

Strategy for Developing Pineapple Farming in South Konawe District of Southeast Sulawesi

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Abstract: This study aims to (1) identify the internal and external factors in the development of pineapple (*Ananas comosus*) farming, and (2) determine the strategies for pineapple development. The research was conducted in Kondoano Village, Mowila Subdistrict, South Konawe District, from May to December 2022. The analytical tool used was the SWOT analysis (Strengths, Weaknesses, Opportunities, Threats). Based on research findings, the coordinate for internal factors was 0.81, while the coordinate for external factors was 1.57. It is evident that pineapple farming is positioned in Quadrant I, indicating a highly favorable situation. Pineapple farming possesses both opportunities and strengths, enabling the utilization of existing strengths and the exploitation of available opportunities. The recommended strategy under these conditions is to support an aggressive growth policy. The appropriate strategy to be implemented is the Strength-Opportunities (SO) strategy, which entails (i) utilizing transportation and communication and information infrastructure and tools to expand the market area, (ii) optimizing land resources to enhance production, and (iii) improving the quality of human resources and adding value to the pineapple.

Keywords: Development, farming, pineapple, strategy, SWOT.

1. Introduction

Pineapple (*Ananas comosus*) is a tropical fruit that has gained global popularity as both a delectable fruit and a versatile ingredient in culinary delights. Its vibrant taste and rich nutritional content make it a sought-after delight among consumers worldwide. Additionally, pineapple is widely consumed for its numerous health benefits [1], making it a popular choice among individuals seeking to enhance their well-being. Therefore, pineapple is one of the fruits with a promising prospect for development.

Indonesia ranks as the third-largest pineapple producer in Southeast Asia, following the Philippines and Thailand. Indonesia contributes approximately 23% to the pineapple production within the region [2]. The country's extensive pineapple production is supported by its climate, which is conducive to pineapple cultivation. With the optimal utilization of this potential, pineapple could become a significant fruit for both domestic consumption and export. According to Badan Pusat Statistik [3] pineapple production in 2022 reached 3.2 million tons, indicating a growth of 10.99% (317.36 thousand tons) compared to 2021. Additionally, the number of pineapple plants yielding in 2022 amounted to 610.05 million plants,

reflecting a rise of 2.18% (13 million plants) from 2021.

Southeast Sulawesi Province is among the regions that also produce pineapple. Despite not being a priority crop in the province [4], the recent upward trend of pineapple plants and production underscores its capacity for expansion in the future. In 2020, the number of pineapple plants reached 1.1 million, marking a sharp increase of 386% from the 2019 count of 229,140 plants. Similarly, pineapple production in 2020 reached 9,754 tons, reflecting a 280% surge from the 2019 figure of 2,566 tons [5]. The three main districts contributing to pineapple production are Muna, West Muna, and South Konawe Districts. According to the data from the Bureau of Statistics [5], these districts respectively contributed to the province's pineapple production in 2022 with figures of 7,610 tons, 671 tons, and 898 tons.

The sharp increase in both the number of plants and the amount of production might be attributed to the perceived benefits and advantages of pineapple farming experienced by farmers. Pineapple cultivation enhances household income, contributes to rural economies, strengthen food security, and mitigates poverty [6]. The notable expansion in planting areas and production is also linked to other factors such as favorable agro-climatic conditions and high market demand. Nevertheless, compared to the available land potential, the extent of the number of plants and pineapple production in Southeast Sulawesi Province remains considerably lower than in other provinces across Indonesia.

Pineapple plants, with their robust growth and adaptability, have the capacity to thrive in the unique agro-climatic conditions of South Konawe District. However, despite the potential and perceived benefits, the cultivation of this fruit in the district has not attained its full potential. The size of land dedicated to pineapple cultivation remains limited, and many farmers are still reluctant to fully embrace this venture. This fact invites a closer examination of the weaknesses and threats that have hindered the expansion of pineapple farming, despite its undeniable potential.

In view of this untapped potential, there is a strong need to devise appropriate strategies for the development of pineapple farming in the South Konawe District. Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis is a useful tool for examining internal and external environments in order to develop systematic ways and supports for successful industry

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strategy formulation [7]. SWOT analysis identifies strengths, weaknesses, opportunities and threats that are faced by an organization. Strengths and weaknesses are identified through an assessment of the internal environment, whereas opportunities and threats are identified through an evaluation of the external environment. When effectively applied, SWOT analysis can offer a solid framework for the formation of plans and policies [8].

This paper aimed to determine strategies to develop pineapple farming in South Konawe District based on a study in a pineapple producing village. A SWOT analysis is used to identify internal and external factors which will form the basis for the formulation of strategies for pineapple development in the area.

2. Materials and Methods

This research was conducted in Kondoano Village, Mowila Subdistrict, South Konawe District. The village is a well-known pineapple producing village in the district, so it was intentionally selected (purposive sampling) as study location. The population in this study consisted of all pineapple farmers in Kondoano Village, totaling 20 individuals. All of these farmers were taken as respondents. Both primary and secondary data were utilized as types and sources of data. Data collection was performed through observation, interviews, and documentation. The research variables encompassed internal factors, including strengths and weaknesses, as well as external factors, encompassing opportunities and threats, and strategies for pineapple development. The data analysis method employed to address the research objectives was the SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) as has been used in previous studies [2], [9].

The SWOT analysis is a systematic approach to identifying various factors in order to formulate organizational strategies by considering both internal and external environmental factors. This analysis is based on a logical framework that seeks to maximize Strengths and Opportunities while simultaneously minimizing Weaknesses and Threats. The SWOT analysis is influenced by the strategic environmental context, encompassing regional conditions, situations, circumstances, and influences that surround and impact the development over time. In terms of its structural framework, the strategic internal environment comprises Strengths and Weaknesses, while the external environment consists of two strategic factors, Opportunities and Threats [10]. According to Hubes and Najib (2008), decision-making for strategy formulation through SWOT analysis involves aligning the most influential key factors, both internal and external, using the IFAS (Internal Factors Analysis Summary) and EFAS (External Factors Analysis Summary) matrices. These matrices generate four potential strategy sets, namely S-O (Strengths-Opportunities), S-T (Strengths-Threats), W-O (Weaknesses-Opportunities), and W-T (Weaknesses-Threats) strategies [2], [11].

3. Results and Discussion

A. Identification of Internal Factors

The internal factors consist of strengths and weaknesses. The factors that contribute to the strengths of the pineapple farming enterprise include the extensive experience in farming that has been accumulated over a considerable period, the availability of land, a ready workforce, productive labor force age, and the presence of communication and information facilities. On average, pineapple farmers have been engaged in cultivation for over five years, which is deemed sufficient. The land holdings of pineapple farmers vary from 0.5 to 3.0 hectares, a range considered adequate for pineapple cultivation. The labor force for farming activities is drawn from both the family and non-family members, providing ample support for farm management. In terms of age, approximately 95% of farmers fall within the productive age range. Another strength lies in the accessibility of communication and information facilities.

The pineapple farmers in Kondoano Village possess a sufficient length of experience, having dedicated themselves to pineapple cultivation for an average duration exceeding five years. This length of experience signifies a deep understanding of the intricacies involved in pineapple farming, ranging from soil preparation to pest management. This experience equips the farmers with practical insights that can be utilized to optimize yields, minimize risks, and enhance overall farm efficiency.

One of the key strengths lies in the availability of cultivable land plots in the village. Ranging from 0.5 to 3.0 hectares per farmer, these land holdings provide ample space for cultivating pineapple plants. This abundance of land not only facilitates the expansion of pineapple cultivation, but also allows for rotational planting and diversification, both of which contribute to sustainable farming practices and the prevention of soil degradation.

The strength of a readily available and diverse labor force is a crucial asset for pineapple farming. Labor resources are drawn both from family members and non-family sources, ensuring that the demands of farm activities are met throughout the cultivation cycle. The diversified labor pool enables efficient management of tasks such as planting, weeding, and harvesting.

An important advantage is the demographic distribution of the workforce, with approximately 95% of farmers falling within the productive age range. This youthful and capable workforce translates to an increased ability to undertake physically demanding tasks and adapt to evolving agricultural practices. The combination of experience and productive age positions the farmers favorably to embrace modern agricultural techniques and innovative approaches to enhance pineapple cultivation.

Pineapple farming benefits from the presence of strong communication and information infrastructure in the village. This strength allows farmers to access up-to-date information on market trends and best agricultural practices. Modern communication tools enable farmers to stay connected with fellow farmers, potential buyers, and social media, fostering a supportive network that aids in decision-making and knowledge sharing.

Pineapple cultivation, like any agricultural endeavor, is not immune to challenges. A critical evaluation of the weaknesses affecting pineapple farming in the context of this study reveals a complex interplay of factors that hinder optimal productivity and economic viability. These weaknesses encompass a range of issues, including limited capital availability, suboptimal cultivation techniques, compromised pineapple quality, deficient post-harvest management, and a lack of technological innovation.

The constraint of limited capital resources presents a significant issue for farmers, hampering their ability to invest in modern equipment, quality inputs, and infrastructure development. This financial dearth often results from the prevailing low economic status of the farmers, exacerbated by the burden of familial responsibilities.

Cultivation techniques are crucial in determining crop yield and quality. However, our investigation revealed instances of suboptimal practices [12], such as the use of uncertified planting materials and improper timing and dosage of fertilizer application. These missteps can impede growth and limit yield potential, contributing to an overall decrease in productivity.

Another dimension of weakness is found in the form of compromised pineapple quality. Pest and disease infestations, coupled with inadequate care and the limited adoption of superior planting materials, contribute to a decrease in the overall quality of the harvested fruit. This phenomenon threatens not only the farmers' marketability but also the region's reputation for producing high-quality pineapples. Pineapple quality is crucial when the products are to be shipped into the global market [13].

Post-harvest handling is crucial in preserving the freshness, nutritional content, and market value of pineapples. Regrettably, inadequate post-harvest practices persist within the sector [12], which can lead to premature spoilage, loss of product appeal, and reduced economic returns.

Furthermore, the absence of technological innovation hampers the progress of pineapple development. Insufficient integration of modern agricultural technologies and practices [12] restricts the potential for enhanced productivity and the development of value-added pineapple products. The lack of innovation also limits the sector's ability to adapt to evolving market demands and environmental challenges.

B. Identification of External Factors

External factors influencing the development of pineapple farming encompass a spectrum of opportunities and threats. Opportunities arise from favorable external conditions that can drive the growth of the industry, while threats stem from potential obstacles that may hinder its progress. Opportunities include market availability, adequate transportation infrastructure, supportive agro-climatic conditions, growing population dynamics, and accessible credit facilities. Threats include fluctuating prices, pest and disease outbreaks, presence of substitute products, rising input costs, and climate change impacts.

An inherent advantage lies in the presence of a market, driven by intermediaries and local markets situated in the vicinity of

the research area. This offers a strategic venue for farmers to effectively distribute and sell their pineapple produce. The accessibility of these markets aids in reducing transportation costs, increasing profitability, and facilitating a direct connection between producers and consumers.

The availability of a well-developed transportation network offers economic benefits that support the pineapple farming sector. This infrastructure enlarges market reach by enabling the swift movement of produce from farms to various markets. The result is the reduced transit time and the capacity to tap into broader consumer bases, thereby improving overall market potential.

The alignment of agro-climatic conditions in the survey village, including climate and suitable temperature ranges, provides a favorable environment for pineapple cultivation. This synergy of climate and temperature lends itself to healthier plant growth and more robust fruit yields, contributing to the overall viability of pineapple farming in the region.

The gradual increase in the local population presents an opportunity that is consistent with the principles of supply and demand. As the number of population increases, so does the consumer base for agricultural produce, including pineapples. This demographic shift naturally stimulates demand, fostering a dynamic market that can be tapped into for sustained economic growth.

Another opportunity is the availability of credit from local banks as a potential source of capital. Access to credit can empower farmers to invest in improved cultivation techniques, technology, and infrastructure. Such financial support can facilitate the expansion of pineapple farming operations and the adoption of modern practices, ultimately enhancing productivity and economic returns.

The threats that warrant careful consideration in the pineapple farming context are fluctuating prices, pest and disease outbreaks, the presence of substitute products, increase costs of inputs, and climate change impact. These threats carry the potential to restrict the progress of the industry and necessitate strategic planning for mitigation.

The inherent vulnerability of agricultural markets can lead to price fluctuations, which often correlate with shifts in production volume. As production levels rise and fall, market prices may experience corresponding fluctuations. Such variations can affect the economic viability of pineapple farming, affecting revenue generation and profit margins. Farmers need to remain vigilant and adaptable to these market dynamics to mitigate potential financial losses.

Pest and disease outbreaks stand as adversaries to pineapple farming endeavors. These attacks can bring about negative consequences, ranging from failed harvests to reduced yields and compromised produce quality. Controlling and managing such incidents require diligent pest and disease management practices, including prevention measures, early detection, and effective treatment strategies.

The presence of substitute products such as fruit, culinary, beverage, and canned substitutes, poses a challenge, as consumers are presented with alternative options that offer similar functionalities. This factor can lead to a decrease in

demand for pineapples, particularly if these substitute products gain popularity due to factors such as convenience, price, or perceived health benefits. Developing strategies to highlight the unique attributes of pineapples and their distinct advantages is crucial to maintain and expand market share.

Increased production input costs, including the increased prices of fertilizers and pesticides, can significantly affect the profitability of pineapple farming. Scarcity and market forces can contribute to these cost hikes. Careful cost management, exploring cost-effective alternatives, and forging strategic partnerships can help offset the impact of rising input costs.

The growing concern of climate change looms over agricultural activities, including pineapple farming. Changing weather patterns, shifting rainfall, and temperature variations can disrupt planting schedules, influence cultivation methods, affect overall production, and even affect the quality of yields [14]. Adapting to these changing climate dynamics necessitates innovative farming practices, tailored crop management strategies, and a resilient approach to meet the evolving challenges [15].

C. Internal and External Factor Analysis Summary

After the internal and external factors have been identified, the next step involves the formulation of the IFAS and EFAS matrices. These matrices are subsequently assigned weights and ratings to generate weighted scores. Tables 1 and 2 present the IFAS and EFAS matrices, respectively.

As presented in Table 1, the primary strengths lie in farming experience with a score of 0.44 and land availability with a score of 0.44. The total score for strength factors is 1.75. The weaknesses encompass limited capital, inadequate cultivation techniques, low pineapple quality, the absence of post-harvest handling, and low technological innovation. The primary weakness factors comprise limited capital with a score of 0.11 and insufficient cultivation techniques with a score of 0.11. The cumulative score for weakness factors amounts to 0.85. The overall weighted score for internal factors (strengths and weaknesses) totals 2.60.

As shown in Table 2, the primary opportunities encompass the availability of credit facilities as a capital source with a score of 0.40 and the presence of a market with a score of 0.36. The total score for opportunity factors is 1.69. The main threats consist of price fluctuations with a score of 0.27 and the existence of substitute products, along with pest and disease attacks, both with a score of 0.20. The cumulative score for threat factors is 0.88. The overall weighted score for external factors is 2.57.

After analyzing the internal and external factors using the IFAS and EFAS matrices, the next step is to place them within the SWOT quadrant to ascertain the positioning of pineapple farming development. The SWOT diagram can be derived from the results of internal factor scores (strengths and weaknesses) and external factor scores (opportunities and threats). By

Table 1
Internal factor analysis summary matrix

Internal Factor	Weight	Rating	Score
Strengths			
Farming experience	0.11	4	0.44
Availability of land	0.11	4	0.44
Availability of labor	0.09	3	0.27
Productive age	0.10	3	0.30
Adequacy of ICT infrastructure	0.10	3	0.30
Total	0.51		1.75
Weaknesses			
Lack of capital	0.11	1	0.11
Farming practices	0.11	1	0.11
Low quality of yields	0.09	3	0.27
Post-harvest handling	0.09	2	0.18
Lack of technological innovation	0.09	2	0.18
Total	0.49		0.85
Total of internal factors	1.00		2.60

Table 2
External factor analysis summary matrix

External Factor	Weight	Rating	Score
Opportunities			
Market availability	0.09	4	0.36
Transportation means and infrastructure	0.09	3	0.27
Agro-climate condition	0.11	3	0.33
Growing population	0.11	3	0.33
Credit availability	0.10	4	0.40
Total	0.50		1.69
Threats			
Fluctuating price	0.11	1	0.11
Pest and disease	0.10	2	0.20
Substitute products	0.10	2	0.20
Increased input costs	0.10	1	0.10
Climate change impact	0.09	3	0.27
Total	0.50		0.88
Total of external factors	1.00		2.57

Table 3
Strategies for pineapple development based on SWOT matrix

Strategy	Details of Strategy
S-O Strategy	<ol style="list-style-type: none"> Utilizing transportation and ICT means and infrastructure to expand marketing areas. Use land resources to increase production Improve quality of human resources and increase value added from pineapple.
S-T Strategy	<ol style="list-style-type: none"> Use farming experience to address pest and disease. Use ICT to know information on market price and weather prediction.
W-O Strategy	<ol style="list-style-type: none"> Use credit to enhance pineapple farming. Improve awareness and knowledge of agricultural technology.
W-T Strategy	<ol style="list-style-type: none"> Improve pineapple quality by using superior variety and apply postharvest handling to increase competitiveness. Develop partnership with input supplier to attain higher production efficiency.

subtracting the total strengths from the total weaknesses, the result becomes the coordinate point for the X-axis. Similarly, subtracting the total opportunities from the total threats yields the coordinate point for the Y-axis. Consequently, the coordinate for the internal factor or the X-axis is calculated as $(1.75 - 0.85) = 0.81$, and the coordinate for the external factor or the Y-axis is calculated as $(1.69 - 0.88) = 1.57$, thereby establishing the coordinate point at $(0.81:1.57)$. This information is presented in the SWOT diagram to determine the positioning of pineapple farming (Fig. 1).

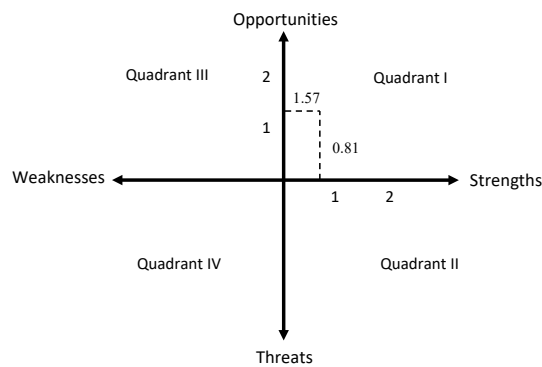


Fig. 1. SWOT diagram of strategy for pineapple development

It is observed from the Fig. 1 that the pineapple farming in the survey village resides within Quadrant I, indicating a favorable situation. Pineapple farming enjoys both opportunities and strengths, thereby enabling the exploitation of available prospects. The strategy to be implemented under such circumstances is to support an aggressive growth policy. Within Quadrant I (SO Strategy), a general approach involves harnessing all internal strengths to maximize the utilization of external opportunities.

D. Strategy for Developing Pineapple Farming

The tool employed for formulating the strategic factors of pineapple farming in the survey village is the SWOT matrix. This matrix can yield four sets of potential strategic alternatives, namely the S-O (Strengths-Opportunities) strategy, the S-T (Strengths-Threats) strategy, the W-O (Weaknesses-Opportunities) strategy, and the W-T (Weaknesses-Threats) strategy.

As shown in Table 3, there are several strategies that can be employed for pineapple development. However, the key strategies most suitable for pineapple development encompass

S-O strategies. These strategies encompass: (i) leveraging transportation and information and communication technology (ICT) infrastructure to expand marketing areas, (ii) harnessing land resources to increase production, and (iii) enhancing the quality of human resources and augmenting value-added measures within the pineapple sector. Adequacy of transportation means and infrastructure reduce the transport cost, leading to better access to inputs and information [13]. The availability of information and communication technology facilities enables the use of social media that could be the main source of information on agricultural practices [16]. Optimal land utilization through appropriate extensification, intensification, and cropping pattern could affect production [6], [12], [17]. Enhancing the capabilities of farmers through agricultural extension services has the potential to enhance the adoption of advanced farming technologies and practices, which, in turn, could result in increased yields in terms of both quantity and quality [6], [16], [18]. Value addition of pineapple through processing activities can reduce perishability, enhance the storage life of the product, and increase its value [19].

4. Conclusion

The factors that contribute to the strengths of the pineapple farming are the extensive experience in farming that has been accumulated over a considerable period, the availability of land, a ready workforce, productive labor force age, and the presence of communication and information facilities. Weaknesses include lack of capital, less application of farming practices, low quality of yields, lack of post-harvest handling, and low technological innovation. Opportunities consist of market availability, transportation means and infrastructure, agro-climate conditions, growing population, and credit availability. Threats include price fluctuations, pest and disease outbreak, substitute products, increased costs of inputs, and climate change impact. The key strategies most suitable for pineapple development encompass S-O strategies, namely, (i) leveraging transportation and information and communication technology (ICT) infrastructure to expand marketing areas, (ii) harnessing land resources to increase production, and (iii) enhancing the quality of human resources and augmenting value-added measures within the pineapple sector.

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References

- [1] P. P. Joy, "Benefits and Uses of Pineapple," *Kerala Agricultural University*, 2010. <https://kau.in/document/benefits-and-uses-pineapple> (accessed Aug. 15, 2023).
- [2] W. Hatmi, "Strategi Pengembangan Usahatani Nenas Di Desa Doda Kecamatan Kinovaro Kabupaten Sigi," *AgriHumanis J. Agric. Hum. Resour. Dev. Stud.*, vol. 3, no. 1, pp. 39–46, 2022.
- [3] Direktorat Statistik Tanaman Pangan Hortikultura dan Perkebunan, *Statistik Hortikultura 2022*. Jakarta: Badan Pusat Statistik, 2023.
- [4] H. Saediman, "Prioritizing Commodities in Southeast Sulawesi Province of Indonesia Using AHP based Borda Count Method," *Asian Soc. Sci.*, vol. 11, no. 15, pp. 171–179, 2015.
- [5] BPS Provinsi Sulawesi Tenggara, *Statistik Produksi Tanaman Hortikultura di Sulawesi Tenggara 2020*. Kendari: BPS Sulawesi Tenggara, 2021.
- [6] J. C. Iwuchukwu, C. E. Nwobodo, and C. E. Udoye, "Problems and Prospects of Pineapple Production in Enugu State, Nigeria," *J. Agric. Ext.*, vol. 21, no. 1, pp. 167–180, 2017.
- [7] H. Shinno, H. Yoshioka, S. Marpaung, and S. Hachiga, "Quantitative SWOT Analysis on Global Competitiveness of Machine Tool Industry," *J. Eng. Des.*, vol. 17, no. 3, pp. 251–258, 2006.
- [8] L. Geo and H. Saediman, "Analysis of Factors Affecting Cocoa Development in Southeast Sulawesi," *Pakistan J. Nutr.*, vol. 18, no. 5, pp. 479–490, 2019.
- [9] I. S. Dewi, Darus, and B. Prasetyo, "Strategi Pengembangan Usahatani Nenas di Kecamatan Tambang Kabupaten Kampar," *J. Agribisnis*, vol. 4, no. 1, pp. 90–102, 2022.
- [10] F. Rangkuti, *Analisis SWOT: Teknik Membedah Kasus Bisnis*. Jakarta: Gramedia Pustaka Utama, 2014.
- [11] M. Hubies and M. Najib, *Manajemen Strategik Dalam Pengembangan Daya Saing Organisasi*. Jakarta: Efek Media Komputindo, 2008.
- [12] M. S. Yusi, "The Analysis of Production Function and Farm Marketing Efficiency of Pineapple (Ananas comosus L Merr) in South Sumatera Province, Indonesia," *African J. Agric. Res.*, vol. 11, no. 23, pp. 1990–1998, 2016.
- [13] L. Kleemann, A. Abdulai, and M. Buss, "Is Organic Farming Worth Its Investment? The Adoption and Impact of Certified Pineapple Farming in Ghana," Kiel, Kiel Working Paper No. 1856, 2013.
- [14] H. Saediman, L. O. Lasmin, M. A. Limi, U. Rianse, and L. Geo, "Rice Farmers' Perception of Climate Variability in South Konawe District of Southeast Sulawesi," *Int. J. Sci. Technol. Res.*, vol. 9, no. 2, pp. 3128–3132, 2020.
- [15] H. Saediman, M. A. Limi, Y. Indarsyih, S. Abdullah, and W. O. Yusria, "Rice farmers' adaptation practices to climate change: a case of Konda subdistrict in Southeast Sulawesi," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 724, p. 012102, 2021.
- [16] H. Saediman, I. S. Mboe, B. Budiyanto, S. Sarinah, and H. Hidrawati, "Smallholder adoption of horticultural crops : the case of dragon fruit in Southeast Sulawesi Smallholder adoption of horticultural crops : the case of dragon fruit in Southeast Sulawesi," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 819, p. 012043, 2021.
- [17] S. Nalubwama *et al.*, "Challenges and Prospects of Integrating Livestock into Smallholder Organic Pineapple Production in Uganda," *Livestock Research for Rural Development*, 2014. <http://www.lrrd.org/lrrd26/6/nalu26113.htm> (accessed Aug. 15, 2023).
- [18] T. Sriwichailamphan, S. Sriboonchitta, A. Wiboonpongse, and Y. Chaovanapoonphol, "Factors Affecting Good Agricultural Practice in Pineapple Farming in Thailand," *Acta Hort.*, vol. 794, pp. 325–334, 2008.
- [19] H. Saediman, A. Amini, R. Basiru, and L. O. Nafiu, "Profitability and Value Addition in Cassava Processing in Buton District of Southeast Sulawesi Province, Indonesia," *J. Sustain. Dev.*, vol. 8, no. 1, pp. 226–234, 2015.