows the results of a pairwise comparison of alternative strategies against financial factors. Based on the graph, it can be seen that the investment subfactor is the most dominant among all other subfactors, indicating that investment support is very important in the development of the cocoa processing industry. The highest score was achieved by alternative strategy 3 with a score of 0.062, followed by strategy 2 (0.053), and strategies 1 and 4, which each had a score of 0.043. Meanwhile, other subfactors such as access to funding and financial benefits showed much lower values, ranging from 0.007-0.02. These results confirm that the success of cocoa agroindustry development is highly dependent on investment support, both from the government and large companies, to ensure financing and smooth production processes as well as product quality improvement.

Priority alternative strategies for cocoa agroindustry development in North Luwu District

The use of the AHP method in this study aims to obtain priority strategies in the development of the cocoa processing agroindustry in North Luwu District. At Table 8 shows that the strategy that is the top priority based on the overall hierarchical structure is the third strategy alternative, namely improving product quality and innovation (0.311). The second priority strategy is to improve and strengthen cooperation and partnership (Strategy Alternative 2) (0.254). The third priority strategy is to utilize technology in both processing and marketing (Strategy Alternative 1) (0.228). Furthermore, the fourth or last priority strategy is strengthening the downstream (off-farm) side (0.206). Development strategy priorities are arranged by considering and comparing the importance of each component in the A'WOT hierarchical structure and bearing in mind that there are limitations in implementing all strategies simultaneously.

The AHP results indicate that improving product quality and innovation (Alternative Strategy 3) is the highest-priority strategy for cocoa agroindustry development in North Luwu District, with a weight of 0.311 (Table 8). The second priority is enhancing and strengthening cooperative relationships and partnerships (Alternative Strategy 2), which obtained a weight of 0.254.

This is followed by utilizing technology in both processing and marketing (Alternative Strategy 1) with a weight of 0.228. Strengthening the downstream (off-farm) sector (Alternative Strategy 4) ranked as the lowest priority, with a weight of 0.206.

The integration of SWOT and AHP was conducted to align strategic alternatives with supporting internal and external factors as well as prioritized sub-factors. This integration links the results of situational analysis with quantitative priority weighting to ensure consistency across the strategic framework. Table 9 presents the relationship between each priority development strategy, its supporting SWOT components, and the main AHP sub-factors.

Table 8. Priority of alternative strategies

Strategy	Alternative Strategy	Weight	Priority
Strategy Alternative 1	Utilizing technology in both processing and marketing	0.228	3
Alternative Strategy 2	Enhancing and strengthening cooperative relationships and partnerships	0.254	2
Alternative Strategy 3	Improving product quality and innovation	0.311	1
Alternative Strategy 4	Strengthening the downstream sector (Off-Farm)	0.206	4

Source: Primary Data Processing Results 2025

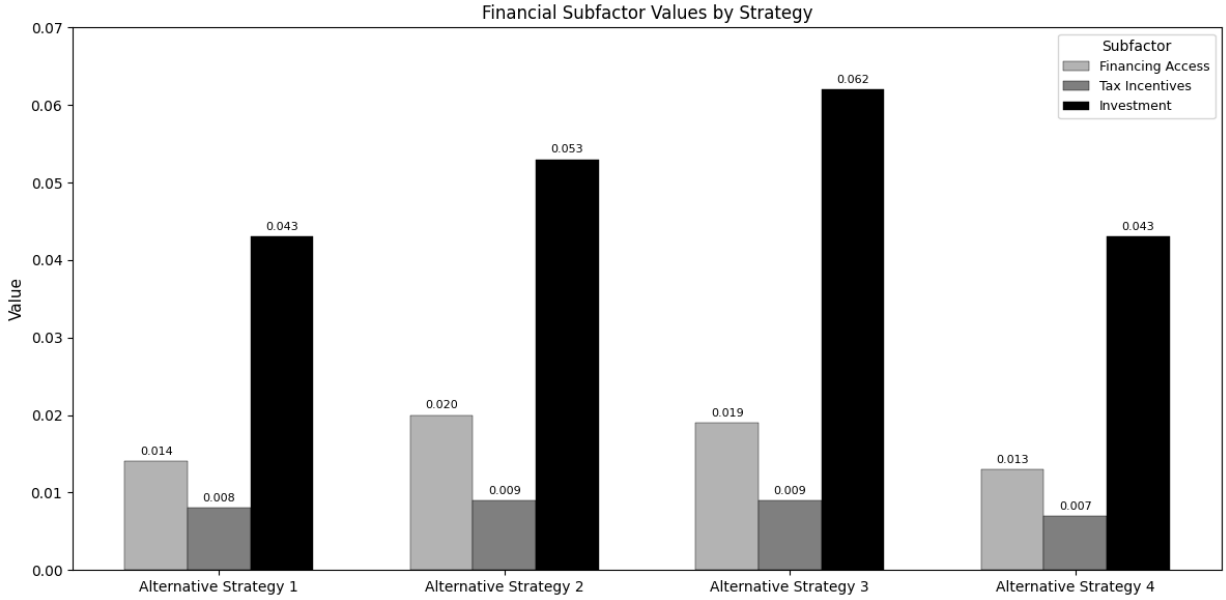

Figure 9. Pairwise comparison of alternative strategies on the financial factor

Based on Table 9, improving product quality and innovation is supported by multiple strength and opportunity factors and is associated with key sub-factors related to raw material quality, investment, and training, with a primary focus on innovative and high-quality products. Strengthening partnerships and collaboration is linked to several weakness and opportunity factors and is supported by sub-factors related to access to financing, training, and product quality standards, emphasizing cross-sectoral collaboration. The strategy of utilizing processing and marketing technology is supported by strength and threat factors and is associated with technology, infrastructure, and national market sub-factors, focusing on digital transformation and efficiency. Meanwhile, strengthening the downstream (off-farm) sector is supported by a combination of strength, opportunity, and threat factors and is associated with product, infrastructure, and investment sub-factors, with a focus on value-added product diversification.

Discussion

The findings of this study demonstrate that the development of the cocoa processing agroindustry in North Luwu District is shaped by a combination of material quality, institutional capacity, technological readiness, and investment support, as reflected in the integration of SWOT and AHP results. The prioritization of cocoa bean quality within the raw material availability factor confirms that quality is a critical determinant of competitiveness in cocoa processing, particularly in meeting product safety and quality standards such as SNI 01-2323-2008. This result aligns with previous studies emphasizing the importance of post-harvest handling and farmer education in producing high-quality cocoa beans (Mulato 2023). Although land area and production quantity remain relevant for ensuring supply continuity (Muzayyanah et al. 2016), the dominance of quality as the top sub-factor indicates a strategic shift from volume-oriented production toward quality-driven agroindustry development, especially in regions with substantial plantation areas such as North Luwu (BPS 2023).

Within the processing factor, the prioritization of technology highlights its central role in improving efficiency, fermentation consistency, drying processes, and overall value addition. This finding is consistent with earlier research that underscores the role of processing technology in enhancing cocoa quality and market value (Quelal-Vásconez et al. 2020; Pita-Garcia et al. 2025). The supporting roles of infrastructure and capital further indicate that technological adoption in cocoa processing cannot be separated from upstream-downstream connectivity and operational financing. Similarly, under the policy factor, education and training emerged as the most critical sub-factor, reinforcing the view that human resource development is fundamental to improving production practices, quality compliance, and institutional coordination (Managanta et al. 2022). These results collectively suggest that policy interventions aimed at capacity building and standardization are essential complements to physical and financial investments in agroindustry development.

The financial factor further strengthens this argument, as investment was identified as the most influential sub-factor, followed by access to financing and tax incentives. This finding corroborates previous studies that emphasize the importance of long-term investment and inclusive financing mechanisms, such as KUR, in supporting agroindustrial expansion and sustainability. Investment not only enables technology adoption and infrastructure development but also facilitates downstream processing and market expansion. In this context, financial incentives play a strategic role in reducing entry barriers for small- and medium-scale processors and encouraging private sector participation in cocoa agroindustry development.

Market orientation plays a strategic role in reinforcing the priority development strategies identified in this study. The local market is primarily supported by increasing consumer awareness of product quality and safety, growing farmer interest in value-added cocoa products, and the expanding use of digital marketing platforms, which collectively strengthen domestic demand and shorten marketing chains (Nabila et al. 2022). At the regional level, market dynamics are increasingly shaped by global demand for high-quality chocolate products, where consistency, traceability, and quality standards become decisive factors in competitiveness (Garner 2023). This dual market orientation suggests that development strategies in North Luwu should simultaneously strengthen local market absorption through digital-based promotion and community-based processing initiatives, while also aligning production quality and downstream processing with regional and international market requirements. Such alignment reinforces the relevance of quality innovation, technological adoption, and downstream strengthening as key strategies for expanding market access and enhancing the sustainability of the cocoa agroindustry.

The prioritization of alternative strategies derived from the AHP analysis reinforces these insights. Improving product quality and innovation emerged as the primary strategy, reflecting the combined importance of raw material quality, investment, and education. This result is consistent with studies showing that product quality is a key determinant of consumer preference and global competitiveness in cocoa markets (Wijaya et al. 2018; Luis et al. 2023). Comparatively, countries such as Ecuador and Nigeria have demonstrated that superior cocoa quality can offset lower production volumes and enhance revealed comparative advantage (Izzatin et al. 2023). The emphasis on innovation also supports sustainable production through environmentally friendly technologies and skill enhancement, aligning with broader sustainability goals in agroindustry development.

The second priority strategy, strengthening cooperation and partnerships, addresses structural weaknesses related to limited capital, simple technology use, and fragmented coordination among actors. This finding aligns with previous research highlighting the role of multi-stakeholder collaboration in improving farmer capacity, quality compliance, and market access (Managanta et al. 2022). By involving government institutions, state-owned enterprises, private companies, cooperatives, and communities, this strategy reflects the need for cross-sectoral coordination in managing infrastructure development, promotion, and environmental sustainability (Saadah 2024). The third strategy, focusing on the adoption of processing and marketing technology, further complements these efforts by emphasizing digital transformation, monitoring systems, and market connectivity. Prior studies have shown that digital and processing technologies can help overcome constraints related to fermentation consistency, moisture control, and quality uniformity, thereby enhancing overall competitiveness (Ferraris et al. 2023; Singh et al. 2023; Sridhar et al. 2023; Adha et al. 2024).

Table 9. Integration of SWOT and AHP results in priority development strategies for the cocoa agroindustry in North Luwu District, South Sulawesi, Indonesia

Strategy	Supporting SWOT items	Key supporting AHP sub-factors	Main focus
Enhancing Product Quality and Innovation	S2, S3, S4, O2, O4, O5	Raw Material Quality, Investment, Training	Innovative and High-Quality Products
Strengthening Partnerships and Collaboration	W2, W3, W5, O1, O3, O5	Access to Financing, Training, Quality Standards	Cross-Sectoral Collaboration
Utilizing Processing and Marketing Technology	S3, S5, T1, T2, T5	Technology, Infrastructure, National Market	Digital Transformation and Efficiency
Strengthening the Downstream (Off-Farm) Sector	S1, S2, O2, O4, T3, T4	Product, Infrastructure, Investment	Value-Added Product Diversification

The fourth strategy, strengthening the downstream (off-farm) sector, highlights the importance of value-added processing and product diversification. This strategy is closely aligned with national policies such as the Cocoa Export Duty, which aim to encourage domestic processing, support small- and medium-scale enterprises, and increase cocoa consumption (Fahmid et al. 2022; Sahruni and Achmad 2023). By focusing on downstream activities such as chocolate and beverage production, this strategy contributes to income diversification, local industry development, and enhanced market positioning.

Beyond formal institutional and technological dimensions, the discussion also reveals the importance of community-based knowledge and cultural practices in shaping cocoa agroindustry development in North Luwu. Traditional farming practices, intergenerational knowledge transfer, and collective labor systems contribute to resilience and ecological balance, complementing scientific and technological interventions. These social and cultural mechanisms facilitate trust, cooperation, and the diffusion of innovation, suggesting that the effectiveness of strategies related to partnerships, training, and technology adoption depends not only on formal policies but also on the strength of local community networks. Furthermore, cultural identity and traditional processing practices offer opportunities for niche product development and territorial branding in downstream agroindustry activities. Integrating these cultural attributes into development strategies can enhance value addition, support small-scale processors, and strengthen the unique identity of North Luwu cocoa products in regional and global markets.

In conclusion, this study confirms that the development of the cocoa processing agroindustry in North Luwu District is shaped by the interaction between stakeholder coordination, raw material quality, investment availability, and human resource capacity. Using an integrated Stakeholder-SWOT-AHP framework, the analysis identifies improving product quality and innovation as the primary strategic priority, followed by strengthening partnerships, adopting processing and marketing technologies, and reinforcing downstream (off-farm) activities. These strategies reflect a growth-oriented regional development context in which internal strengths and external opportunities can be systematically translated into actionable policy directions. From a policy standpoint, the findings offer a structured decision-support basis for local governments to align agroindustry development programs with investment planning, farmer capacity-building initiatives, quality standard enforcement, and technological infrastructure provision. The prioritization results emphasize the need for coordinated cross-sectoral governance involving government institutions, private actors, cooperatives, and farmer organizations to enhance implementation effectiveness and long-term sustainability.

Several limitations should be acknowledged. The analysis relies on expert judgment and stakeholder perceptions, which may introduce subjectivity despite the application of consistency testing in the AHP process. In addition, the district-level focus limits the generalizability of the findings to other cocoa-producing regions with different institutional and market characteristics. Future research should extend this framework by incorporating value-chain integration analysis, climate risk considerations, and digital traceability systems to strengthen resilience and competitiveness. Longitudinal and performance-based assessments are also recommended to support more adaptive and evidence-based cocoa agroindustry policy formulation.

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