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SWOT-AHP-Based Strategies for Improving Corn Productivity and Export Sustainability in Gorontalo, Indonesia

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Abstract. Corn is a strategic commodity for Gorontalo Province because it supports food security, farmer income, regional agribusiness development, and export-oriented agricultural competitiveness. However, corn productivity and export sustainability in the region are still constrained by production risks, limited post-harvest facilities, weak institutional support, and market access challenges. This study aims to formulate and prioritize strategies for improving corn productivity and export sustainability in Gorontalo Province using an integrated SWOT-AHP approach. Data were collected through surveys of 98 corn farmers, stakeholder interviews, field observations, and expert judgment. SWOT analysis was used to identify internal and external strategic factors related to cultivation, post-harvest, distribution, and institutional aspects, while AHP was applied to determine the priority weights of criteria, sub-criteria, and alternative strategies. The SWOT results show that weaknesses were more dominant than strengths, and threats were more dominant than opportunities, placing corn farming in the WT quadrant with coordinates of X = −0.53 and Y = −0.64. This indicates that the appropriate strategic direction is a defensive strategy, emphasizing the minimization of internal weaknesses and the anticipation of external threats. The AHP results show that production was the highest priority criterion (0.39), followed by post-harvest (0.31), institutional aspects (0.22), and distribution (0.08). At the sub-criteria level, productivity improvement obtained the highest priority weight (0.67). The main alternative strategy was pest and disease control (0.46), followed by the addition of harvest and post-harvest facilities (0.18) and seed quality improvement (0.16). These findings indicate that strategies to improve corn productivity and export sustainability in Gorontalo should prioritize risk management in production, post-harvest infrastructure improvements, and support for quality seed. The study provides practical guidance for local government, extension officers, farmer groups, and agribusiness actors in strengthening the competitiveness of Gorontalo corn.

Keywords Analytical Hierarchy Process; Corn; Export; SWOT; Sustainability

INTRODUCTION

Corn is a strategic agricultural commodity because it supports food security, livestock feed supply, industrial raw materials, farmer income, and regional agribusiness development. At the global level, maize plays an important role in production, consumption, and international trade, indicating that corn development requires not only productivity improvement but also stronger market-oriented strategies. In Indonesia, corn is one of the priority commodities for

supporting food self-sufficiency and strengthening agricultural competitiveness. Therefore, increasing corn productivity and maintaining export sustainability are important issues for corn-producing regions such as Gorontalo Province.

Gorontalo Province has strong potential for corn development because it is one of Indonesia's corn-producing regions with export opportunities. This potential is supported by corn production capacity, export experience, and the strategic role of corn in regional agribusiness development. Previous studies have shown that Gorontalo has good prospects for corn exports, supported by export ports and market opportunities, although transportation infrastructure, export continuity, and competitiveness remain important challenges (Susilowati et al., 2021). The competitiveness of Gorontalo corn has also been demonstrated through revealed comparative advantage analysis, indicating that corn is an important export commodity for the province and has the potential to strengthen regional economic competitiveness (Dehi et al., 2023).

Despite this potential, corn development in Gorontalo still faces several challenges related to productivity, input efficiency, production risk, post-harvest handling, market access, and institutional support. Corn productivity is influenced by the allocation of production inputs, including land, labor, fertilizers, insecticides, and herbicides, which indicates the importance of efficient input management in improving maize production (Salam et al., 2024). In addition, export sustainability depends not only on production volume but also on product quality, supply stability, market diversification, competitiveness, and the capacity to respond to logistical and trade-related risks (Arbulú Ballesteros et al., 2026; Erenstein et al., 2022).

Previous studies have emphasized that improving corn productivity requires technical improvement at the farm level, particularly in cultivation practices, input management, and production risk control. Hajad et al. (2021) showed that the development of corn planting technology can support more efficient cultivation practices, while Karman et al. (2020) found that organic fertilizer use can improve corn productivity and farmers' income. These findings indicate that productivity improvement should be supported by appropriate technology, balanced input use, and better field-level management.

However, productivity improvement alone is not sufficient to ensure export sustainability. Export-oriented corn development requires an integrated approach that connects production, post-harvest handling, distribution, market access, and institutional support. Food system transformation in developing regions is closely related to the performance of input and output value chains, agricultural research, innovation, and market linkages (Reardon et al., 2019). In addition, agrifood value chain development can create opportunities for technology

transfer, value addition, and stronger farmer participation in market-oriented agriculture (Barrett et al., 2022).

Therefore, strategies to improve corn productivity and export sustainability in Gorontalo should integrate technical, socioeconomic, institutional, and supply chain dimensions. This is important because the development of regional corn agribusiness depends not only on farmers' production capacity but also on post-harvest infrastructure, farmer organizations, extension services, market coordination, and adaptive policy support. A mission-oriented agricultural innovation system can help align the roles of farmers, government, researchers, extension officers, and agribusiness actors in supporting sustainable food system transformation (Klerkx & Begemann, 2020).

To address these complex issues, this study uses an integrated SWOT-AHP approach. SWOT analysis is used to identify internal strengths and weaknesses as well as external opportunities and threats, while AHP is used to prioritize strategic alternatives based on expert judgment and pairwise comparison (David et al., 2017; Saaty, 1990). The integration of SWOT and AHP allows qualitative strategic factors to be quantified and ranked more systematically, making it useful for strategy formulation and priority setting (Kurttila et al., 2000). This integrated approach has also been applied in agricultural development strategy studies to prioritize strategic alternatives under complex production and environmental conditions (Nguyen & Canh, 2022).

The novelty of this study lies in the application of an integrated SWOT-AHP approach to formulate and prioritize strategies for improving corn productivity and export sustainability in Gorontalo Province. Unlike previous studies that mainly discussed corn productivity, export opportunities, or agricultural technology separately, this study integrates cultivation, post-harvest, distribution, and institutional dimensions into a structured strategic priority framework. Therefore, the study provides not only a diagnosis of internal and external strategic factors but also priority rankings of strategies that can guide farmers, farmer groups, extension officers, local government, and agribusiness actors.

Figure 1 presents a literature review on corn productivity and export sustainability. The mapping is used solely as supporting evidence to demonstrate the research gap, not as the primary analytical method of this study. Based on the literature gap and field conditions in Gorontalo Province, this study aims to: (1) identify the internal and external factors affecting corn productivity and export sustainability; (2) formulate alternative strategies using SWOT analysis; and (3) determine priority strategies using the AHP method.

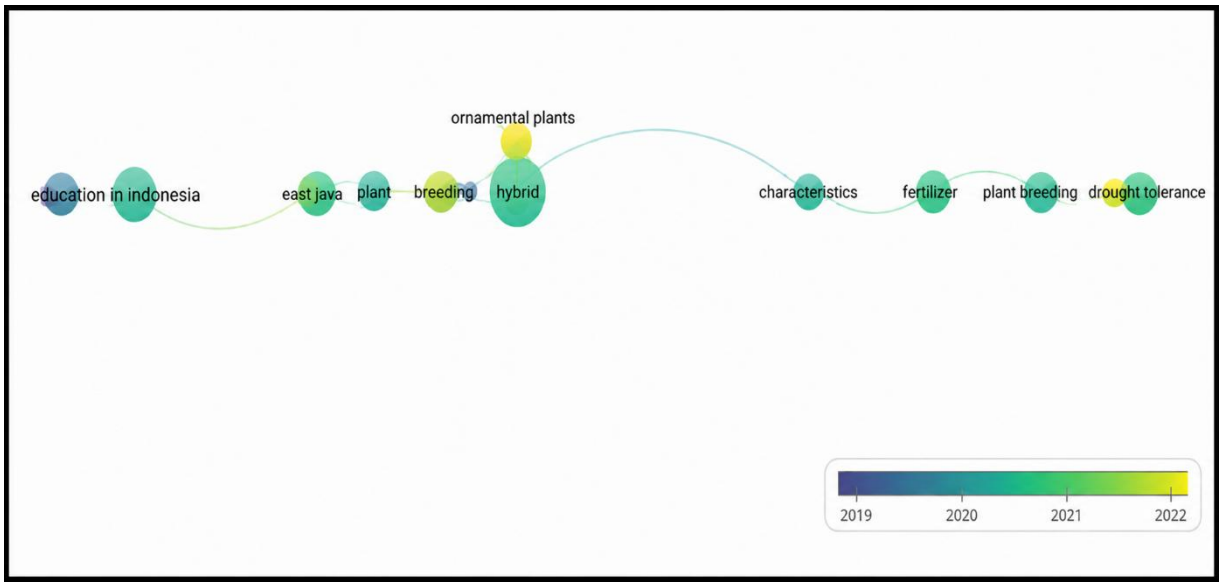

Figure 1. Literature Mapping of Corn Productivity and Export Sustainability Studies

METHODS

Research Location and Respondents

This research was conducted in Gorontalo Province, Indonesia, comprising five regencies and one city: Pohuwato Regency, Bone Bolango Regency, Boalemo Regency, Gorontalo Regency, North Gorontalo Regency, and Gorontalo City. The research location was selected purposively because Gorontalo Province is one of Indonesia's corn production centers and has potential for the development of export-oriented corn agribusiness.

The study population consisted of 6,266 corn farmers. The sample size was determined using the Slovin formula, with a 10% margin of error, resulting in 98 farmer respondents. The sample was distributed proportionally across the study area, comprising 23 farmers from Gorontalo Regency, 28 from Boalemo Regency, 19 from Pohuwato Regency, 12 from Bone Bolango Regency, 13 from North Gorontalo Regency, and 3 from Gorontalo City. Farmer respondents were selected based on their involvement in corn farming activities and their knowledge of cultivation, post-harvest handling, marketing, and institutional conditions related to corn farming.

Data Collection and Research Instruments

Data were collected through farmer surveys, stakeholder interviews, field observations, and secondary data review. The farmer survey collected information on respondent characteristics, cultivation practices, input use, production constraints, post-harvest activities, marketing conditions, and institutional support. Stakeholder interviews were conducted to gather information on corn development policies, export opportunities, farmer group activities,

extension services, and agribusiness constraints. Field observations were used to examine land conditions, production infrastructure, post-harvest facilities, and distribution-related conditions.

This study used several research instruments, including a structured farmer questionnaire, a stakeholder interview guide, an Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) assessment sheet, and an AHP pairwise comparison sheet. The SWOT indicators were developed based on field conditions, farmer responses, stakeholder inputs, and relevant information on corn production, post-harvest management, distribution, and institutional support. The AHP pairwise comparison sheet was used to assess the relative importance of criteria, sub-criteria, and alternative strategies.

SWOT Analysis

SWOT analysis was used to identify internal and external strategic factors affecting corn productivity and export sustainability in Gorontalo Province. This approach follows the strategic management framework in which internal and external factors are evaluated to formulate appropriate strategic alternatives (David et al., 2017). Internal factors were classified into strengths and weaknesses, while external factors were classified into opportunities and threats. The SWOT analysis covered four main aspects: cultivation, post-harvest, distribution, and institutional support.

The identified SWOT factors were then arranged into the IFE and EFE matrices. Each factor was assigned a weight and rating to determine its relative importance and strategic position. The IFE matrix was used to evaluate the internal condition of corn farming by comparing strengths and weaknesses. In contrast, the EFE matrix was used to evaluate external conditions by comparing opportunities and threats. The results of the IFE and EFE matrices were used to determine the strategic position of corn farming in Gorontalo Province and to formulate alternative strategies.

The alternative strategies generated from the SWOT analysis included seed quality improvement, pest and disease control, balanced fertilization, improvement of harvest and post-harvest technology, addition of harvest and post-harvest facilities, productivity improvement, strengthening the role of extension workers, strengthening farmer groups, and development of farmer partnerships.

AHP Analysis

The alternative strategies generated from the SWOT analysis were further analyzed using the Analytic Hierarchy Process (AHP) to determine their relative priorities. AHP was used because it allows strategic alternatives to be ranked based on expert judgment through pairwise

comparison. AHP is widely used in multi-criteria decision-making because it structures complex decision problems into a hierarchy and compares decision elements through pairwise judgments (Saaty, 1990). The integration of SWOT and AHP was used to transform strategic factors into priority weights, enabling alternative strategies to be ranked more systematically (Kurttila et al., 2000; Nguyen & Canh, 2022). This approach was applied to support strategic decision-making by identifying which strategies should be prioritized to improve corn productivity and support export sustainability in Gorontalo Province.

The AHP hierarchy consisted of four levels: the main goal, criteria, sub-criteria, and alternative strategies. The main goal was to formulate strategies to improve corn productivity and sustain export sustainability in Gorontalo Province. The criteria consisted of production, post-harvest, distribution, and institutional aspects. The sub-criteria and alternative strategies were derived from the SWOT analysis results.

Expert judgments were obtained from three key informants representing different stakeholder perspectives, namely the head of a farmer group association, an agricultural extension officer, and a representative of the agricultural office. Pairwise comparisons were conducted to assess the relative importance of criteria, sub-criteria, and alternative strategies. The results were processed using Super Decisions software to generate priority weights and rankings. These priority weights were then used to identify the most important strategies for increasing corn productivity and supporting export sustainability in Gorontalo Province.

RESULT AND DISCUSSION

The Results and Discussion section presents the strategic condition of corn farming in Gorontalo Province based on farmer characteristics, corn production trends, SWOT analysis, IFE-EFE matrices, and AHP priority weights. The analysis focuses on identifying internal and external factors affecting corn productivity and export sustainability, followed by prioritizing alternative strategies using the SWOT-AHP approach. This structure allows the study to explain not only the current condition of corn farming but also the strategic priorities needed to improve productivity, reduce production risks, strengthen post-harvest management, and support export sustainability.

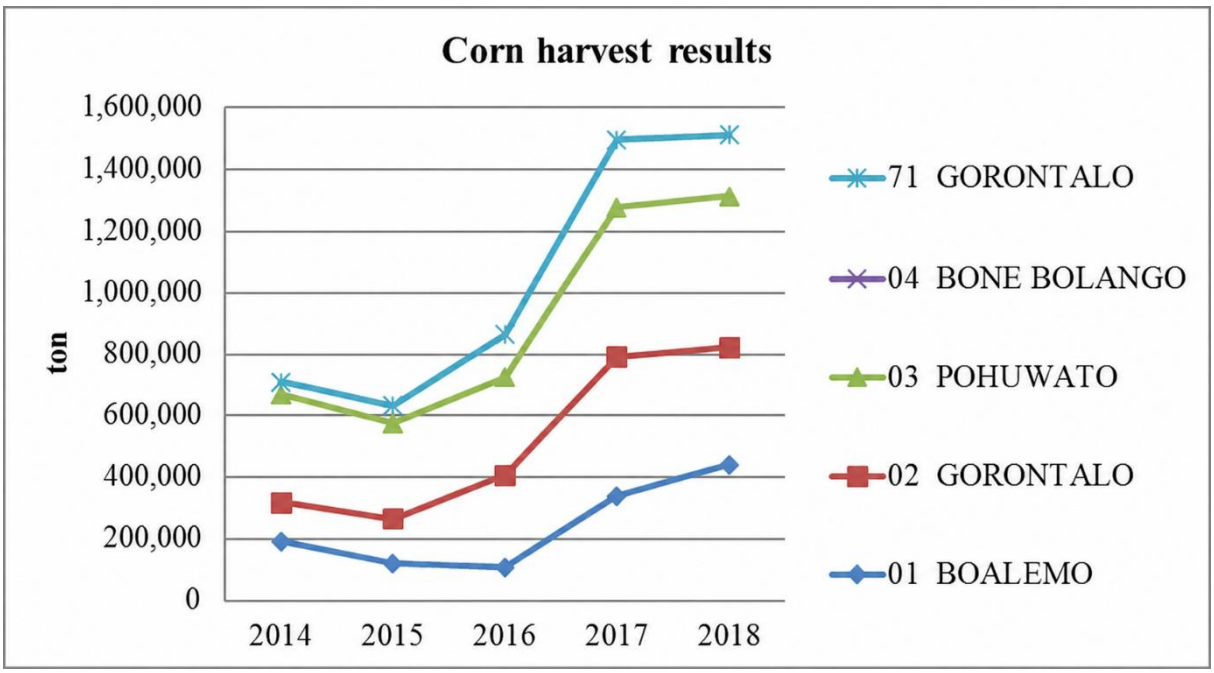

Figure 2. Corn Production in Gorontalo Province 2014-2018
Source: Statistics Indonesia, processed data.

During the 2014–2018 period, corn production in Gorontalo Province generally increased, though there were some fluctuations. The decline in 2015 may indicate the influence of climate-related constraints, particularly drought, which can reduce yield per unit area and affect overall production. Corn production is closely related to harvested area, soil fertility, rainfall, input availability, and farmers' capacity to manage production risks. Therefore, fluctuations in production should be understood not only as a technical cultivation issue but also as part of broader production risk management.

In addition to production trends, farmer characteristics are important for understanding the strategic condition of corn farming in Gorontalo Province. Farmer age, education, land ownership, and farming experience can influence technology adoption, production decision-making, access to market information, and the capacity to implement productivity and post-harvest improvement strategies. These characteristics also reflect farmers' readiness to respond to policy changes and market demands, particularly in the context of export-oriented agriculture. Furthermore, differences in farmer profiles may lead to variations in productivity levels and the effectiveness of farming practices applied in the field. Understanding these aspects is essential for designing targeted interventions and support programs that can enhance farmer performance and sustainability. Therefore, the characteristics of farmer respondents are presented in Table 1.

Table 1. Characteristics of farmer respondents

Characteristics	Information	Amount	Percentage (%)
Age (Years)	<20	1	0.98
	20-30	4	4.08
	31-40	21	20.58
	41-50	32	32.65
	>50	40	40.81
Education	Not completed primary school	39	39.79
	Elementary School	44	44.89
	Junior High School	6	6.12
	Senior High School	7	7.14
	Bachelor	2	1.96
Land ownership	One's own	93	94.89
	Rent	5	5.11
Farming Experience (Years)	<5	3	3.06
	5-10	12	12.24
	11-15	8	8.16
	16-20	16	15.68
	21-25	38	38.77
	>25	21	21.43

Source: Data Processed (2026)

Table 1 shows that most corn farmers in Gorontalo Province were in the older age group. Farmers aged 50 years or older accounted for the largest proportion of respondents, followed by those aged 41–50 years. This indicates that experienced farmers dominate corn farming in Gorontalo, but it also reflects the limited involvement of younger farmers in corn agribusiness. The dominance of older farmers may pose a challenge to technology adoption, innovation, and the implementation of more adaptive farming practices.

Regarding education, most respondents had relatively low levels of formal education. The majority of farmers had only completed elementary school, while a large proportion had not completed primary school. Only a small proportion of respondents had completed higher education. This condition may affect farmers' ability to access market information, adopt new technologies, understand export quality requirements, and manage farm business risks. Therefore, extension services, farmer training, and institutional support are important to strengthen farmers' knowledge and managerial capacity.

Most respondents owned their agricultural land, indicating that land ownership can be an important internal strength for the development of corn farming in Gorontalo. Farmers who own their land have greater control over production decisions, land management, and long-term investment in farming activities. However, land ownership alone is not sufficient to

improve productivity unless supported by access to quality inputs, technology, post-harvest facilities, and market networks.

The farming experience of respondents also shows that most farmers had been involved in corn farming for a long period, particularly between 21 and 25 years, and for more than 25 years. This indicates that farmers have substantial practical experience in corn cultivation. However, long farming experience should be combined with innovation, institutional strengthening, and technology adoption to improve productivity and support export sustainability. Previous studies emphasize that smallholder agricultural development depends not only on farmers' experience but also on socioeconomic capacity, institutional support, collaboration, and the dissemination of innovation (Asgar et al., 2024; Asprooth et al., 2023; Maula & Susilowati, 2024).

Based on farmer characteristics, production trends, and field conditions, the strengths, weaknesses, opportunities, and threats of corn farming in Gorontalo Province were identified. These factors were grouped into four main aspects: cultivation, post-harvest, distribution, and institutional support. The identified SWOT factors are presented in Table 2.

The identification results indicate that Gorontalo has several strengths for corn development, particularly in increasing corn production, expanding available agricultural land, farmers' practical cultivation experience, active farmer groups, and government support for intensifying corn farming. However, several weaknesses remain, including limited farmer capital, increasing production costs, low technology adoption, inadequate post-harvest facilities, dependence on intermediaries, limited access to distribution channels, and weak supporting institutions. These weaknesses indicate that productivity improvement requires not only technical interventions but also institutional strengthening, the dissemination of innovation, and improved managerial capacity among smallholder farmers (Asgar et al., 2024; Asprooth et al., 2023; Maula & Susilowati, 2024).

External factors also indicate that corn farming in Gorontalo offers several opportunities, including land expansion, infrastructure improvement, adoption of appropriate technologies, diversification of corn-derived products, increased market prospects, the use of digital applications for marketing and monitoring, and institutional collaboration. However, corn farming also faces significant threats, including uncertain weather conditions, pest and disease attacks, limited capital, rapid technological change, disruptions to drying activities due to high rainfall, limited distribution networks, limited access to market information, and weak institutional roles.

Table 2. SWOT Analysis of Corn Farming in Gorontalo Province

Aspect	Strengths	Weaknesses	Opportunities	Threats
Cultivation	**S1**. Corn production tends to increase. **S2**. Free seed assistance is available. **S3**. Agricultural land is sufficiently available. **S4**. Farmers' motivation to produce corn is increasing. **S5**. Farmers have practical cultivation experience.	**W1**. Agricultural production inputs remain in short supply. **W2**. Production costs are increasing. **W3**. Farmers' capital is limited. **W4**. Productivity remains suboptimal. **W5**. Adoption of agricultural technology is still low. W6. Farmers' formal education is relatively low.	**O1**. Land expansion is still possible. **O2**. Cultivation infrastructure can be improved. **O3**. Corn production has the potential to increase. **O4**. Appropriate technology can be adopted. **O5**. Farmers' capacity to use technology can be improved.	**T1**. Weather conditions are increasingly uncertain. **T2**. Pest and disease attacks may reduce production. **T3**. Limited capital may constrain farming activities. **T4**. Technological development is increasingly rapid. **T5**. Farmers may be unable to keep up with technological changes.
Post-harvest	**S6**. Corn production volume supports post-harvest development. **S7**. Farmers have experience in basic post-harvest handling.	**W7**. Post-harvest supporting facilities are inadequate. **W8**. Drying, shelling, and storage facilities are still limited. **W9**. Product quality may decline due to limited post-harvest handling.	**O6**. Post-harvest infrastructure can be improved. **O7**. Diversification of corn derivative products is possible. **O8**. Post-harvest technology can improve product quality.	**T6**. High rainfall can disrupt drying activities. **T7**. Poor post-harvest handling may reduce export quality.
Distribution	**S8**. Corn sales have increased in domestic and export markets. **S9**. Export demand for corn has increased.	**W10**. Farmers' marketing still depends on intermediaries. **W11**. Farmers' profits remain relatively low. **W12**. Farmers have limited access to distribution channels.	**O9**. Market prospects for corn are increasing. **O10**. Corn imports can be reduced through domestic production. **O11**. Digital applications can be used to monitor and market corn.	**T8**. Distribution networks remain limited. **T9**. Farmers have limited access to market information.
Institutional	**S10**. Farmer groups are active in supporting corn farming. **S11**. Government programs support corn farming intensification.	**W13**. The functions of the farmer group are not yet optimal. **W14**. The role of supporting institutions is still weak.	**O12**. Supporting institutions for corn production are available. **O13**. Institutional collaboration can strengthen production and marketing.	**T10**. Weak institutional roles may limit access to information, assistance, and markets.

Source: Data Processed (2026)

Overall, the SWOT factors in Table 2 indicate that corn development in Gorontalo requires an integrated strategy that connects production improvement, post-harvest handling, market access, and institutional support. Agricultural competitiveness depends not only on production capacity but also on efficient supply chains, market linkages, innovation systems, and adaptive institutional support (Kembauw et al., 2021; Klerkx & Begemann, 2020; Reardon et al., 2019). Therefore, the SWOT factors were further evaluated using the IFE and EFE matrices to determine the strategic position of corn farming in Gorontalo Province.

Table 3. Internal Factor Evaluation (IFE) Matrix

IFE	Factor	Weight	Rating	Weighted score	Total
Strengths	S1	0.036	3	0.107	1.48
	S2	0.101	4	0.405	
	S3	0.095	3	0.285	
	S4	0.031	3	0.092	
	S5	0.030	3	0.090	
	S6	0.020	4	0.079	
	S7	0.037	4	0.146	
	S8	0.023	3	0.069	
	S9	0.068	3	0.205	
Weakness	W1	0.022	3	0.066	2.01
	W2	0.026	3	0.078	
	W3	0.059	4	0.235	
	W4	0.054	4	0.215	
	W5	0.045	3	0.135	
	W6	0.039	3	0.116	
	W7	0.031	3	0.092	
	W8	0.051	4	0.202	
	W9	0.038	3	0.11	
	W10	0.029	3	0.086	
	W11	0.061	4	0.242	
	W12	0.055	4	0.220	
	W13	0.052	4	0.209	

Source: Data Processed (2026)

Table 3 presents the IFE matrix for corn farming in Gorontalo Province. The total weighted score for strengths was 1.48, while the total weighted score for weaknesses was 2.01. This result indicates that internal weaknesses were more dominant than strengths. The dominant internal weaknesses include limited farmer capital, high production costs, inadequate post-harvest facilities, weak farmer group functions, and low access to distribution channels. These internal constraints may limit productivity gains and weaken corn farming's readiness to support export-oriented agribusiness development.

The internal coordinate was obtained from the difference between strengths and weaknesses, namely 1.48 − 2.01 = −0.53. The negative internal coordinate indicates that the internal condition of corn farming in Gorontalo remains constrained by weaknesses that need to be addressed through technical improvements, institutional strengthening, and improved access to production and post-harvest support.

Table 4. External Factor Evaluation (EFE) Matrix

EFE	Factor	Weight	Rating	Weighted score	Total
Opportunities	O1	0.03	3	0.09	1.56
	O2	0.10	4	0.39	
	O3	0.08	4	0.34	
	O4	0.03	4	0.12	
	O5	0.03	3	0.09	
	O6	0.02	3	0.06	
	O7	0.04	4	0.15	
	O8	0.02	3	0.06	
	O9	0.02	3	0.07	
	O10	0.05	4	0.20	
Threats	T1	0.12	5	0.58	2.20
	T2	0.08	4	0.34	
	T3	0.07	4	0.29	
	T4	0.05	3	0.16	
	T5	0.04	3	0.13	
	T6	0.08	4	0.30	
	T7	0.08	3	0.23	
	T8	0.06	3	0.18	

Source: Data Processed (2026)

Table 4 presents the EFE matrix. The total weighted score for opportunities was 1.56, while the total weighted score for threats was 2.20. This result indicates that external threats were more dominant than opportunities. The main threats include uncertain weather conditions, pest and disease attacks, limited capital, narrow distribution networks, and low access to market information. These threats are closely related to production risk and market uncertainty, which may reduce yield stability, product quality, and farmers' bargaining position. Therefore, strategic planning for corn development in Gorontalo must consider both production risk management and supply chain strengthening (Kembauw et al., 2021; Wang & Hu, 2021).

The external coordinate was obtained by subtracting opportunities from threats, namely 1.56 − 2.20 = −0.64. Combining the internal coordinate of −0.53 and the external coordinate of −0.64 places corn farming in Gorontalo Province in the WT quadrant. This position indicates a defensive strategic direction, meaning that the recommended strategy should focus on minimizing internal weaknesses and anticipating external threats.

Given this strategic position, the development of corn farming in Gorontalo should prioritize reducing production risks, improving post-harvest infrastructure, strengthening farmer institutions, and expanding access to markets and distribution networks. This defensive strategy does not mean limiting development, but rather prioritizing risk reduction and institutional strengthening to improve corn productivity and export sustainability more effectively. The strategic position is presented in Figure 3.

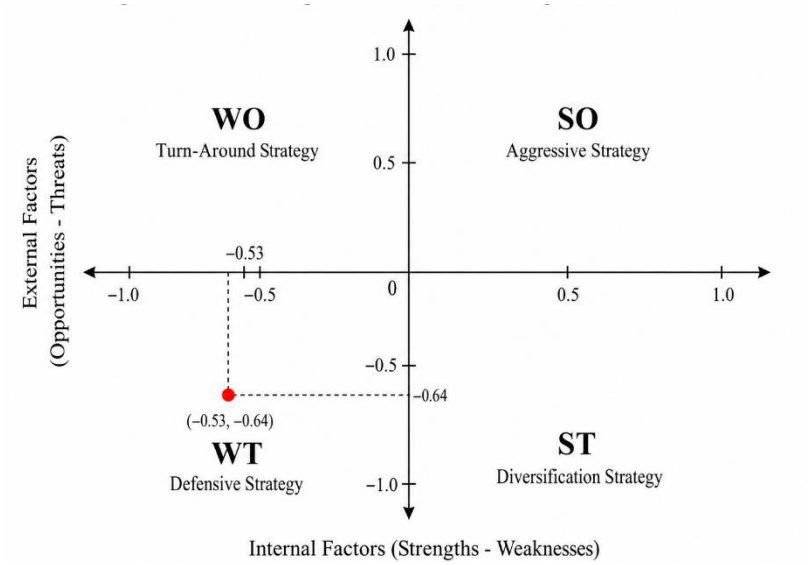

Figure 3. SWOT Strategic Position of Corn Farming in Gorontalo Province
Source: Data processed from IFE and EFE matrices (2026).

As shown in Figure 3, the strategic position of corn farming in Gorontalo Province lies in the WT quadrant, with coordinates (X, Y) = (-0.53,- 0.64). The negative internal coordinate indicates that weaknesses are more dominant than strengths, while the negative external coordinate indicates that threats are more dominant than opportunities. Therefore, the appropriate strategic direction is defensive, emphasizing minimizing internal weaknesses and anticipating external threats.

This defensive position shows that the development of corn farming in Gorontalo should focus on reducing production risks, strengthening farmers' capacity, improving post-harvest facilities, and reducing dependence on intermediaries. In this context, a defensive strategy does not mean limiting development, but rather prioritizing risk reduction and institutional strengthening to achieve more effective productivity improvement and export sustainability.

Based on the SWOT analysis, the alternative strategies formulated in this study were: (1) seed quality improvement; (2) pest and disease control; (3) balanced fertilization; (4) improvement of harvest and post-harvest technology; (5) addition of harvest and post-harvest

facilities; (6) productivity improvement; (7) strengthening the role of extension workers; (8) strengthening farmer groups; and (9) development of farmer partnerships.

The alternative strategies were then structured into an AHP hierarchy to determine their relative priorities. The hierarchy consisted of four levels: the main goal, criteria, sub-criteria, and alternative strategies. The main goal was to formulate strategies to improve corn productivity and sustain export sustainability in Gorontalo Province. The criteria included production, post-harvest, distribution, and institutional aspects, while the sub-criteria and alternative strategies were derived from the SWOT analysis. The AHP hierarchy is presented in Figure 4.

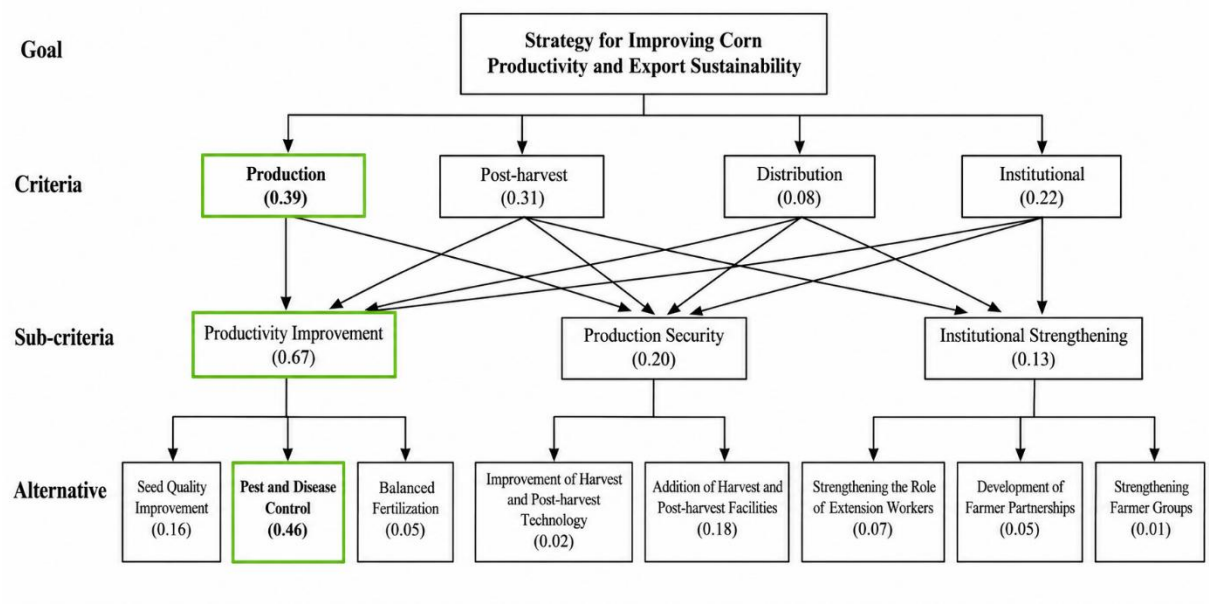

Figure 4. AHP Hierarchy of Strategies for Improving Corn Productivity and Export Sustainability in Gorontalo Province

Figure 4 illustrates the AHP hierarchy used to prioritize strategies for improving corn productivity and export sustainability in Gorontalo Province. The hierarchy begins with the main goal, followed by four criteria: production, post-harvest, distribution, and institutional aspects. These criteria were linked to three sub-criteria, namely productivity improvement, production security, and institutional strengthening. The lowest level of the hierarchy consists of alternative strategies derived from the SWOT analysis.

The highlighted path in the hierarchy indicates the dominant priority structure, as determined by expert judgment. Production was identified as the most important criterion, productivity improvement was the highest-priority sub-criterion, and pest and disease control became the leading alternative strategy. This structure suggests that improving corn productivity and export sustainability in Gorontalo should begin by reducing production risks

and strengthening farm-level productivity. The priority weights generated from the AHP analysis were then used to rank the criteria, sub-criteria, and alternative strategies. The complete priority weights and rankings are presented in Table 5.

Table 5. AHP Priority Weights and Rankings

Level	Element	Priority Weight	Rank
Criteria	Production	0.39	1
Criteria	Post-harvest	0.31	2
Criteria	Institutional	0.22	3
Criteria	Distribution	0.08	4
Sub-criteria	Productivity improvement	0.67	1
Sub-criteria	Securing production	0.20	2
Sub-criteria	Institutional reinforcement	0.13	3
Alternative strategy	Pest and disease control	0.46	1
Alternative strategy	Adding harvest and post-harvest facilities	0.18	2
Alternative strategy	Seed quality improvement	0.16	3
Alternative strategy	Strengthening the role of extension workers	0.07	4
Alternative strategy	Balanced fertilization	0.05	5
Alternative strategy	Development of farmer partnerships	0.05	5
Alternative strategy	Improvement of harvest and post-harvest technology	0.02	7
Alternative strategy	Strengthening farmer groups	0.01	8

Source: Data processed using Super Decisions.

The AHP results presented in Table 5 show that production was the most important criterion, with the highest priority weight of 0.39. This indicates that strategies to increase corn productivity and export sustainability in Gorontalo should first focus on strengthening production capacity. Post-harvest was the second-priority criterion, with a weight of 0.31, indicating that post-harvest management is also crucial for maintaining product quality and reducing losses. Institutional aspects ranked third, with a weight of 0.22, while distribution had the lowest priority weight of 0.08. Although distribution received the lowest weight, it remains important because export sustainability requires stable supply chains and market access. This finding supports previous studies showing that agricultural competitiveness is influenced not only by production performance but also by supply chain efficiency and market accessibility (Kembauw et al., 2021; Wang & Hu, 2021).

At the sub-criteria level, productivity improvement obtained the highest priority weight of 0.67. This result indicates that increasing productivity is the main strategic direction for developing the Gorontalo corn sector. Securing production ranked second, with a weight of 0.20, indicating the importance of maintaining production stability against climate risks, pest

attacks, and input constraints. Institutional reinforcement ranked third, with a weight of 0.13, suggesting that farmer groups, extension services, and supporting institutions remain necessary to strengthen the implementation of productivity and post-harvest strategies. Previous studies also emphasize that smallholder agricultural development depends on institutional support, farmer collaboration, and the dissemination of innovation (Asproth et al., 2023; Nendissa et al., 2024).

Among the alternative strategies, pest and disease control received the highest priority weight of 0.46. This shows that pest and disease management should be the main focus for boosting corn productivity in Gorontalo. Pest and disease outbreaks are closely linked to climate variability and can directly lower yield, grain quality, and production stability. Therefore, integrated pest management, regular field monitoring, farmer training, and extension support are essential to reduce production risks and ensure a stable corn supply. This finding is consistent with previous studies showing that improvements in cultivation technology, fertilizer management, and field-level production practices are important for increasing corn productivity and farmers' income (Hajad et al., 2021; Karman et al., 2020).

The second priority strategy was adding harvest and post-harvest facilities, with a weight of 0.18. This strategy is important because post-harvest constraints can reduce product quality and weaken export competitiveness. Facilities such as drying areas, shelling equipment, dryers, and storage warehouses can help farmers reduce post-harvest losses, maintain grain moisture content, improve product quality, and reduce dependence on private traders or intermediaries. The priority given to post-harvest facilities supports the argument that infrastructure and supply chain efficiency are essential for improving the competitiveness of agricultural products, especially for export-oriented commodities (Kembauw et al., 2021).

Seed quality improvement ranked third, with a weight of 0.16. This finding shows that the use of quality seeds remains an important supporting strategy for increasing productivity. Quality seeds can improve plant performance, support yield stability, and reduce production risks when combined with balanced fertilization and proper cultivation practices. Meanwhile, strengthening the role of extension workers, balanced fertilization, farmer partnerships, post-harvest technology improvement, and strengthening the function of farmer groups are complementary strategies to support the implementation of the main priorities. Although these strategies received lower priority weights, they remain important because productivity improvement requires coordination among technical, institutional, and market-related actors.

Overall, the SWOT-AHP results indicate that strategies to improve corn productivity and export sustainability in Gorontalo should focus on three main areas: reducing production risks through pest and disease control, improving post-harvest infrastructure, and strengthening productivity through quality seed support. These strategies require coordination among farmers, farmer groups, extension officers, local government, and agribusiness actors. By prioritizing these strategies, Gorontalo can improve corn quality, reduce production and post-harvest losses, strengthen farmers' income, and enhance the competitiveness of corn in export-oriented agribusiness.

CONCLUSION

This study concludes that corn farming in Gorontalo Province has the potential to support productivity improvement and export-oriented agribusiness development. However, it still faces several internal weaknesses and external threats. The SWOT analysis shows that weaknesses were more dominant than strengths, while threats were more dominant than opportunities. Based on the SWOT analysis, corn farming in Gorontalo is located in the WT quadrant, indicating a defensive strategic position. This strategy emphasizes minimizing internal weaknesses and anticipating external threats, particularly those related to limited farmer capital, high production costs, inadequate post-harvest facilities, weak institutional roles, climate uncertainty, pest and disease attacks, and limited access to market information.

The AHP results indicate that production was the most important criterion, followed by post-harvest, institutional, and distribution aspects. At the sub-criteria level, productivity improvement became the main strategic direction. Among the alternative strategies, pest and disease control was the highest priority, followed by the addition of harvest and post-harvest facilities and seed quality improvement. These findings indicate that efforts to increase corn productivity and export sustainability in Gorontalo should prioritize risk management in production, post-harvest infrastructure improvements, and support for quality seed.

The main contribution of this study lies in integrating SWOT and AHP to formulate and prioritize strategies for corn productivity and export sustainability in Gorontalo Province. Unlike studies that only describe production constraints or technical cultivation practices, this study provides a structured priority ranking to guide farmers, farmer groups, extension officers, local government, and agribusiness actors in determining which strategies to implement first.

The practical implication of this study is that local government and extension institutions should strengthen integrated pest and disease control programs, improve farmer training, and expand access to quality production inputs. Farmer groups and agribusiness actors should also

be supported by providing drying areas, shelling equipment, dryers, and storage warehouses to reduce post-harvest losses and improve grain quality. Strengthening post-harvest facilities and institutional coordination can improve farmers' bargaining power, stabilize corn supply, and enhance the competitiveness of Gorontalo corn in domestic and export markets.

This study is limited by the use of expert-based priority assessment and the specific regional context of Gorontalo Province. Future studies are recommended to involve a larger number of experts, include more detailed export market data, and compare strategic priorities across different corn-producing regions to strengthen the robustness of policy recommendations for sustainable corn agribusiness development.

Author Contributions

Indriana contributed to the conceptualization of the study, research design, data collection, field observation, data curation, initial analysis, and preparation of the original manuscript draft. Sjahril Botutihe contributed to the development of the research methodology, the SWOT-AHP analysis, the interpretation of results, the visualization of the strategic framework, and the critical revision of the manuscript. Jolanda CE Lamaega contributed to the validation of the research framework, supervision of the analytical process, interpretation of findings, academic review, and final refinement of the manuscript. All authors contributed to the discussion of the results, reviewed and approved the final version of the manuscript, and agreed to be accountable for the accuracy and integrity of the work.

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