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Research Article
Analysis of Factors Affecting Cocoa Development in Southeast Sulawesi

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Abstract

Background and Objectives: Cocoa production in Southeast Sulawesi experienced tremendous growth at the beginning of the 1980s but since the late 1990s, cocoa productivity, quality and consistency have deteriorated due to a combination of various factors. This study aimed to assess factors affecting cocoa development in Southeast Sulawesi, Indonesia. **Materials and Methods:** Data and information were collected using desk study, questionnaires and in-depth interviews. Respondents consisted of smallholder farmers, local collectors, processing and trading companies, decision makers and researchers. Data were analyzed using the SWOT-AHP (Strength-Weakness-Opportunity-Threat-Analytical Hierarchy Process) method. **Results:** The weaknesses group obtained the highest priority, followed by the threats, opportunities and strengths groups. The analysis provided the most influential factors from each group. Among 32 factors identified, "pest and disease attack" was rated as the most influential factor, whereas "availability of production input" was the lowest rated. **Conclusion:** The SWOT-AHP approach has proven useful for identifying and quantifying the relative significance of factors affecting cocoa development. The dominance of negative factors indicated the seriousness of the challenges facing the cocoa subsector, so adopted strategies should aim first at addressing weaknesses and threats while maximizing opportunities and strengths to ensure the sustainability of the cocoa subsector in the province.

Key words: Chocolate, cocoa beans, cocoa development, seedling quality, suitable agro-climate

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Cocoa is an important estate crop in Indonesia. It has been one of the main sources of income and employment for farmers and is the third major export product after palm oil and rubber. In 2015, approximately 1.7 million households were engaged in cocoa production[1]. The area devoted to cocoa production is 1.71 million ha, with total cocoa production amounting to 0.59 million tons and productivity amounting to 775 kg ha^{-1} [1]. As the third largest cocoa-producing country in the world after the Ivory Coast and Ghana[2], Indonesia exported 330,029 t of cocoa beans in 2016, with a value of 1.24 billion US dollar[3]. World cocoa demand is estimated to grow 30% by 2020[4], whereas global production is predicted to fall and cocoa prices to rise[5]. Indonesia is expected to benefit from this unmet demand and hence, there is much potential for expanding cocoa production.

Sulawesi contributed to 70-80% of the national production and has been the leading cocoa-producing region in Indonesia[5]. Expansion of cocoa acreage and production in this island took place from the 1980s to the 1990s, which was attributable to, among other things, the low cost of labor, the abundance of suitable land, a highly competitive marketing network and the entrepreneurial skill and innovation of smallholders[6,7]. In Southeast Sulawesi Province, cocoa is the leading commodity among estate crops[8] and is mainly grown in the Districts of Kolaka, East Kolaka, North Kolaka, Konawe, South Konawe, North Konawe and Bombana. The production area of cocoa in Southeast Sulawesi is 255,779 ha with 165,530 cocoa farming households, production amounting to 91,808 t and productivity of 817 kg ha^{-1} [1]. The province provides a 19.30% share of the total national production, which is entirely from smallholder plantations[1].

Cocoa production in Southeast Sulawesi faces a number of challenges. These include aged trees and pest and disease attacks, which have led to decreased productivity, quality and consistency[9]. Productivity could be as low as 400 kg ha^{-1}, except in areas covered by programs initiated by the government of Indonesia, donor organizations, or the private sector, where productivity could reach 1,500 kg ha^{-1}. Due to their low quality and inconsistency, cocoa beans from this area are sold for a discounted price on the world market[10]. Since income from cocoa farming is no longer attractive, many farmers switched to alternative crops or diversified their livelihood system to include crops that could provide stable income[11]. These issues should be addressed to avoid a decline in the cocoa subsector and to provide sufficient supply to meet the growing demand for the cocoa industry.

To improve the effectiveness of strategies and programs to increase production and quality, an in-depth understanding of factors affecting cocoa development is needed[12]. One of the methods commonly used to identify such factors is SWOT (Strengths-Weaknesses-Opportunities-Threats) analysis. SWOT analysis identifies strengths, weaknesses, opportunities and threats that are faced by an organization. Strengths and weaknesses are identified through appraisal of the internal environment, whereas opportunities and threats are identified through appraisal of the external environment. If used properly, SWOT can provide a strong foundation for effective formulation of planning and policy. However, SWOT does not quantify the relative importance of various factors and the assessment could be subjective[13]. For this reason, the importance of each factor in a plan or policy is not understood[13]. This shortcoming can be solved if SWOT is combined with an analytical hierarchy process or AHP.

The SWOT-AHP approach enables the quantification of strengths, weaknesses, opportunities and threats and hence provides more realistic and effective decisions compared to SWOT or AHP methods alone[14,15]. SWOT-AHP has been applied in many studies in various areas, such as the environment[14,16], tourism[13], land administration[17], consumer electronic firms[18], agriculture[19], forest management[20,21], livestock management[22], Geographic Information System (GIS) implementation[23] and store distribution[24]. Despite its popularity in the literature of strategic planning, its use in the development of commodities is still lacking. This study aimed to assess factors that affected cocoa development in Southeast Sulawesi, Indonesia using the SWOT-AHP method.

MATERIALS AND METHODS

Study area and respondents: The field survey was carried out in the Kolaka and Konawe Districts of Southeast Sulawesi Province. The two districts were selected purposively because they well represented the cocoa growing districts in the province. Respondents consisted of (1) Farmers, subdistrict collectors and cocoa processing and exporting companies, (2) Staff at the Office for Agriculture at Kolaka and Konawe Districts and (3) Researchers at the Assessment Institute for Agricultural Technology (*Badan Pengkajian dan Penerapan Teknologi*, or BPTP) and Halu Oleo University. Respondent farmers were selected from three leading cocoa farmers' groups in each district for six groups in total. The selected groups were the ones recommended by the District Office for Agriculture based on the groups' ability to function as learning units, forums for collaboration and production units. Respondents at the downstream agribusinesses were selected

using the snowball sampling method. Overall, the total number of interviewed respondents was 18 farmers, four local collectors, two government staff and two processing/trading companies (in Kolaka).

Data and information were collected through a desk study, in-depth interviews and questionnaires. A desk study was conducted to review reports, publications, documents and other relevant information from government institutions and other secondary sources. Interviews were conducted with farmers and stakeholders at on-farm and downstream agribusinesses, staff from government institutions and researchers at BPTP. Data and information collected from the desk study and interviews were used to identify SWOT factors, including prospects, challenges and policies related to cocoa development. Identified SWOT factors were included in the AHP questionnaires that were provided to researchers at BPTP and Halu Oleo University for pairwise comparison as part of the SWOT-AHP methodology.

Data analysis: This study used the SWOT-AHP approach, which began with an assessment of the internal and external environment as part of SWOT analysis. Internal factors consisted of the strengths and weaknesses that exist in the cocoa subsector, whereas external factors consisted of the opportunities and threats that are present for the development of the cocoa subsector. The identification of these SWOT factors involved people who are familiar with the topic[25], specifically, key stakeholders and experts linked to cocoa development in the two districts in the province.

AHP is an analytical method used to make decisions from various alternatives by considering problem complexity[26] through a simple, creative and flexible way while maintaining consistency in the decision being adopted[27]. The essential AHP method seeks to decompose unstructured, complex situations into their components, arrange this part or variable into a hierarchy, gives numerical values to the subjective consideration of the relative importance of each variable and synthetizes these considerations to determine variables with the highest priority and further actions needed[28]. Using this method, decision making is based on a number of alternative criteria based on pairwise comparison[14]. Three basic principles in the AHP method are hierarchy establishment, priority setting and weight allocation. To apply these three principles, a questionnaire was completed using a pairwise comparison with a 9-point scale. The value of 1 indicated equal importance, while 9 indicated extreme or absolute importance.

The objective of using AHP in the SWOT framework was to evaluate SWOT factors in more systematic ways and to quantify their intensities. When combined with AHP, the SWOT approach could produce quantitative values from each SWOT factor for decision making. The SWOT and AHP were integrated through the following three steps[14,15]:

- **Step 1: SWOT analysis:** Relevant factors in the external and internal environments were identified through a literature review, a review of the District Mid-Term Development Plan, field visits and interviews with respondents. The generated factors were further reviewed, organized and placed in each SWOT group. The number of factors in each SWOT group was kept under ten factors to limit the number of pairwise comparisons to be performed. The results of pairwise comparison provided quantitative values of priority for each factor included in the SWOT
- **Step 2: Pairwise comparison between factors in each SWOT group:** Survey questionnaires were developed for pairwise comparisons between factors within each SWOT group. The questionnaires used a one-to-nine rating scale to assess the importance of each factor relative to the other. The questionnaire was provided to researchers from BPTP Kendari and Halu Oleo University. Researchers were allowed to deliberate and come to a consensus in assigning a relative weight. In doing so, the basis for comparison was the following two questions. (1) Between factors to be compared, which one has higher influence, as strength, weakness, opportunity and threat? (2) What is the extent of that influence? With pairwise comparison, local priorities of the factors within the group were then calculated using the eigenvalue method. Priority values reflected expert perception of the relative importance of the concerned factors
- **Step 3: Pairwise comparison among four SWOT groups:** The factor with the highest local priority value was selected from each SWOT group. A pairwise comparison for these four factors was performed, as in Step 2, to obtain the group priority value, which reflected the relative importance of factors among SWOT groups. The group priority value was then multiplied by the priority value of each factor in Step 2 to obtain the global priority value. The sum of all global priority values equals to one

RESULTS

Identification of SWOT factors: Based on the identification of internal and external factors in cocoa development, factors that constituted strengths were (1) Large plantation area,

(2) Suitable agro-climate, (3) Available labor, (4) Industrial use of the crop, (5) Good infrastructure, (6) Sufficient farming experience, (7) Available production inputs and (8) A competitive marketing system. Factors that become weaknesses were (1) Low quality seedlings, (2) Low productivity, (3) Low financial capacity, (4) Low-quality cocoa beans, (5) Lack of extension services, (6) Weak farmers organizations, (7) Poor farming practices and (8) Aged trees.

In the external environment, the factors included in opportunities were (1) High market demand, (2) More processing factories, (3) Potentially increased power of producers, (4) Investment in infrastructure/facilities, (5) Utilization of whole cocoa fruit, (6) International support, (7) Government programs and (8) Market for quality, specialty beans. Factors that were categorized as threats were (1) Pest and disease attack, (2) More profitable crops or livelihoods, (3) The emergence of alternative products, (4) Degradation of the environment, (5) Price fluctuation, (6) New emerging cocoa-producing countries, (7) Requirements of global markets and (8) Climate change.

Pairwise comparison between factors within each SWOT group: Table 1-4 present the results of a pairwise comparison between factors in each SWOT group. Under the strength group, "suitable agro-climate" was the highest-rated factor. Under the weaknesses category, "aged trees" was the highest-rated factor. Under opportunities, the highest-rated factor was "high market demand". Lastly, under threats, "pest and disease attack" was the highest-rated factor.

Pairwise comparison between SWOT groups: Referring to the group priority values in Table 5, weaknesses had the highest priority value (0.358), followed by threats (0.304), opportunities (0.232) and strengths (0.107). This means that weaknesses and threats are more dominant SWOT groups in cocoa development. In other words, cocoa development has more weaknesses and threats than strengths and opportunities. The dominance of the two groups can also be seen in Fig. 1, which shows the relationship between SWOT groups in cocoa development. Characteristics and intensities

Table 1: Pairwise comparison matrix of the strengths group

Strengths	S1	S2	S3	S4	S5	S6	S7	S8	GP	Rank
(S1) Large plantation areas	0.071	0.080	0.138	0.040	0.136	0.175	0.135	0.047	0.103	4
(S2) Suitable agro-climate	0.354	0.400	0.277	0.356	0.239	0.291	0.216	0.567	0.337	1
(S3) Labor availability	0024	0.067	0.046	0.030	0.102	0.029	0.081	0.038	0.052	6
(S4) Industrial use of the crop	0.213	0.133	0.185	0.119	0.170	0.117	0.189	0.063	0.149	3
(S5) Good infrastructure	0.018	0.057	0.015	0.024	0.034	0.019	0.081	0.031	0.035	7
(S6) Farming experience	0.024	0.080	0.092	0.059	0.102	0.058	0.081	0.038	0.067	5
(S7) Input availability	0.014	0.050	0.015	0.170	0.011	0.019	0.027	0.027	0.023	8
(S8) Competitive marketing	0.283	0.133	0.231	0.356	0.205	0.291	0.189	0.189	0.235	2

Consistency ratio (CR): 0.094, GP: Priority value within the group

Table 2: Pairwise comparison matrix of the weaknesses group

Weaknesses	W1	W2	W3	W4	W5	W6	W7	W8	GP	Rank
(W1) Low quality seedlings	0.150	0.080	0.107	0.173	0.155	0.173	0.326	0.245	0.173	3
(W2) Low productivity	0.450	0.170	0.179	0.173	0.155	0.173	0.326	0.082	0.214	2
(W3) Low financial capacity	0.050	0.034	0.036	0.058	0.017	0.019	0.022	0.035	0.034	8
(W4) Poor quality of beans	0.050	0.057	0.036	0.058	0.155	0.058	0.036	0.049	0.062	5
(W5) Lack of extension	0.050	0.057	0.107	0.019	0.052	0.058	0.036	0.049	0.053	7
(W6) Weak farmer institutions	0.050	0.057	0.107	0.058	0.052	0.058	0.036	0.049	0.058	6
(W7) Poor farming practices	0.050	0.057	0.179	0.173	0.155	0.173	0.109	0.245	0.143	4
(W8) Aged plants	0.150	0.511	0.250	0.288	0.259	0.288	0.109	0.245	0.263	1

CR: 0.087, GP: Priority value within the group

Table 3: Pairwise comparison matrix of the opportunities group

Opportunities	O1	O2	O3	O4	O5	O6	O7	O8	GP	Rank
(O1) High market demand	0.329	0.523	0.326	0.207	0.269	0.205	0.300	0.250	0.301	1
(O2) More processing plants	0.110	0.174	0.196	0.310	0.192	0.205	0.300	0.250	0.217	2
(O3) Power of producers	0.066	0.058	0.065	0.103	0.115	0.068	0.100	0.050	0.078	6
(O4) Infrastructure/facilities	0.164	0.058	0.065	0.103	0.115	0.205	0.100	0.050	0.108	4
(O5) Use of whole cocoa fruit	0.047	0.035	0.022	0.034	0.038	0.023	0.033	0.050	0.035	8
(O6) International support	0.110	0.058	0.065	0.034	0.115	0.068	0.033	0.150	0.079	5
(O7) Government programs	0.110	0.058	0.065	0.103	0.115	0.205	0.100	0.150	0.113	3
(O8) Market for quality beans	0.066	0.035	0.196	0.103	0.038	0.023	0.033	0.050	0.068	7

CR: 0.099, GP: Priority value within the group

Table 4: Pairwise comparison matrix of the threats group

Threats	T1	T2	T3	T4	T5	T6	T7	T8	GP	Rank
(T1) Pest and disease attack	0.384	0.549	0.326	0.207	0.269	0.300	0.250	0.329	0.338	1
(T2) More profitable crop	0.128	0.183	0.196	0.310	0.192	0.300	0.250	0.329	0.230	2
(T3) Alternative products	0.055	0.037	0.065	0.103	0.115	0.100	0.050	0.027	0.045	7
(T4) Degradation of the environment	0.096	0.061	0.065	0.103	0.115	0.100	0.050	0.110	0.114	4
(T5) Price fluctuation	0.077	0.037	0.022	0.034	0.038	0.033	0.050	0.037	0.072	5
(T6) New producing countries	0.055	0.037	0.065	0.034	0.115	0.033	0.150	0.022	0.027	8
(T7)Requirements of global market	0.077	0.037	0.065	0.103	0.115	0.100	0.150	0.037	0.050	6
(T8) Climate change	0.128	0.061	0.129	0.096	0.175	0.156	0.148	0.110	0.125	3

CR: 0.061, GP: Priority value within the group

Table 5: Matrices of comparisons between groups

Groups	S	W	O	T	GP	Rank
(S) Strengths	0.111	0.118	0.111	0.087	0.107	4
(W) Weaknesses	0.333	0.353	0.222	0.522	0.358	1
(O) Opportunities	0.222	0.353	0.222	0.130	0.232	3
(T) Threats	0.333	0.176	0.444	0.261	0.304	2

CR: 0.064

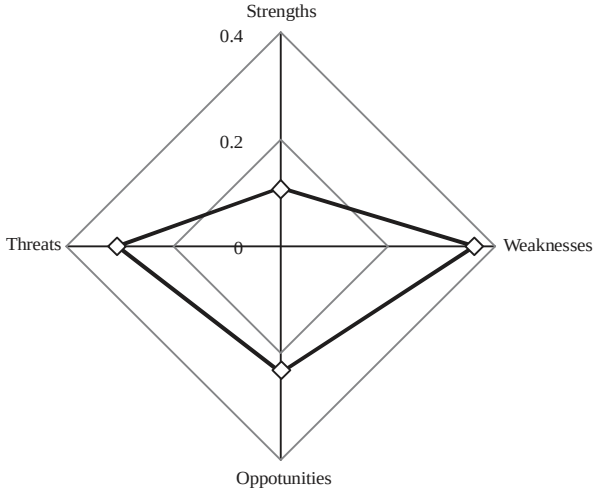

Fig. 1: Relationship between SWOT factors in cocoa development

of the relationships between SWOT groups can be used to inform strategies and policies to be adopted for developing cocoa production henceforth.

Global priority value: The next step in the SWOT-AHP method is to calculate the global priority value of each SWOT factor. The global priority value is obtained by multiplying the group priority value by the local priority value. The global priority value is presented in Table 6 (the last column) and Fig. 2. The sum of all global priority values equals one.

The global priority value indicates the level of relative importance of each factor in cocoa development. As shown in Table 6 and Fig. 2, the factor with the highest priority value is "pest and disease attack" (T1). After this factor, eleven factors with higher ratings in order of priority are "aged trees" (W8), "low productivity" (W2), "high market demand" (O1), "more profitable crop or livelihood" (T2), "low quality seedlings/planting materials" (W1), "poor farming practices" (W7), "more processing plants" (O2), "climate change" (T8), "suitable agroclimate for cocoa cultivation" (S2), "degradation of the environment" (T4) and "government programs" (O7).

DISCUSSION

SWOT-AHP revealed that experts consider weaknesses to be the most important consideration for the development of cocoa production, followed by threats, opportunities and strengths (Table 5). Weaknesses are three times more important than strengths, which had the lowest priority.

Under the strengths group, "suitable soil and climate" was rated as the most influential factor. The climate in Southeast Sulawesi is tropical with relatively regular rains and a dry season, which is ideal for cocoa growing. At the beginning, many cocoa fields were created by opening up forests and cocoa was planted under the shade of taller banana plants, which was ideal for juvenile cocoa trees. Cocoa cultivation was pioneered by Buginese farmers mainly in East Kolaka, North Kolaka and Kolaka districts and suitable soil and climate contributed to the rapid expansion of cocoa in Southeast Sulawesi[7]. Other factors mentioned in the strengths group indicate that "competitive marketing," "industrial use of the crop," and "large plantation area" play a significant role in cocoa development. A competitive marketing network enables farmers to obtain a higher farmer's share. According to Akiyama and Nishio[7], the farmer's share of Free on Board (FOB) prices reached approximately (90%) in Sulawesi, which was much higher than that in other cocoa-producing countries. Due to technological advancements and new

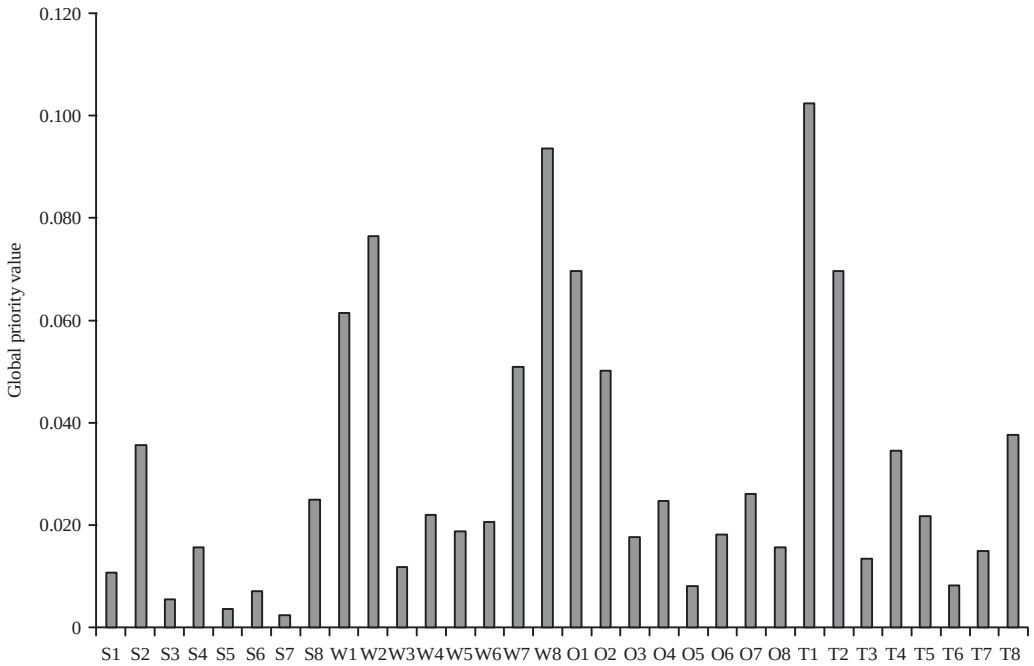

Fig. 2: Global priority values of each SWOT factor

Table 6: Priority and consistency ratio from comparison of SWOT groups and factors in cocoa development

SWOT groups	Group priority	SWOT factors	Local priority	Global priority
Strengths	0.107	(S1) Large plantation area	0.103	0.011
		(S2) Suitable agroclimate for cocoa cultivation	**0.337**	**0.036**
		(S3) Available man-power	0.052	0.006
		(S4) Industrial use of the crop	0.149	0.016
		(S5) Good infrastructure	0.035	0.004
		(S6) Sufficient farming experience	0.067	0.007
		(S7) Available production inputs	0.023	0.002
		(S8) Competitive marketing system	0.235	0.025
Weaknesses	0.358	(W1) Low quality seedlings/planting materials	0.173	0.062
		(W2) Low productivity	0.214	0.077
		(W3) Low financial capacity	0.034	0.012
		(W4) Poor quality of beans	0.062	0.022
		(W5) Lack of extension	0.053	0.019
		(W6) Weak farmers organizations	0.058	0.021
		(W7) Poor farming practices	0.143	0.051
		(W8) Aged plants	**0.263**	**0.094**
Opportunities	0.232	(O1) High market demand	**0.301**	**0.070**
		(O2) More processing plants	0.217	0.050
		(O3) Potentially increased power of producers	0.078	0.018
		(O4) Investment in infrastructure/facilities	0.108	0.025
		(O5) Utilization of whole cocoa fruit	0.035	0.008
		(O6) International support	0.079	0.018
		(O7) Government programs	0.113	0.026
		(O8) Market for quality, specialty beans	0.068	0.016
Threats	0.304	(T1) Pest and disease attack	**0.338**	**0.103**
		(T2) More profitable crop or livelihood	0.230	0.070
		(T3) Emergence of alternative products	0.045	0.014
		(T4) Degradation of the environment	0.114	0.035
		(T5) Price fluctuation	0.072	0.022
		(T6) New emerging countries	0.027	0.008
		(T7) Stringent requirements to international market	0.050	0.015
		(T8) Climate change	0.125	0.038

The most important factors in each SWOT group are written in bold

product development, cocoa beans can be processed to produce a variety of products in different forms[4], such as chocolate, cosmetic products and ingredients for almost any foodstuff. Cocoa and chocolate are widely reported to have beneficial health effects[29] and chocolate itself can become a product on its own or be used in combination with other ingredients to form confectionary products. A large plantation area provides a competitive advantage in cocoa trade because the province is able to supply large quantities of beans.

Other factors with lower ratings included "sufficient farming experience," "labor availability," "good infrastructure," and "available production inputs." Sufficient farming experience implies that farmers have sufficient knowledge of cocoa farming practices, though they might still use conventional methods. Labor availability is important because cocoa farming is labor intensive, particularly during pruning, harvesting and drying. Good infrastructure facilitates the movement of farming inputs from one point to another. Good infrastructure also enables movement of cocoa beans from production sites to collection points and buying companies in Kolaka; beans are then shipped to Makassar. Input availability supports the implementation of farming practices leading to production with reasonable costs.

Under the weaknesses group, "aged trees" was rated as the most influential factor followed by "low productivity," "lack of quality seedlings or planting materials," and "poor farming practices." These factors are interrelated. Most cocoa trees are already beyond their economically productive life, which together with other factors such as pest and disease attack, poor quality seedlings and poor farming practices contribute to diminishing cocoa yields. Therefore, smallholder farmers have to do culling and replanting to maintain productivity but many of them were reluctant to give up immediate income to improve long-term revenue potential. Therefore, farmers abandon their aged cocoa trees and do not replace or replant them. A low yield of cocoa trees is also reported as the main production constraint in West Sumatera[30]. Low productivity means low income for farming households. Poor farming practices are somehow related to abandonment of cocoa farming due to their aged trees. Knowing that their cocoa trees will not provide high yield, farmers do not take care of their farm intensively. This abandonment and low productivity also explain why smallholder farmers are less eager to learn and implement pest and disease management, especially when extension services are limited and pests and diseases are prevalent.

Other factors with lower importance in the weaknesses group included "low quality of cocoa beans," "weak farmers organizations," "lack of extension," and "limited financial capacity." Most producers do not conduct fermentation because commercial incentives have been inadequate[31]. There is no price difference between fermented and unfermented beans and both local collectors and processing/trading companies are ready to buy their output in the form of unfermented bulk beans[32]. Therefore, efforts should be made to create incentives at the farm level to improve cocoa quality to attract the on-farm investment needed to stabilize and increase cocoa production. Weak farmers organizations do not enable farmers to act together to solve common issues with input procurement, the on-farm subsystem[33], processing or marketing[34]. Dysfunctional agricultural research coordination[35] and limited knowledge and lack of resources and facilities of public extension services hamper them from building effective service provision mechanisms that can deliver improved technologies and training to smallholder farmers[36]. A lack of financial capacity limits the ability of smallholder farmers to invest in on-farm operations to maintain or increase farm productivity and is a main reason that farmers take loans from middlemen. Smallholder farmers are free to sell their cocoa beans to any collector or even directly to processing/trading companies in Kolaka but they often sell to middlemen who have provided credit because they feel morally obligated to do so with such a "credit tying"[37].

In the opportunities group, "high market demand" was rated as the most influential factor. As there are no alternative crops or synthetic products to make chocolate, cocoa production is expected to increase to meet market demand[38]. Final chocolate consumption in the major chocolate markets, such as Europe, the United States, Brazil, Japan and Australia, increased by 10% from 2002-2010. Likewise, actual cocoa bean demand is experiencing a similar increasing trend[39]. The main market for the cocoa industry is Europe but the Asia-Pacific is predicted to become the fastest growing market in the future. As one of the main cocoa-producing countries, Indonesia is expected to utilize this open market for cocoa beans[39].

The next three highly rated factors in the opportunities group were "more processing factories," "government programs," and "investment in infrastructure/facilities." Following the increase in the supply of raw cocoa bean materials for domestic use as a result of the issuance of an export tax policy on cocoa beans by the Government of Indonesia in 2010, most international companies established processing facilities in Indonesia to produce semi-processed or completely processed cocoa. The establishment of more cocoa processing plants will increase value added and domestic demand for cocoa beans[40]. Government support can be seen, among other things, from the implementation of

the National Movement for the Improvement of Cocoa Production and Quality starting in 2008 to recover the cocoa subsector that faced decreasing productivity, quality and consistency. The activities of the National Movement included rehabilitation through side-grafting propagation technique, replanting with the use of superior varieties produced from somatic embryogenesis and intensification. Investment in infrastructure/facilities is expected to come from both private sectors that seek to utilize the increased domestic supply of cocoa beans and the local governments that seek to maintain and benefit from the status of the province as the leading cocoa-producing area. The proliferation of the Kolaka District to become three districts (Kolaka, East Kolaka and North Kolaka) will definitely enable each district to focus better on improving infrastructure in its area to reach even the remotest places.

Other factors in the opportunities group included "potentially increased power of producers," "utilization of whole cocoa fruit," "international support," and "market for quality or specialty beans." In view of product scarcity, product differentiation, certification, added value and specialty products[41], producer and supplier power has the potential to increase. This can be realized, however, if smallholder farmers form cooperatives or associations. In addition to beans, whole cocoa fruit, including the husk, shell and pod, can be utilized to produce different products, such as animal feed[42], soft drinks, alcohol, fertilizer, mulch, jam and marmalade. There have been many projects sponsored by international organizations such as United States Agency for International Development (USAID), Australian Centre for International Agricultural Research (ACIAR) and Swiss Contact that work on improving various aspects of cocoa production in Southeast Sulawesi. Private companies strengthen their presence in Sulawesi to ensure a high supply of cocoa beans following the issuance of the export tax for cocoa beans[9] and to comply with ethical and environmental standards requested by chocolate consumers worldwide in the form of certification programs for cocoa farmers in targeted areas[43]. In the international market, there is always demand for better quality or specialty beans, such as mainstream products and premium chocolate[41]. There has also been an increased demand for better quality beans for the domestic cocoa grinding industry[9].

"Pest and disease attack" was the most influential factor in the threat group. The pests and diseases that were found included the cocoa pod-borer, vascular streak dieback (VSD) and pod rot. In Southeast Sulawesi, cocoa pod borer attack was first observed in 1995, with incidence on cocoa trees ranging from 37.5-100%[44]. Its impact on yield can be extremely serious and no fundamental control is available except for eradication of affected cocoa trees[7]. Furthermore, the loss caused by pod rot disease is estimated at 26-50% of cacao production every year[45]. In Sulawesi, the incidence of black pod even exceeded 50% in ripe pod harvest during the wet season[46]. Among the factors contributing to lower farm productivity, including "aging trees", "soil fertility decline" and "socioeconomic trends" such as the increasing average age of farmers, VSD has been one of the most important factors and has frequently influenced smallholders to replace their cacao with other crops. In their 2008/2009 annual report, the International Cocoa Organization (ICCO) identified VSD as a main constraint to cacao production in the region[47]. Trees that are infected by pests and diseases will no longer be available for production, thus threatening the supply.

Other factors that were included in the threat group were "fluctuation of cocoa price," "more profitable crops or livelihoods," "more stringent requirements for international market," "competition from alternative products," "degradation of the environment," and "climate change." Cocoa prices are volatile and are influenced by many factors, such as fluctuation of the exchange rate, extreme weather, pests and diseases, speculation and political instability in cocoa producing countries. Crops perceived to be more profitable, such as pepper, patchouli (*Pogostemon cablin*) and oil palm could make farmers abandon their farming, especially when return is low due to low productivity, aged trees and pest and disease attack. In line with standards set by international bodies, the public sector and the private sector, international buyers demand compliance with several requirements regarding health, food safety, quality, heavy metal contamination, traceability and sustainability that do not always match the capacity and reality of production[41]. The emergence of other vegetable fats, such as cocoa butter substitutes (CBS)[48], poses a threat to cacao butter. Palm, mango kernel and shea butter are allowed in the European Union (EU) as substitutes for making chocolate, which makes buyers import less cocoa for that use[41]. Decreasing soil fertility is one of the factors responsible for declining cocoa yield[6,36]. In some cases, decreasing soil fertility could be part of environmental degradation since many cocoa fields were created by opening up forests without considering land suitability and land use plans.

Climate change was included as one of the influential factors because cocoa production is dependent on weather conditions. Cocoa trees are highly susceptible to drought and rainfall distribution[49]; climate change can also modify the stages and intensity of cocoa pest and pathogen development

and modify the resistance of host trees[50]. For example, rainfall below 100 mm per month for the period of three months will damage cocoa trees and hence reduce the yield and cocoa beans supply[4].

Pairwise comparison between groups indicated that weaknesses and threats were more dominant SWOT groups in cocoa development. Furthermore, based on the global priority values, among the top 12 most influential factors, eight factors were from the weaknesses and threats groups: pest and disease attack, aged trees, low productivity, competition with perceived profitable crops, low-quality planting materials, poor farming practices, climate change and environmental degradation. These results confirm the seriousness of the challenges facing the cocoa subsector in the province, which has experienced a decline in productivity and quality since the late 1990s. On the other hand, among the 12 most influential factors, four factors are from the opportunities and strengths groups, which are positive for the development of the cocoa subsector, namely, high market demand, more processing plants, suitable agro-climate and supportive government programs. These positive factors hold promise for the future of cocoa production. In fact, the sustainability of cocoa production in the province will depend on the strategies and interventions that the government, private sector and all other stakeholders will adopt. In this regard, since the obtained numerical values reflect the degree of influence or the degree of the relative importance of the existing factors both within a SWOT group and among SWOT groups, they can be used to formulate or choose a development strategy, plans, or other needs.

Based on the priorities of the SWOT factors, there are two ways to formulate strategies, specifically, to create new strategies by using information resulting from the comparison and to compare several strategies with respect to SWOT factors to obtain the preference for each strategic option[14]. Strategy formulation is not addressed in this study. In this regard, any strategies to be adopted should aim first at omitting the existing threats and weaknesses as they were given more importance than the opportunities and strengths. Strategies to be adopted could cover integrated efforts to address several factors. For example, the government could continuously encourage farmers to carry out rehabilitation of aged plants with side-grafting techniques using superior cocoa planting materials, followed by provision of extension activities to help farmers adopt improved farming practices and ensure that they receive updated information regarding technology and best practices.

The SWOT-AHP method used in this study is a powerful multicriteria analysis tool with the capability to make qualitative and quantitative decision attributes commensurable and it provides flexibility with a smaller number of samples. The use of pairwise comparison enables the prioritization of SWOT factors to acquire their ranking according to their importance. The SWOT-AHP method incorporates objective information from respondents in the field and subjective preference and expert knowledge in the same decision analysis, resulting in more rational decisions. However, the study has some limitations. First, SWOT factors might not be independent of each other, as experts had to also consider those factors proposed by respondents during SWOT analysis. Second, SWOT-AHP relies heavily on qualitative judgments of SWOT factors by experts. Some explanations of SWOT factors used past references that might need to be reinvestigated to ascertain their relevance to the present conditions. Third, the sample smallholder farmers and areas were selected purposively so they did not sufficiently cover the full variability of cocoa farming, in terms of farmers' involvement in the National Program for the Improvement of Cocoa Production and Quality. As such, the study lacks an analysis of the three important components of the program, namely, replanting, rehabilitation and intensification. The next studies should comprehensively assess the influence of each component of the program on cocoa productivity, quality and consistency.

CONCLUSION

The study results showed that "suitable agro-climate" was the most important factor in the strengths category. In the weaknesses category, the most important factor was "aged trees." The most rated factor in the threat group was "pest and disease attack." "High market demand" acquired the highest rating in the opportunities group. Based on the group priority value, the weaknesses group obtained the highest rating, followed by threats, opportunities and strengths. Furthermore, the global priority value showed that the highest priority was "pest and disease attack," whereas the lowest priority was "available production inputs." Negative factors predominated in the cocoa subsector, as eight of 12 of the highest global priorities represented threats and weaknesses. The use of the SWOT-AHP method enabled the prioritization of SWOT factors and groups to identify which factors should be given more attention. Numerical results from the priorities of SWOT factors can be used to formulate strategies for cocoa development. On the basis of the results of the study, strategies formulated need to emphasize first the elimination of threats and weaknesses as they were assigned higher weighting than strengths and opportunities. The dominance of negative

factors reflects the seriousness of the challenges facing the cocoa subsector. Local governments and all concerned stakeholders should work together to address threats and weaknesses while maximizing opportunities and strengths to ensure the sustainability of the cocoa subsector in the province.

SIGNIFICANCE STATEMENT

Cocoa production in Southeast Sulawesi has experienced decreasing yield and quality in recent years. The province is a major cocoa-producing area in Indonesia, so a crisis in cocoa production would threaten the domestic supply of cocoa beans and hence the cocoa industry. The study identified internal and external factors that influence cocoa development and quantified their importance and priorities. The study provides information that enables local governments and all relevant stakeholders to formulate the best strategies to avoid the steady decline of the cocoa subsector in the province.

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REFERENCES

1. Ditjen Perkebunan, 2017. Statistik Perkebunan Indonesia: Kakao 2015-2017. Ditjen Perkebunan Kementerian Pertanian, Jakarta. http://ditjenbun.pertanian.go.id.
2. Rosmawaty, L.R. Baka, Bahari, S.A.A. Taridala and H. Saediman, 2015. Development potential of cocoa agroindustry in Southeast Sulawesi, Indonesia. IOSR J. Agric. Vet. Sci., 8: 39-44.
3. Kementerian Pertanian, 2017. Statistik Pertanian 2017. Kementerian Pertanian, Jakarta.
4. Beg, M.S., S. Ahmad, K. Jan and K. Bashir, 2017. Status, supply chain and processing of cocoa-A review. Trends Food Sci. Technol., 66: 108-116.
5. AIP-PRISMA., 2015. Cocoa sub-sector growth strategy document in Papua. https://aip-rural.or.id/data/uploaded_file/2018-03-10_07-14-52am_9._GSD_4CO-COCOA-PA_v1_20160120.pdf
6. Ruf, F., 1993. Indonesia's position among cocoa producing countries. Indonesia Circ. Sch. Oriental Afr. Stud. Newslett., 21: 21-37.
7. Akiyama, T. and A. Nishio, 1997. Sulawesi's Cocoa boom: Lessons of smallholder dynamism and a hands-off policy. Bull. Indones. Econ. Stud., 33: 97-121.
8. Saediman, H., 2015. Prioritizing commodities in Southeast Sulawesi province of Indonesia using AHP based borda count method. Asian Soc. Sci., 11: 171-179.
9. Saxbol, A.P., 2014. Barriers to upgrading of cocoa production at the farm level in Southeast Sulawesi. Master's Thesis, Department of Food and Resource Economics, Faculty of Science, University of Copenhagen.
10. Neilson, J., 2007. Global markets, farmers and the state: Sustaining profits in the Indonesian cocoa sector. Bull. Indones. Econ. Stud., 43: 227-250.
11. Mithöfer, D., J.M. Roshetko, J.A. Donovan, E. Nathalie and V. Robiglio *et al*., 2017. Unpacking 'sustainable'cocoa: Do sustainability standards, development projects and policies address producer concerns in Indonesia, Cameroon and Peru? Int. J. Biodivers. Sci. Ecosyst. Serv. Manage., 13: 444-469.
12. Saediman, H., M.A. Limi and Y. Indarsyih, 2015. Aplikasi SWOT-AHP untuk menganalisis faktor-faktor yang mempengaruhi pengembangan komoditas padi sawah Di Provinsi Sulawesi Tenggara. Prosiding Seminar Swasembada Pangan, Kendari, Maret 9, 2015, Kendari, pp: 416-426.
13. Kajanus, M., J. Kangas and M. Kurttila, 2004. The use of value focused thinking and the A'WOT hybrid Method in tourism management. Tourism Manage., 25: 499-506.
14. Kurttila, M., M. Pesonen, J. Kangas and M. Kajanus, 2000. Utilizing the Analytic Hierarchy Process (AHP) in SWOT analysis: A hybrid method and its application to a forest-certification case. Forest Policy Econ., 1: 41-52.
15. Kahraman, C., N.C. Demirel and T. Demirel, 2007. Prioritization of E-government strategies using a SWOT-AHP analysis: The case of Turkey. Eur. J. Inform. Syst., 16: 284-298.
16. Eslamipoor, R. and A. Sepehriar, 2014. Firm relocation as a potential solution for environment improvement using a SWOT-AHP hybrid method. Process Saf. Environ. Protect., 92: 269-276.
17. Polat, Z.A., M. Alkan and H.G. Sürmeneli, 2017. Determining strategies for the cadastre 2034 vision using an AHP-based SWOT analysis: A case study for the Turkish cadastral and land administration system. Land Use Policy, 67: 151-166.
18. Seker, S. and M. Ozgurler, 2012. Analysis of the Turkish consumer electronics firm using SWOT-AHP method. Procedia-Social Behav. Sci., 58: 1544-1554.
19. Shrestha, R.K., J.R.R. Alavalapati and S.R. Kalmabacher, 2004. Exploring the potential for silvopasture adoption in South-Central Florida: An application of SWOT-AHP method. Agric. Syst., 81: 185-199.

20. Etongo, D., M. Kanninen, T.E. Epule and K. Fobissie, 2018. Assessing the effectiveness of joint forest management in Southern Burkina Faso: A SWOT-AHP analysis. For. Policy Econ., 90: 31-38.
21. Szulecka, J. and E.M. Zalazar, 2017. Forest plantations in Paraguay: Historical developments and a critical diagnosis in a SWOT-AHP framework. Land Use Policy, 60: 384-394.
22. Wasike, C.B., T.M. Magothe, A.K. Kahi and K.J. Peters, 2011. Factors that influence the efficiency of beef and dairy cattle recording system in Kenya: A SWOT-AHP analysis. Trop. Anim. Health Prod., 43: 141-152.
23. Taleai, M., A. Mansourian and A. Sharifi, 2009. Surveying general prospects and challenges of GIS implementation in developing countries: A SWOT-AHP approach. J. Geogr. Syst., 11: 291-310.
24. Hosseini, S.A., F. Heidary, A. Hayati and R. Heidary, 2013. The analysis of spatial distribution in chain stores of rasht using mixed AHP and SWOT models. Int. J. Acad. Res. Bus. Social Sci., 3: 177-186.
25. Rutsaert, P., Z. Pieniak, A. Regan, A. McConnon and M. Kuttschreuter *et al*., 2014. Social media as a useful tool in food risk and benefit communication? A strategic orientation approach. Food Policy, 46: 84-93.
26. Shinno, H., H. Yoshioka, S. Marpaung and S. Hachiga, 2006. Quantitative SWOT analysis on Global competitiveness of machine tool industry. J. Eng. Design, 17: 251-258.
27. Olum, S., G. Xavier, O. Collins, D. Webale, W. Odongo, D. Ongeng and H.D. Steur, 2018. Stakeholders' perceptions of agronomic iodine bioforti cation: A SWOT-AHP analysis in Northern Uganda. Nutrients, Vol. 10, No. 4. 10.3390/nu10040407
28. Abdel-Basset, M., M. Mai and F. Smarandache, 2018. An extension of neutrosophic AHP-SWOT analysis for strategic planning and decision-making. Symmetry, Vol. 10, No. 4. 10.3390/sym10040116
29. Noori, S., H. Zafar and T. Mahboob, 2009. Biochemical effectiveness of cocoa powder on electrolytes homeostasis, liver and cardiac specific enzymes and renal function. Pak. J. Nutr., 8: 882-886.
30. Sefriadi, H., R. Villano, E. Fleming and I. Patrick, 2013. Production constraints and their causes in the cacao industry in West Sumatra: From the farmers' perspective. Int. J. Agric. Manage., 3: 30-42.
31. Hariyati, Y., 2013. Pendapatan dan faktor yang mempengaruhi petani melakukan fermentasi kakao di kabupaten jembrana. DwijenAgro, Vol. 3, No. 2.
32. Schaad, N. and I. Fromm, 2017. Analysis of cocoa beans processing and quality in post-harvest in Southeast Sulawesi in Indonesia. Proceedings of the 2017 International Symposium on Cocoa Research (ISCR), November 13-17, 2017, Lima, Peru.
33. Saediman, H., 2003. Monitoring survey report of integrated agricultural and rural development project in Southeast Sulawesi, Indonesia. Department of Agribusiness, Postgraduate Program, Halu Oleo University, Kendari.
34. Listyati, D., A. Wahyudi and A.M. Hasibuan, 2014. Strengthening institutional to improve bargaining position of farmers in cocoa marketing system. J. Tanaman Industri Penyegar, 1: 15-28.
35. Saediman, H., 2015. Improving agricultural research coordination at subnational level in Indonesia: An assessment of opportunities for strengthening provincial technology commission. Int. J. Agric. Extens., 3: 123-136.
36. ACDI/VOCA., 2005. Final report: Sustainable cocoa enterprise solutions for smallholders (SUCCESS) alliance-Indonesia. ACDI/VOCA., Washington DC.
37. Saediman, H., S.A.A. Taridala and M. Ono, 2006. Sago marketing practises and problems: A survey of two Sago growing villages in Southeast Sulawesi. Agriplus, 16: 1-7.
38. Utomo, B., A.A. Prawoto, S. Bonnet, A. Bangviwat and S.H. Gheewala, 2016. Environmental performance of cocoa production from monoculture and agroforestry systems in Indonesia. J. Cleaner Prod., 134: 583-591.
39. Rubiyo and Siswanto, 2012. Peningkatan produksi dan pengembangan kakao (*Theobroma cacao* L.) di Indonesia. Buletin RISTRI., 3: 33-48.
40. Yudyanto, H. and F.F. Hastiadi, 2017. Analysis of the imposition of export tax on Indonesian cocoa beans: Impact on the processed cocoa export Indonesia and Malaysia. Int. J. Econ. Fin. Issues, 7: 552-560.
41. CBI., 2015. CBI competition: Cacao. CBI Market Intelligence, The Hague, The Netherlands. https://www.cbi.eu/market-information.
42. Pazla, R., M. Zain, H.I. Ryanto and A. Dona, 2018. Supplementation of minerals (Phosphorus and Sulfur) and *Saccharomyces cerevisiae* in a sheep diet based on a cocoa by-product. Pak. J. Nutr., 17: 329-335.
43. Hafid, H., J. Neilson, T. Mount and F. Mckenzie, 2013. Sustainability impact assessment of a certification scheme in the Indonesian cocoa industry: 2012 pilot survey results. http://www.geosci.usyd.edu.au/documents/cocoa2.pdf.
44. Baharudin, 2005. Pengendalian hama penggerek buah kakao (Conopomorpha cramerella). Buletin Teknologi Dan Informasi Pertanian, pp: 8-14.
45. Sudjud, S., I.R. Sastrahidayat, G. Mudjiono and A. Muhibuddin, 2013. The intensity distribution of cacao pod rot disease (*Phytophthora palmivora* Butl.) in Smallholder Plantation in North Maluku Indonesia. J. Biol. Agric. Healthcare, 3: 131-139.

46. Purwantara, A., P. McMahon, A.W. Susilo, S. Sukamto and S. Mulia *et al*., 2015. Testing local cocoa selections in Sulawesi:(ii) resistance to stem canker and pod rot (black pod) caused by *Phytophthora palmivora*. Crop Protect., 77: 18-26.
47. McMahon, P.J., A.W. Susilo, A.K. Parawansa, S.R. Bryceson and Nurlaila *et al*., 2018. Testing local cacao selections in sulawesi for resistance to vascular streak dieback. Crop Protect., 109: 24-32.
48. Nazaruddin, R., S.N.I. Zakiyan and S. Mamot, 2011. The effect of enzymatic alcoholysis on the physicochemical properties of commercial cocoa butter substitutes. Pak. J. Nutr., 10: 718-723.
49. Anim-Kwapong, G.J. and E.B. Frimpong, 2004. Vulnerability and adaptation assessment under the Netherlands climate change studies assistance programme phase 2 (NCCSAP2) vulnerability of agriculture to climate change-impact of climate change on cocoa production. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.494.4508&rep=rep1&type=pdf
50. Asante, W.A., E. Acheampong, E. Kyereh and B. Kyereh, 2017. Farmers' perspectives on climate change manifestations in smallholder cocoa farms and shifts in cropping systems in the forest-savannah transitional zone of Ghana. Land Use Policy, 66: 374-381.