The Strategy for Self-Sufficiency Improvement in Corn and Opportunities for Export Sustainability in the Province of Gorontalo Using Swot and Ahp Analysis

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Abstract. The demand for basic food needs is increasing in proportion to the rate of population growth. The production of staple food, such as rice, is not able to meet the demand in terms of quantity and quality, so that the import action cannot be avoided. Another possible alternative in meeting basic needs is food substitution, such as corn. One of the areas that have the potential to become a pioneer in the development of maize/corn agriculture is Gorontalo Province. Geographical potential and maize/corn agricultural production have led Gorontalo Province to become one of the exporters of maize/corn in Indonesia. However, the continuity is reduced so that in addition to unstable supply, farmers are very dependent on middlemen in corn export activities. This then became the basis of research to determine potential developments that might be carried out to increase self-sufficiency in corn by using SWOT analysis and to know the possible priority strategies for efforts to increase maize/corn production in Gorontalo Province. This research was conducted in Gorontalo Province with the analysis method using SWOT and AHP. In the SWOT analysis method, the grouping of internal and external factors is based on cultivation, post-harvest, distribution and institutional activities. By using the rater on the IFE –EFE matrix, the proposed type of strategy is obtained using the WT strategy. The formulation of this strategy is then used as an alternative strategy which is analyzed using the AHP method to determine the priority weights that need to be done.
Keywords: Analytical Hierarchy Process, Corn, Productivity improvement, SWOT

1. Introduction

The demand for basic food needs is increasing in proportion to the rate of population growth. The production of staple food, such as rice, is not able to meet the demand in terms of quantity and quality, so that the import action cannot be avoided. Another possible alternative to fulfil basic needs is food substitution, such as corn, tubers, and sago. Food substitution meets the requirements if there is sufficient production available(Kariyasa, 2014). In developing countries like Indonesia, which makes the agricultural sector as one of the important commodity in the sustainability of people's lives, it is necessary to guarantee food security. Stable and independent food security, so that the State is able to independently meet its needs(Aprillya et al., 2019).

The corn commodity is a food commodity that has a strategic role in the development of agriculture and the economy in Indonesia(Katiandagho et al., 2011). This commodity has a multipurpose function of 4 (F) either for food, feed, fuel, and industrial raw materials. However, with the rapid development of the livestock industry, corn is the main component (60%) in the feed ration. It is estimated that more than 58% of domestic maize needs are used for feed, while only about 30% for food consumption and the rest for other industrial needs and seeds. The potential for development as an export commodity in recent years has begun to increase, where the geographical conditions allow this plant to be produced in large quantities(Aprillya et al., 2019).

One of the areas that have the potential to become a pioneer in the development of maize/corn agriculture is Gorontalo Province.Besides having a Corn Development Center Technical Institute, the maize area in Gorontalo Province is quite extensive. The harvested area for maize/corn in Gorontalo Province from 2011-2017 has increased, as an effort to meet the availability of

maize/corn both within the province and outside the province(Hasan et al., 2019). Along with the increase in harvested area, in the year 2017 experienced the highest increase in corn production. This increase occurred with the existence of government's efforts to make Gorontalo Province a national corn granary in the form of land extension(Rusliyadi, 2018).

Along with the existence of government programs and the large potential for the development of this corn food product, then further in-depth analysis is needed for the future goal in the form of export stability. To ensure the stability of supply for exports, the level of production must exceed domestic demand and have sufficient reserves to be used as export products(Zhang et al., 2016). Domestic or local needs in certain conditions can be met properly even the production capacity exceeds demand. This excess production capacity is then turned into an export product. However, conditions such as pest attacks and weather changes which have been experienced in recent years causing a decrease in production(Sittisaman, 2019). So that it becomes a consideration in an effort to maintain the stability of export supply that has been done.

This study aimed to determine the potential for development that might be carried out to increase self-sufficiency in corn by using SWOT analysis and to find out the priority strategy that might be carried out for efforts to increase maize/corn production in Gorontalo Province. So that in the future, from the existing potential, both internal and external, corn production activities in Gorontalo Province will be able to harmonize the imbalances that occur so that obtain better results.

2. Methodology

This research was conducted in Gorontalo Province which consists of 5 regencies and 1 city, namely Pohuwato Regency, Bone Bolango Regency, Boalemo Regency, Gorontalo Regency, North Gorontalo Regency and Gorontalo City. The location determination of this research is conducted by purposive (deliberately) with the consideration that Gorontalo Province is one of the regions in Indonesia which is the center of maize/corn production.The population of this study were 6.266 farmers and 98 farmers were taken as samples.

This research integrates the SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis method and Analytical Hierarchy Process (AHP). SWOT analysis in the early stages was used to classify the criteria for strengths, weaknesses, opportunities and threats from maize/corn production in Gorontalo Province. The criteria grouping with SWOT is used as the basis for determining the alternative strategy used to achieve the objectives of this study. The alternatives that emerge from the SWOT analysis are then continued with the AHP analysis method to determine the best priority to achieve the research objectives.

SWOT analysis was carried out by identifying the Strengths, Weaknesses, Opportunities and Threats faced in corn production activities in Gorontalo Province. Strengths and weaknesses are identified through an internal environmental assessment, while opportunities and threats are identified through an external environmental assessment. If the identification of problems is carried out correctly, a SWOT analysis can form a basis for the good planning and policy formulation (Ommani, 2011). However, in determining the criteria required expert respondents who know the complexity of the problem as well as detailed observations about the potential of the internal and external environment.(Priyono, 2018).

Identifying strengths in maize/corn commodities in Gorontalo Province can be used as a basis for advancing future production, while weaknesses can be used as a reference for improvement so that maize/corn farming in Gorontalo Province is better. Conditions that become opportunities must be used as well as possible as a point of view in future development, while threats become an indicator of awareness toward unfavourable possibilities in the future. This SWOT point of view is then integrated with other methods in the strategic decision making to support research objectives.

Mapping in internal-external factors as well as alternative strategies that emerge are then modeled into a hierarchy. The hierarchy that is built is arranged based on the level of priority achievement which becomes the objective of the research.The hierarchy that has been built is followed by a prioritization procedure to determine the relative importance of each criterion (Sonawane & Rodrigues, 2015). At each level of the criteria will be compared in pairs according to the level of influence and based on the criteria determined at the higher level. Determination of priority scale in pairwise comparisons using a Likert scale according to the Saaty standard(Santoso et al., 2018). There are four levels in the hierarchy. The first level is the strategy formulation objectives, the second level

is the four groups of criteria based on corn farming activities in Gorontalo, the third level is the main strategic factor, the fourth level is the alternative strategy that must be evaluated and compared. As for the schematic framework of the study is shown in Figure 1 below.
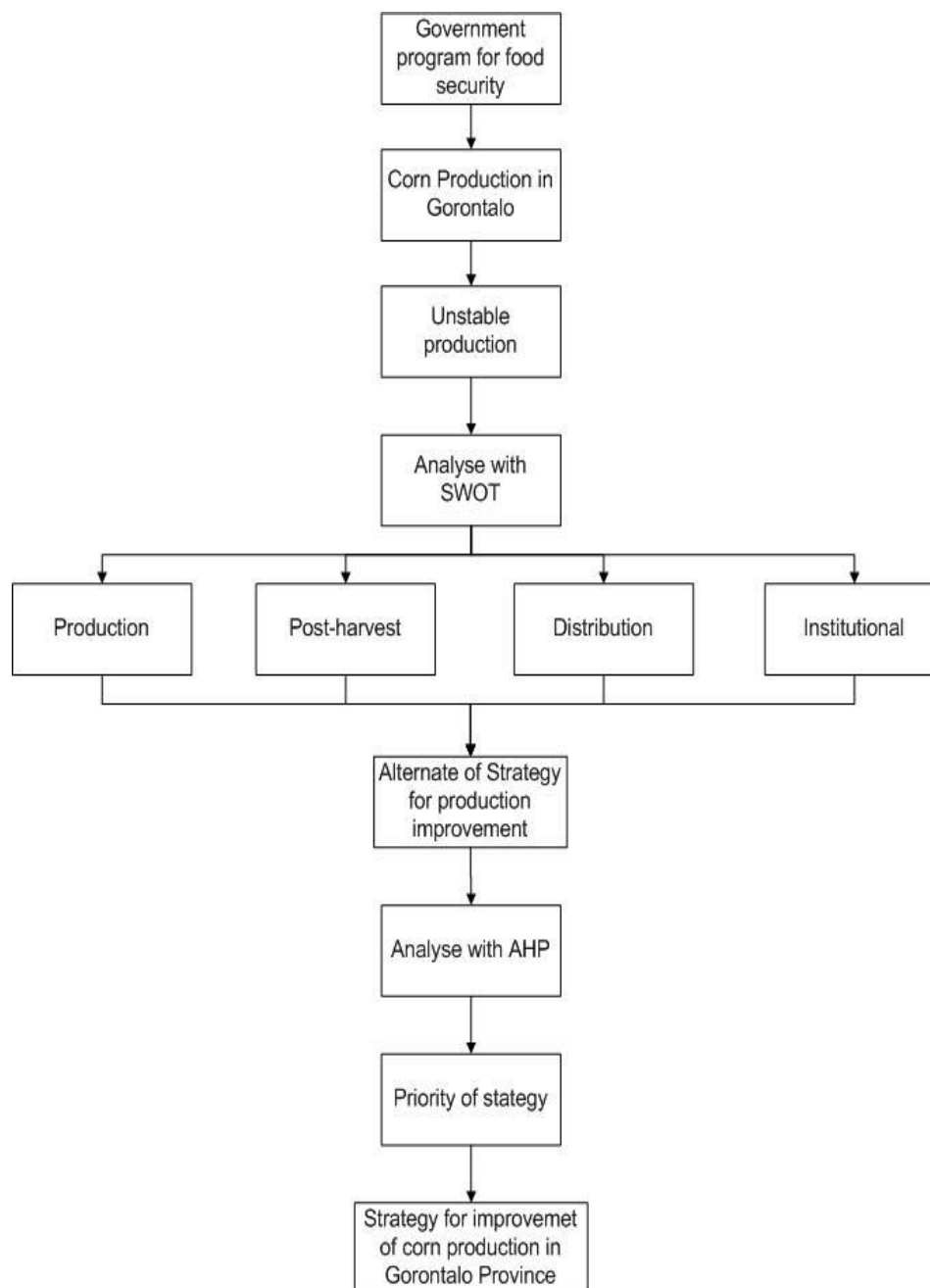

Figure 1. Research framework

3. Results and Discussion

Traditionally, corn has also been used as a staple food for the people of Gorontalo since a long time ago. Thus, the community is already very familiar and expert in corn cultivation. Although the corn commodity is not the only food commodity aimed at meeting the food needs of the community, due to the relatively better economic value of maize, corn has become an agricultural food commodity that is quite potential to be developed. So that now corn as one of the leading commodities in Gorontalo Province becomes the main focus of the government to strengthen food security. Strengthening food security is aimed at strengthening local independence to meet regional food needs and strengthen regional economies.
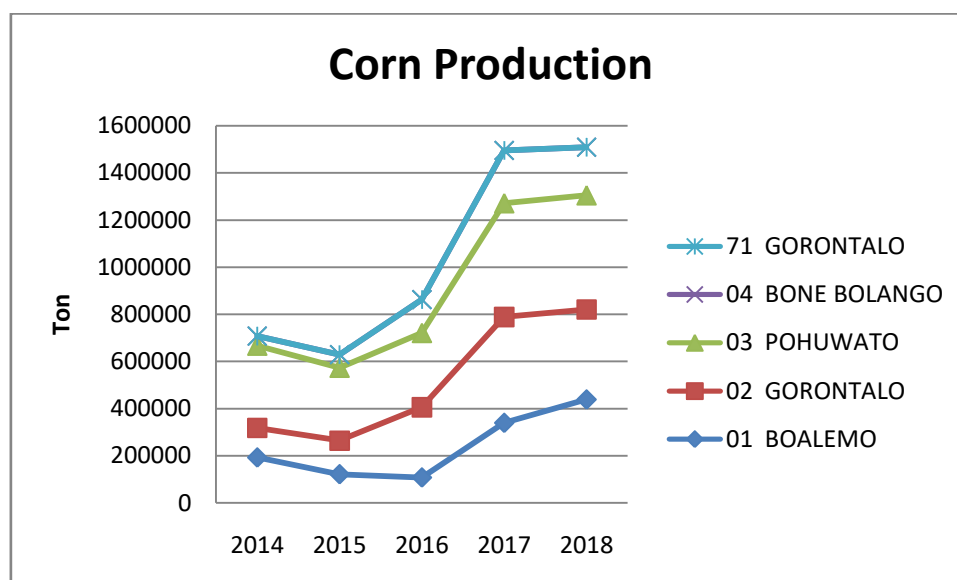
Figure 2. Corn production in Gorontalo Province in 2014-2018

In the last five years, corn production has fluctuated and tends to increase. The decline in 2015 was due to prolonged dry weather, which had an impact on the amount of production. The year of 2015 is a critical period for farmers in corn production due to a decline in production. The level of production is closely related to the amount of land area and the level of productivity of the land that can be harvested, so that when there is a decrease in harvested area and productivity it will affect on the amount of production. The factor that affects the decline in harvested area and productivity is the influence of climatic conditions.Low rain intensity will affect the quality of maize and plant conditions.The occurrence of dryness in 2015 became an unpredictable and controllable risk factor causing a decrease in harvested area, productivity and corn production.

Along with the land extensification program that will become a program of the Gorontalo government in the future, technical constraints in agricultural activities become obstacles to increasing productivity. The losses that occur in maize farming activities are generally caused by changes in weather, attacks by plant-destroying organisms, and lack of supporting facilities and infrastructure. The following are the characteristics of corn farmers in Gorontalo Province which can be seen in Table 1.

Table. 1 Characteristics of farmer respondents

Characteristics	information	Total	Percentage (%)
	<20	1	1%
	20-30	4	4%
Age	31-40	21	21%
	41-50	32	33%
	>50	40	41%
	Not completed elementary	39	40%
	Elementary	44	45%
Education	Junior Highschool	6	6%
	High school	7	7%
	Bachelor	2	2%
Land ownership	self-owned	93	95.0%
	Lease	6	5.0%
Duration of farming	<5	3	3%

5-10	12	12%
11-15	8	8%
16-20	16	16%
21-25	38	39%
>25	21	21%

In general, the condition of human resources as farmers in supporting the development of corn production in Gorontalo Province is rather low. This can be seen from most farmers aged over 50, who at that age have experienced a decrease in productivity to carry out agricultural activities. Viewed from the other side in the form of education, equal to 45% of farmers have elementary education and as many as 40% of farmers have not graduated from elementary school. Only 15% of all respondents have a higher education than Elementary level. The two characteristics in the form of age and education become an obstacle in itself for the government and agencies, especially on work motivation or motivation to innovate in order to increase corn production.

The ownership of agricultural land is generally private ownership. Only 5% of the respondents rent land to be cultivated. This potential is actually beneficial for farmers with private land ownership so that costs and income will belong to the farmers. In addition, farmers have the authority to innovate in an effort to increase production.Farmers are the first producers to be able to guarantee the quality of the products produced so that innovation efforts and farmer integrity are important(Dzulkarnain et al., 2019).Supported by the data displayed as well as more in-depth research on the strengths, weaknesses, opportunities and threats of corn farming in Gorontalo Province, the identification of the factors included in SWOT can be seen in table 2.

Table 2. Identification of the strengths, weaknesses, opportunities, and threats of corn farming in Gorontalo

	Strengthness	Weakness	Opportunity	Threats
Cultivation	(S1) Production increased (S2) Procurement of free seeds (S3) Sufficient land availability (S4) The availability of a sufficient number of workers (S5) The existence of sufficient cultivation knowledge (experience)	(W1) The availability of the insufficient number of agricultural production facilities (W2) Production costs are increasing (W3) Low farmer capital (W4) High production costs (W5) Low productivity (W6) The existence of efforts to increase innovation and the use of technology that is still low (W7) Low farmer education	(O1) The possibility of land extensification (O2) Infrastructure improvements (cultivation, post harvest) (O3) Production Improvement (O5) The use of appropriate technology	(T1) Weather constraints (unpredictable) (T2) Attack of Plant Pest Organisms (T3) Lack of capital
Post-harvest		(W8) Inadequate post-harvest supporting facilities	(O4) The potential for diversification of derivative products is varied (O6) Increase in the ability of farmers in using technology	(T4) The faster movement of technology (T5) Inability to keep up with technological developments
Distribution	(S6) sales enhancement	(W9) Farmers' marketing still depends	(O7) Sales prospects are	(T6) Narrow distribution

	both nationally and exports (S7) Increase in demand for exports	on middlemen (W10) Farmers' profits are still low	increasing (O8) Reduction in corn imports (O9) The use of electronic-based applications to market and monitor the marketing conditions of corn	network (T7) The low level of market information known by farmers
Institutional	(S8) The existence of active participation of farmer groups (S9) The existence of the government's corn agriculture intensification program	(W11) The function of farmer groups is not yet effective (W12) Other institutional roles that are not yet strong (W13) The low access of farmers in distribution channels	(O10) The availability of supporting institutions for corn production	(T8) The lack of demand and supply information or assistance due to lack of institutional roles

Internal factors in the form of strengths and weaknesses as well as external factors in the form of opportunities and threats from corn farming activities in Gorontalo Province have been identified, so that need the existence of assessment regarding with the internal and external conditions towards the research objectives in the form of self-sufficiency enhancement in corn and production continuity. The identification between internal and external factors in agricultural activities is important, especially for the sustainability of activities to support the performance of all elements of supporting activities such as farmers, suppliers, distributors, middlemen to consumers to get a satisfactory performance(Choirun et al., 2020).The assessment of internal and external factors is set out in table 3 and table 4 in the form of IFE matrix and EFE matrix. Weighting conducted with the Likert scale from 1-5.

Table 3. Internal Factor Evaluation (IFE) Matrix

IFE	Factor	Weight	Rating	Weighted score	Total
	S1	0,036	3	0,107	
	S2	0,101	4	0,405	
	S3	0,095	3	0,285	
	S4	0,031	3	0,092	
Strengths	S5	0,030	3	0,090	1,48
	S6	0,020	4	0,079	
	S7	0,037	4	0,146	
	S8	0,023	3	0,069	
	S9	0,068	3	0,205	
	W1	0,022	3	0,066	
	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	
Weakness	W7	0,031	3	0,092	2,01
	W8	0,051	4	0,202	
	W9	0,038	3	0,114	
	W10	0,029	3	0,086	
	W11	0,061	4	0,242	
	W12	0,055	4	0,220	

| W13 | 0,052 | 4 | 0,209 |

Table 3 and table 4 are the assessment results of the expert respondents in determining the condition of corn farming in Gorontalo Province. The value of each matrix represents the coordinates on the internal-external matrix. The value of the IFE matrix in the form of a weight of strengths amounted to 1,48 and weakness amounted to 2,01 becomes the X-axis coordinates. The coordinate value of the axis is the sum of the weight values of strength and weakness, namely amounted to 3,49. Likewise, in the EFE matrix value which represents the Y-axis coordinates has the value of the sum of the opportunities and threats weights, while the value of the Y-axis coordinates is 3,76.

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	

The results of weighting the IFE and EFE matrices are then depicted on the internal and external matrices in Figure 3. This matrix consists of 9 quadrants which have different positions. The coordinates formed from the results of existing assessments indicate the position of the state of corn farming in Gorontalo Province. The coordinates are in quadrant I, which means that the respondent gives an assessment that the current conditions are good, so that to achieve the goal, strategies are needed for the position of growth and build.
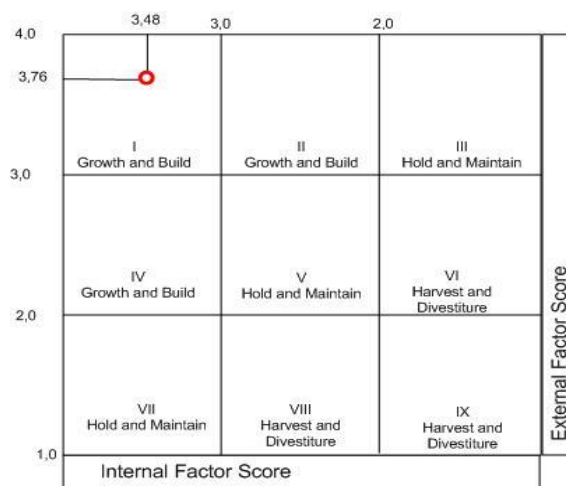

Figure 3. Internal-External Matrix

In the quadrant I position, it can be conducted by formulating a WT (Weakness-Threats) Strategy or by being defensive, namely by minimizing deficiencies and avoiding threats.So that several alternative strategies can be arranged as follows.

1. The improvement of seeds quality
2. Control of Plant Pest Organisms
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 personnel
8. Strengthening farmer groups
9. Development of farmer partnerships

The existing strategy is then formed in the form of a hierarchy. The hierarchy consists of 4 levels where level 1 is Goal, level 2 is Criteria, level 3 is sub criteria and level 4 is alternative strategy obtained from the results of the SWOT analysis. Analysis with AHP was carried out by weighting using pairwise comparisons between indicators for each level(Santoso et al., 2017). The hierarchy that has been formed is then analyzed using Super Decision software as an analysis tool for expert opinion. The super decision software will then analyze the consistency level of the respondents' questionnaires result. Respondents used in the form of expert respondents as many as 3 people consisting of the chairman of the joint group of farmers, extension agents and the head of the agriculture department. The level of consistency of the results of the appropriate answers is <1%, then the priority level is analyzed based on the value of importance according to the respondent. The following are the calculation results for the priority level in the hierarchy shown in Figure 4.
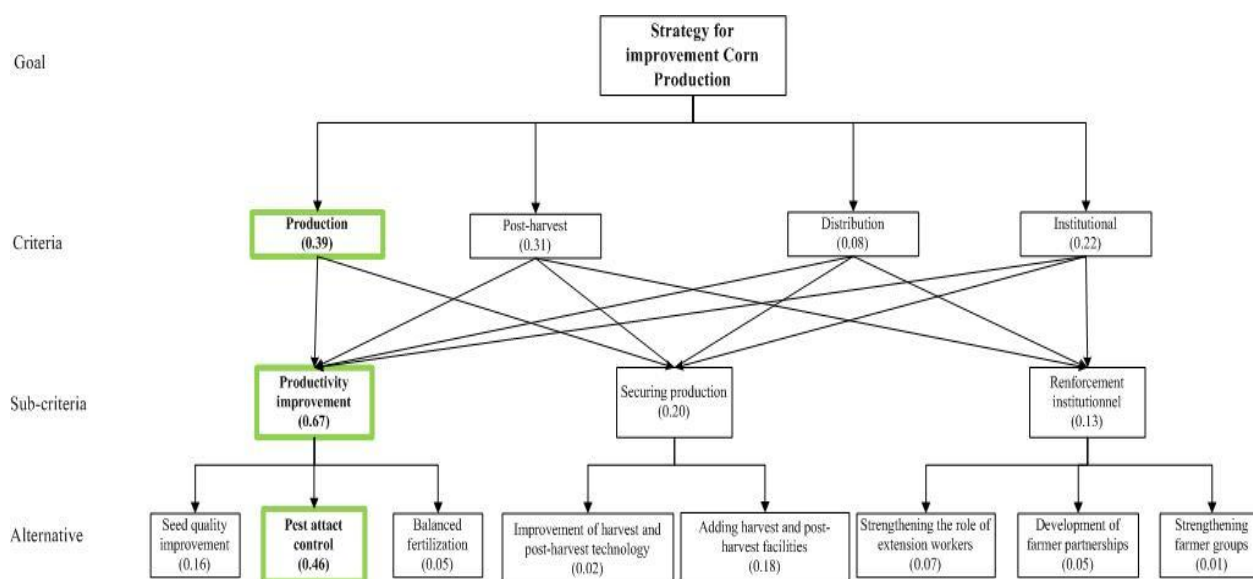

Figure 4. Hierarchy of the Strategy for corn production improvement in Gorontalo Province

Based on the running results of AHP obtained the cultivation criteria with sub-criteria in the form of productivity improvement can be conducted by Plant Pest Organisms controlling. The greatest risk that occurs in weather changes in the cultivation of corn commodity is damage caused by disease and pest attacks.Another alternative strategy that becomes a priority in the effort of corn production improvement is the addition of harvest and post-harvest facilities. These facilities are in the form of drying land, shelling equipment, and dryer. Dryer is used when the rainfall is high so that the drying process is hampered, but its availability is still limited in a limited number as well. As for the other facilities that need to be added in the form of the warehouse.The availability of storage warehouses as additional post-harvest facilities supports the resilience of farmers' supplies in providing raw material supplies for consumers and becomes a supporting facility to increase production capacity(Kurniawan

et al., 2019; Saadah et al., 2019). The existing corn storage warehouse is still working with the private sector. Farmer groups and joint farmer groups still do not have independent storage warehouses, so that the harvest and post-harvest activities are still very dependent on the private sector or middlemen.

4. Conclusion

From the case study, it can be seen that the level of maize/corn production in Gorontalo Province is classified as good. Several aspects such as shortages/weakness and threats are taken into consideration in efforts to increase the stability of production and self-sufficiency in corn. This can be seen from the results of identification and SWOT analysis which refers to a defensive strategy, namely by minimizing deficiencies and anticipating threats. The results of weighting priority with AHP analysis formed from 4 levels which are formed from the formulation of the strategy from the SWOT analysis. From the results of the analysis obtained an alternative strategy in the form of Plant Pest Organisms controlling. The greatest risk that occurs in weather changes in the cultivation of corn commodity is damage caused by disease and pest attacks.Another alternative strategy that becomes a priority in the effort to increase corn production is the addition of harvest and post-harvest facilities. These facilities are in the form of drying land, shelling equipment, dryer.

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