AGRISOCIONOMICS
Jurnal Sosial Ekonomi dan Kebijakan Pertanian
ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (2): 511-526, June 2025

Banggai Yam Development Strategy Based Interpretative Structural Modelling For Food Security In Banggai Islands

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Submitted 3 December 2024; Approved 30 January 2025

ABSTRACT

Banggai Yam holds significant potential and investment opportunities that require promotion; however, it has not been optimally utilized, resulting in a limited impact on community welfare. This research aims to assess income levels and identify constraints in the development of Banggai Yam as a local food source. The research was conducted in Banggai Islands Regency using quantitative descriptive analysis and the Interpretative Structural Modelling (ISM) approach. Respondents were selected using a stratified purposive sampling technique, resulting in 76 interviews, which included 68 farmers, 2 financial institutions, 4 government representatives, and 2 academics from the region. Findings show that Banggai Yam farming generates significant financial returns, increasing farmers' income over the course of one growing season, thus categorising it as a viable farming practice in the Banggai Islands Regency. Six key strategies for developing Banggai Yam as a local food source were identified (government support, farmer training and mentoring, uncoordinated marketing, annual Banggai Yam cultivation, shifting cultivation practices, and unregulated land use). Effectively addressing these constraints and prioritising strategies will ultimately drive the goal of increasing incomes and guide the sustainable development of Banggai Yam in the Banggai Islands Regency.

Keywords: *Banggai Yam; Development strategy; Financial; ISM.*

BACKGROUND

Agricultural development is a process that reflects structural changes in society as a whole (Putsenteilo *et al.* 2020), aimed at promoting economic growth, increasing income, and eradicating poverty to achieve better material and spiritual living conditions (Atah *et al.* 2018; Wartoyo and Haida 2023). The agricultural sector serves as a crucial driver of economic growth at both local and national levels (McArthur & McCord 2017; Darwanto and Raharjo 2018; Agboola *et al.* 2022). Development efforts in this sector are predominantly focused on rural areas, where agriculture remains a primary economic activity (Hermawan 2012; Kusio & Fiore 2022). Additionally, agricultural development aims to enhance the production and quality of competitive products to seize market opportunities and improve farmer income for their welfare (de Janvry & Sadoulet 2020; Dzingirai 2021). It also seeks to improve human capital to support successful economic development through sustainable agribusiness systems and practices (Hernita *et al*. 2021; Surya *et al*. 2021).

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
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Banggai Islands Regency possesses abundant natural resources; however, these have not been utilized optimally, resulting in limited contributions to the improvement of community welfare (Sariani *et al.* 2023). Behera & France (2016) emphasize the need to promote the potential and investment opportunities in agriculture, particularly in food crops developed through integrated farming systems. This is essential for advancing Banggai Yam cultivation to meet local food demands (Katili *et al.* 2023). According to Malthusian theory, a growing population correlates with increased food needs, highlighting the importance of maintaining food reserves by utilizing local resources (Widiatmaka *et al.* 2015; Kusrini *et al*. 2017). Thus, food security encompasses not only economic development but also socio-cultural progress, emphasizing the conservation of natural resources and the environment (Johns *et al.* 2013). The food subsector is an integral part of agriculture and plays a crucial role in regional development (Nassirou Ba 2016). Additionally, the agricultural sector holds competitive advantages that can enhance the income of farmers and communities, facilitating rapid and effective regional welfare development (Dethier & Effenberger 2012; Mellor 2017). The potential of Banggai Yam in the Banggai Islands Regency suggests that its development could enhance community income and serve as a strategy to support regional economic growth.

The resource of tuber crops serves as a distinguished local food source for the community of Banggai Islands Regency, particularly exemplified by Banggai Yam, which has been cultivated by the indigenous people for generations. Sustainable maintenance and development of this commodity are essential. This requires a range of strategies that engage multiple stakeholders, particularly the government's role in coordinating with relevant parties to assist farmers with land management, facilitate product marketing, and implement modern agricultural techniques that support the growth of Banggai Yam to meet the food needs of the Banggai Islands community. The development of Banggai Yam is widespread across all districts within the regency. This commodity not only acts as an alternative food source to rice but also represents a primary staple in the traditional diet of the Banggai Islands community. Furthermore, Banggai Yam provides a promising income source with a high market value for the local population. Data from 2016 indicated that Banggai Yam production reached 4,147 tons, increasing to 5,607 tons in 2017. By 2019, production had surged to 10,850.31 tons, but in 2020, it declined to 6,940 tons, resulting in an average production of 6,649.18 tons per year. In 2021, production further dropped to 3,164.54 tons, with a harvested area of 172.13 hectares (Agriculture Office of Banggai Islands, 2022). Field observations indicate that confusion among farmers regarding the marketing of their produce, coupled with the high costs and lengthy harvest time associated with cultivating Banggai Yam, contributes to the decline in production. Additionally, farmers have not felt significant support from the government, leading to decreased interest in cultivation. To address this downward trend, the government should reform agricultural policies related to Banggai Yam to boost production levels. Key supporting initiatives should include research and development, provision of modern farming equipment, and enhancement of human resources to achieve surplus production that meets community food needs and improves welfare. Furthermore, strategies that foster mutually beneficial collaboration among farmers, government, and other stakeholders are crucial for the sustainable development of Banggai Yam in the Banggai Islands Regency. Therefore, the findings of this study can provide valuable insights for decision-makers

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aiming to improve the management of Banggai Yam. It is crucial to formulate strategic development directions for Banggai Yam to enhance community welfare in the Banggai Islands Regency.

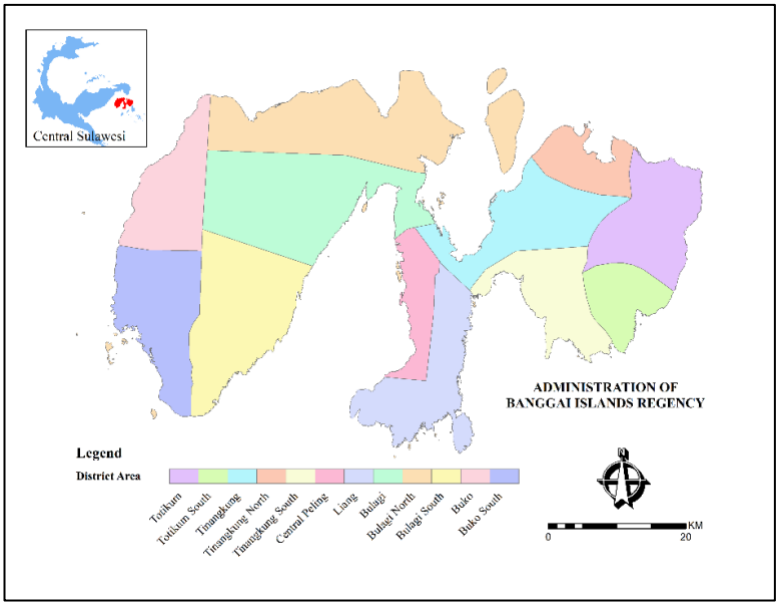
RESEARCH METHODS

Location and Time of the Study

The research was conducted in Banggai Islands Regency from July 2023 to January 2024, employing a mixed-methods approach that combines both quantitative and qualitative analyses. The quantitative analysis was utilized to assess the income and feasibility of swet farming, while the qualitative analysis aimed to identify development strategies for Banggai Yam in the region. As for the research location can be seen in Figure 1 below.

Data Collection

Respondents were selected purposively, focusing on districts that are centers for Banggai Yam production in Banggai Islands Regency. Economic conditions of the community were identified using both primary and secondary data, encompassing quantitative and qualitative aspects. Primary data were collected directly through surveys, involving interviews with respondents and experts using questionnaires. Secondary data were sourced from institutions, literature, and other relevant information related to the study. Data analysis was conducted quantitatively and qualitatively, followed by descriptive explanations. Sampling for respondents using stratified purposive sampling technique. This method was selected to ensure representation from each stratum, resulting in a sample that accurately reflects the population. Moreover, this technique minimizes sample variability, enhancing the precision of population estimates. A total of 76 respondents were interviewed, comprising 68 farmers, 2 representatives from financial institutions, 4 government officials, and 2 academics in Banggai Islands Regency. The farmers included in this study were married, of advanced age, and had over 10 years of farming experience, providing them with substantial knowledge in cultivating Banggai Yam. The financial institutions involved are non-bank entities, as farmers typically rely on them for assistance with costs related to land clearing and harvesting under specific agreements. Government respondents consisted of extension staff from the Department of Agriculture and Food Security, whose role is critical in disseminating the latest agricultural information to farmers. The selected academics were lecturers with relevant expertise in this research.



Figur 1. Study Location

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Data Analysis

Determining the Financial Feasibility of Banggai Yam Farming in Banggai Islands

The financial feasibility analysis of Banggai Yam farming in this study is derived from total revenue minus total costs. The following mathematical formula outlines the income analysis for agricultural enterprises (Soekartawi 2016; Rahajuni *et al.* 2022):

$$\mathbf{TR = Py \times Y}$$
$$\mathbf{TC = FC + VC}$$
$$\mathbf{Pd = TR - TC}$$

Description: TR = Total farm income (Rp); PY = Output price (Rp); Y = Quantity of output (kg); TC = Total farming costs (Rp); FC = Total fixed costs (Rp); VC = Total variable costs (Rp); Pd = Income.

Furthermore, R/C ratio analysis is used to illustrate how much farming is economically feasible. R/C ratio shows the amount of revenue obtained from the product of each rupiah spent in farm production. Analysis of the feasibility of return cost ratio (R/C ratio) can be formulated as follows (Qomariah *et al.* 2021):

$$\mathbf{R/C} = \frac{TR}{TC}$$

If the R/C ratio value obtained is >1, then the farm is profitable/feasible, meaning that the value of the output produced is greater than the value of the production factors used. If the R/C ratio value = 1, the farm is at the break-even point (BEP). If the R/C ratio value is <1, it means that the farm is not profitable or feasible.

Determination of Banggai Yam Development Strategy in Banggai Islands

This analysis aims to develop alternative strategies for Banggai Yam cultivation in Banggai Islands Regency, tailored to the region's characteristics, community needs, and appropriate developmental progress. The method employed for this analysis is Interpretative Structural Modelling (ISM), which facilitates a group learning process (Nirmalasanti *et al.* 2021). ISM constructs a model that illustrates the complexity of the system through carefully designed patterns using graphics and text. Its application involves two main components: establishing a hierarchy and classifying sub-elements, ultimately designing an abstract problem hierarchy to map issues in a quadrant format with prioritized concerns (Casnan *et al.* 2021).

The ISM analysis is conducted to explore the interconnections and dependencies among stakeholders involved in formulating constraint-based strategies (Sumantri *et al.* 2020; Wirdaniati *et al.* 2022) for Banggai Yam development. The stakeholders examined in this study include Banggai Yam farmers, collectors, financial institutions, local government, agricultural extension workers, and research/academic institutions. The financial institutions involved are non-bank institutions, as farmers usually rely on them for assistance with costs related to land clearing and harvesting under certain agreements, such as financial bailouts. Government respondents consist of extension staff from the Department of Agriculture and Food Security, whose role is very important in disseminating the latest agricultural information to farmers, so that farmers can apply modern farming patterns that can increase the yield of Banggai Yam. while Academics chosen are lecturers who have expertise relevant to this research. the research will certainly be very useful for farmers, because farmers will get solutions to the problems they face in cultivation and socio-economics. This research aims to identify the primary constraints affecting the development strategy for Banggai Yam. The initial step involves inventorying constraint-related factors through interviews and focus group discussions to

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http://ejournal2.undip.ac.id/index.php/agrisocionomics
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gather sub-elements that are directly linked to field conditions. Once these sub-elements are identified, a comparative assessment is conducted using the VAXO method with input from experts representing academia, business, government, and the community. The development strategy analysis employs the ISM method, resulting in three components: (1) identification of key sub-elements; (2) preparation of a hierarchy; and (3) classification of sub-elements. Data processing for ISM is performed using Eximpro software. The analysis steps, based on the ISM method include: 1) identifying parameters within the system; 2) establishing contextual relationships between sub-elements; and 3) creating a Structural Self-Interaction Matrix (SSIM). The contextual relationships are then transformed using the VAXO symbol (Marimin 2017). A detailed account of the ISM-VAXO relationships is presented in Table 1.

Table 1. Contextual relationships between ISM-VAXO elements

Symbol Counterfactual relationship between elements i and j (eij)	Definition of contextual relationship between elements (eij)
V	Element i causes a contextual relationship with j but not vice versa (eij=1 and eij=0)
A	Element j causes contextualisation with i but not vice versa (eij=0 and eij=1)
X	Elements i and j cause a mutual contextual relationship (eij =1 and eij=1)
O	Elements i andi and vice versa, do not cause a contextual relationship (eij=0 and eij=0)

Symbol 1 indicates the presence of a contextual relationship, while symbol 0 signifies the absence of such a relationship between sub-elements i and j. The classification of sub-elements is based on the processed results from the Reachability Matrix (RM), which adheres to transitivity rules. This processing yields values for Driver Power (DP) and Dependence (D), which are used to classify the sub-elements. Generally, the classification of sub-elements is divided into four categories (Marimin 2017):

a. Sektor 1; *weak driver– weak dependence variables* (Autonomous). Sub-elements in this sector are generally unrelated to the system and may have a slight relationship that can be strong.
b. Sektor 2; *weak driver – strongly dependent variables* (Dependent). The sub-elements within this sector are non-free sub-elements.
c. Sektor 3; *strong driver –strongly dependent variables* (Linkage). The sub-elements included in this sector should be assessed carefully, as the relationships between sub-elements are unstable. Any action on a sub-element will impact other sub-elements and feedback effects can magnify the impact.
d. Sektor 4; *strong driver – weak dependent variables* (Independent). The sub-elements in this sector are the remaining part of the system and are called independent variables

RESULT AND DISCUSSION

Feasibility of Banggai Yam Farming in Banggai Islands Regency

This analysis aims to determine the income or profit levels associated with agricultural enterprises (Listiani *et al.* 2019; Wildan *et al.* 2021). According to Makoka *et al.* (2017), the income and profits realized are highly dependent on both revenue and expenditure costs related to production. Income is closely linked to the level of production; as production increases, income is expected to

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rise as well. Van der Ploeg (2019); Sa'adah & Umam (2021) note that income, derived from sales of the produced goods, serves as an input for the production process at prevailing market prices. This study specifically examines the income or profit from Banggai Yam cultivation in Banggai Islands Regency, focusing on a single planting season, as Banggai Yam is cultivated only once a year. Additionally, Sheliena *et al.* (2024) suggest that analyzing income from a single season provides a sufficient overview of potential earnings for farmers. The results of the income analysis for Banggai Yam in Banggai Islands Regency are presented in Table 2.

Table 2. Income of Banggai Yam farmers in Banggai Islands Regency

No.	Uraian	Nilai Lahan (Rp)
1.	*Revenue*	
	Gross production of Banggai Yam (kg)	18.384,6
	Production Depreciation (kg)	132
	Net production of Banggai Yam (kg)	18.252,6
	Price/kg (Rp)	7.214
	(TR) Total Revenue	131.674.256,40
2.	*Cost*	
	a. *Fixed cost*	
	Tool Depreciation	425.000
	Family living expenses (4 people/6 months)	10.010.000
	Total sub-cost	10.435.000
	b. *Variable cost*	
	Seed cost	2.574.000
	Labor (6 people; 9 x /6 months)	17.820.000
	Other cost	1.000.000
	Total sub-cost	21.394.000
	(TC) Total Cost (a+b)	31.829.000
3.	*Income*	
	Pd = TR-TC	99.845.256
4.	*Feasibility*	
	RC = TR/TC	4,1

The components of the income analysis were obtained from questionnaires and direct interviews with 68 Banggai Yam farmers in Banggai Islands Regency. Total revenue (TR) is defined as the net production of Banggai Yam per hectare multiplied by its selling price per kilogram. The costs associated with Banggai Yam farming include the depreciation of tools, which are replaced throughout the planting season until harvest (like a cutting machine blade, machetes, battery sprayers, and mini senso chains). Additionally, family living expenses were determined from interviews, reflecting daily expenditures converted to cover six months. Seed costs were based on the amount needed for planting one hectare in a single season, while labor costs were calculated from the total working days required for six workers over six months. Other costs were assumed to be unidentified expenses or potential errors in this analysis. Therefore, the total cost (TC) incurred during one planting season until harvest is derived from the sum of fixed and variable costs in Banggai Yam farming in Banggai Islands Regency.

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The research findings on the income from Banggai Yam in Banggai Islands Regency (Table 2) indicate that the total revenue for respondents during a single planting season amounts to Rp. 131.674.256,40 per hectare. The average fixed costs incurred by Banggai Yam farmers are Rp. 10.435.000 per hectare. Additionally, variable costs, which fluctuate based on production levels, average Rp. 21.394.000 per hectare. Consequently, the total production costs, combining fixed and variable expenses, amount to Rp. 31.829.000 per hectare. By subtracting the total costs from total revenues, the income for Banggai Yam farmers per hectare is calculated to be Rp. 99.845.256. Furthermore, the feasibility of Banggai Yam farming in Banggai Islands Regency is assessed with a ratio of 4.1. According to Soekartawi (2016); Rahajuni *et al.* (2022), a benefit-cost ratio (R/C) greater than 1 indicates that economic activities are profitable and efficient for development. This suggests that Banggai Yam farming is indeed profitable and viable for continued cultivation. However, the development of Banggai Yam has not been well implemented; therefore, we identified the constraining factors to strategize its development.

Identification and Structuring of Constraint Elements in the Development of Banggai Yam in Banggai Islands

The sub-elements of constraints and programs necessary for the development strategy of Banggai Yam were derived from interviews, expert insights, and direct observations at the research site. The initiative aims to improve food security through food diversification by encouraging communities to adopt Banggai yam as a substitute for rice, according to the resources available in the region. According to Wibowo *et al.* (2024), an applicable strategy is to promote the utilization of local food resources (local food wisdom). However, the development of Banggai Yam has faced several challenges, including limited human resources and minimal government support, hindering optimal progress. The analyzed sub-elements are directly related to the development strategy of Banggai Yam in the Banggai Islands Regency. The identified constraints include seventeen sub-elements, such as uncoordinated marketing, lack of investors, high seed prices, absence of agricultural machinery, annual cultivation frequency, shifting cultivation practices, insufficient government attention, lack of support or training, absence of legal recognition for Banggai Yam, difficult access to farmland, limited derivative products, inadequate research, ineffective farmer groups, unstructured land use, asynchronous planting, high labor costs, and low farmer education levels. These constraints were reported directly by Banggai Yam farmers in Banggai Islands Regency.

The analysis utilizing Interpretive Structural Modeling (ISM) on the constraints affecting the development of Banggai Yam in Banggai Islands Regency reveals the feasibility of implementing a sustainable development strategy. The relationships among paired comparisons of sub-elements were assessed within the Structural Self-Interaction Matrix (SSIM), based on insights from ten experts. The final aggregation in the SSIM is derived from the reachability matrix (RM), which underwent initial RM processing and transitivity checks. This process resulted in grouping sub-elements into a single category of constraints (Sumantri *et al.* 2020). Key information for understanding the structure of the Banggai Yam development system includes the hierarchy of sub-elements and their classification based on characteristics represented by driver power and dependency levels, as illustrated in Figure 2.

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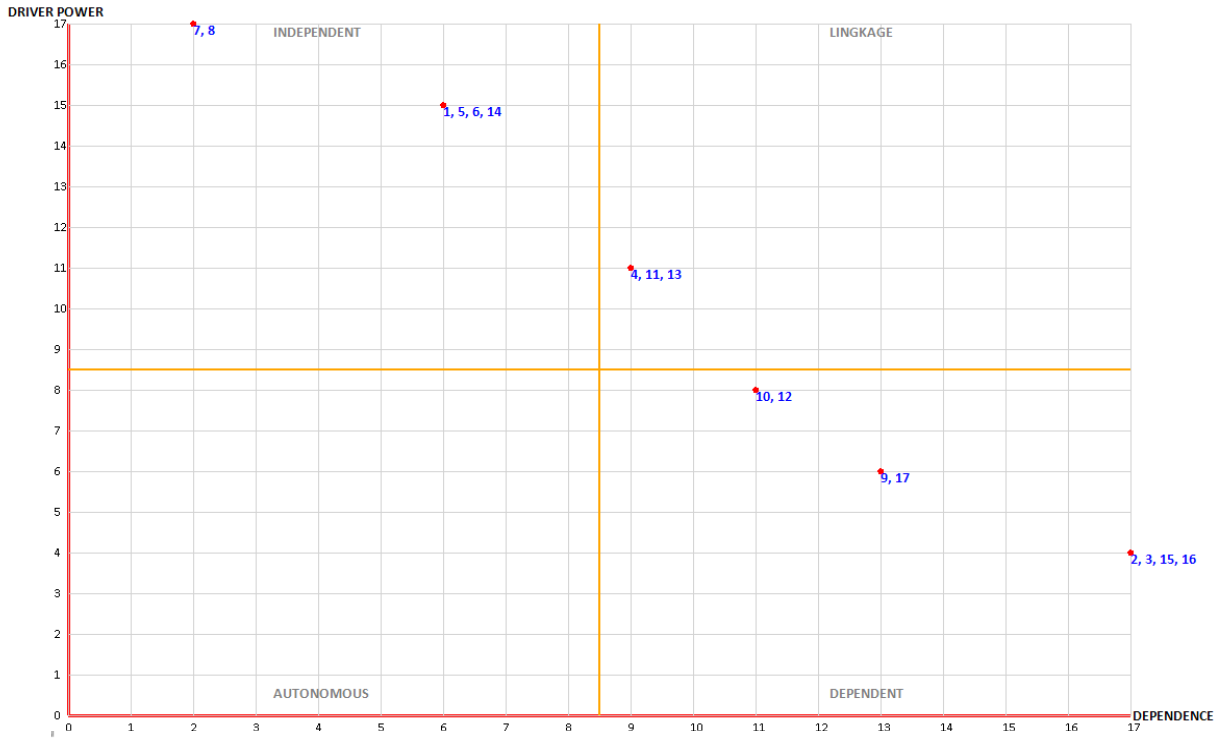

Figur 2. Driver-power and Dependency

Based on Figure 2, the analysis identified 17 sub-elements of constraints affecting Banggai yam development, which were categorised into three quadrants: Quadrant II (dependent), includes factors such as lack of investors, high seed prices, absence of legal recognition, difficult access to farmland, lack of research, non-synchronous planting, high labour costs, and low farmer education. These sub-elements are characterised by their dependence on other factors and exhibit weak driving forces, which can hinder development if not managed well (Pancawati et al. 2018; Rohmah et al. 2019). Susanto et al. (2018) stated that effective management is essential to prevent such constraints from becoming significant barriers to Banggai yam cultivation in the Banggai Islands. Farmers need capital, especially to purchase expensive seeds, and face challenges due to difficult terrain and poor road conditions, which increase labour costs. The involvement of local governments is crucial in providing resources, such as agricultural extension officers, to facilitate non-formal education and

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training for farmers (Ardita *et al.* 2017; Rahyunanto *et al*. 2020). This engagement aims to increase knowledge on effective cultivation practices, which will ultimately increase farmers' income and ensure the sustainable availability of Banggai Yam.

In Quadrant III (linkage), three key constraints affect the sustainable development of Banggai yam in the Banggai Islands Regency: the absence of agricultural machinery, the lack of derivative products, and ineffective farmer groups. Chandramowli *et al*. (2011) these sub-elements are interrelated, meaning that actions taken on one can significantly impact the others, creating a feedback loop that can amplify effects. Sjafrina *et al.* (2023) effective management of these constraints is crucial, as they can influence and be influenced by various factors. To optimize production, it is essential to enhance the capabilities of farmer groups and provide necessary agricultural tools, such as soil processing, planting, and harvesting machinery, which can reduce labor costs and improve productivity (Peranginangin *et al*. 2022).

Additionally, the limited processing skills within the community hinder the development of Banggai yam derivative products, despite its potential as a food substitute for rice and wheat flour due to its high carbohydrate content (Okereke *et al*. 2021; Yalindua *et al*. 2021). Field observations indicate that Banggai yam is already utilized as a rice substitute and in local cake production, highlighting its nutritional value. According to Amar *et al*. (2021) given its protein, fat, and carbohydrate content, there is a strong case for further developing Banggai yam as a viable food source, which could enhance food security and farmers' incomes in the region.

Sub-elements in this sector are the remaining part of the system and are called independent variables. Sub-elements in Quadrant IV (Independent), can influence other sub-elements, but cannot be influenced by other sub-elements (Rohmah *et al.* 2019; Yusianto *et al*. 2019; Munawir *et al*. 2022). In addition, this sub-element can affect changes that occur in all other elements in the system (Firmansyah *et al.* 2023). This is because the sub-element has the power as a big driver of the low level of sub-elements. The sub-elements in quadrant IV (Independent) are, marketing has not been directed, banggai yam is cultivated once a year, banggai yam cultivation is shifting, lack of government concern, absence of assistance/training of farmers, land use has not been directed. Seeing the very significant prospect of banggai yam being used as a local food substitute for rice, government concern is needed as the main driver in the development of banggai yam in the Banggai Islands.

Another driver is assisting/training to banggai yam farmers, to increase farmers' knowledge in managing more directed land in accordance with the designation of banggai yam. In addition, banggai yam cultivation techniques that are mobile will require high costs and will have a negative impact on social, economic, and environmental conditions. With assistance/training, it can also help increase the production of banggai yam as a provision of local food raw materials for food security independently (Megahwati and Priadana 2023). According to (Tuhuteru *et al.* 2022), tubers are a solution to food availability that can improve food security in each region. The structure diagram of banggai yam development shows that the hierarchical structure of constraint subelements in banggai yam development is obtained over 6 levels, as shown in Figure 3.

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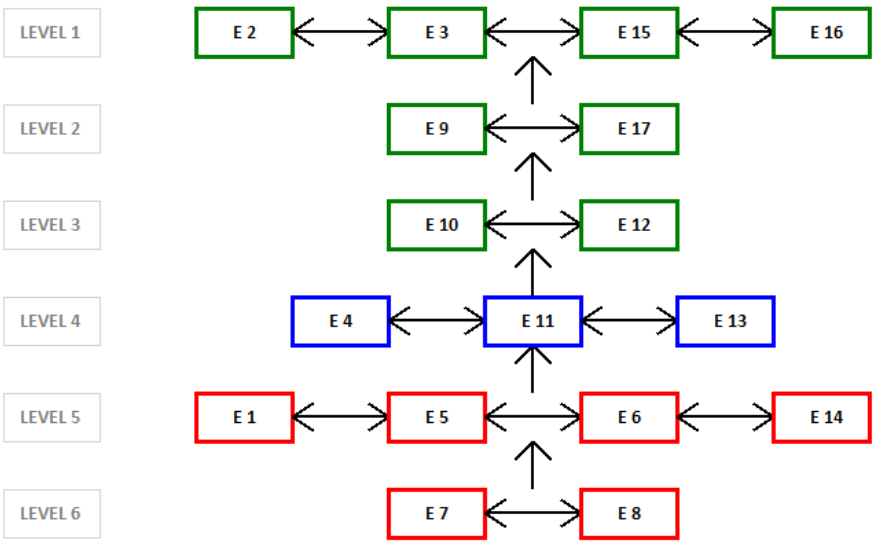

Figure 3. Structural model of constraints in the development strategy of Banggai Yam in Banggai Islands

The results obtained from the ISM model show the level of priority that must be addressed in determining alternative strategies to support the development of Banggai Yam as local food availability in the Banggai Islands (Figure 3). From the diagram of all elements of constraints in this study, a hierarchical model of policy alternatives was obtained by considering problems and constraints, the priority of independent factors, namely (i) the importance of government concern in the development of Banggai Yam in the Banggai Islands district, for example, the preparation of budget allocations and the realization of programs in making Banggai Yam as a local food substitute for rice. In line with Noer *et al*. (2022), stated that the role of the government is an important solution to the sustainability of local food in facing food security in each region. Apart from that, the role of the government in developing local food in the region is divided into three, including regulators, facilitators, and dynamists in formulating regulations and their implementation, bridging the various interests of the community and solving community problems to improve welfare (Megahwati & Priadana 2023). (ii) the need for training and mentoring by agricultural extension officers for Banggai Yam farmers regularly, to increase the knowledge and effectiveness of farmers and farmer groups in developing Banggai Yam from land processing to product processing. According to Visetnoi & Sirisoponsilp (2019), farmers need a companion to gain knowledge in farming, which usually occurs in young farmers who do not have much experience. In addition, Babu *et al*. (2016) stated that training and assistance to farmers greatly influences the success of farming from initial management to marketing agricultural products. (iii) Banggai Yam marketing can be done by involving stakeholders in managing Banggai Yam production as processed products. However, in obtaining a good product, it needs to be supported by the application of adequate technology to increase the optimal product value Kairupan *et al*. (2022), so that Banggai Yam can be processed as food ingredients such as cake-making flour and analogue rice. Local food products will be recognized and in high demand, if they involve stakeholders who collaborate with the community as a key element in product marketing (Babu *et al*. 2016; Eikelenboom & Long (2023). (iv) Banggai Yam is cultivated once a year, so it is

ISSN 2580-0566; E-ISSN 2621-9778
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necessary to involve researchers in the development of Banggai Yam so that it can be cultivated twice or even more a year, (v) the need to increase farmers' knowledge of the importance of cultivating Banggai Yam land so that planting Banggai Yam does not move around. According to Soedarto & Ainiyah (2022), one of the efficient ways to overcome the shifting cropping system is by implementing a modern agricultural system, which is carried out with extensification and intensification of agricultural techniques. In addition, efforts can also be made to practice conservation-based agricultural techniques (Dumasari 2020). (vi) It is necessary to increase farmers' knowledge in more directed land management, so as not to cause damage to land and environmental ecosystems in the Banggai Islands district. According to Akanbi (2024), overcoming the challenges of land and environmental damage is very important, so it is necessary for policies to conduct training programs and agricultural extension services to realize the improvement of farmer education in sustainable agricultural land management. Thus, if the structural model of the constraints element of the alternative policy can be overcome following the priority scale obtained, then the development of Banggai Yam for local food availability in the Banggai Islands Regency can run optimally and sustainably.

Strategic Direction for Development of Banggai Yam in Banggai Islands

The alternative strategic direction that must be taken is to prioritise the selected factors in the independent quadrant. The draft strategic direction that can be taken to overcome other constraints is to solve the main priority constraints as follows:

1. Realisation of local government programs in developing Banggai Yam as a local food substitute for rice in Banggai Islands Regency (E7)
2. Intense counselling to increase farmers' knowledge in Banggai Islands Regency (E8)
3. Increased distribution expansion through cooperation between stakeholders for the management of Banggai Yam products, so that marketing is more directed (E1).
4. Increase the cropping index (IP) of Banggai Yam, so that Banggai Yam can be cultivated twice a year (E5).
5. Optimising direct assistance to farmers on the importance of good land management, so that the cultivation of Banggai Yam does not move around, thus reducing the relatively high costs (E6).
6. Counselling in an effort to improve farmer education in good and correct land management in accordance with the direction of the spatial pattern of the Banggai Yam development area (E14).

CONCLUSION AND SUGGESTION

This research shows that Banggai Yam has a financial economic impact that can increase the income of Banggai Yam farming during one planting season so that Banggai Yam farming can be categorized as feasible to be developed or cultivated in the Banggai Islands Regency. Furthermore, alternative strategies in the development of Banggai Yam for local food availability in the Banggai Islands Regency are faced with six key sub-elements such as government concern (E7), farmer assistance/training (E8), undirected marketing (E1), cultivation of Banggai Yam once a year (E5), cultivation of Banggai Yam on the move (E6) and undirected land use (E14), which are indicated as the main drivers or alternative strategies in overcoming the obstacles to the development of Banggai Yam in Banggai Islands. This is because the Independent Quadrant has a driving power that can affect other constraint sub-elements. Handling the right constraints and priorities will ultimately be a driver

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in fulfilling the main objective, namely the direction of the policy strategy for developing Banggai Yam for sustainable local food availability in the Banggai Islands.

ACKNOWLEDGEMENT

We would like to thank the Indonesian Education Scholarship (BPI) of the Ministry of Education, Culture, Research and Technology of the Republic of Indonesia, through funding from the Education Fund Management Agency (LPDP) and the Higher Education Financing Centre (BPPT) for providing funds for this research (No: 1924/J5.2.3/BPI.06/10/2021).

REFERENCES

Agboola, M. O., Bekun, F. V., Osundina, O. A., & Kirikkaleli, D. (2022). Revisiting the economic growth and agriculture nexus in Nigeria: Evidence from asymmetric cointegration and frequency domain causality approaches. *Journal of Public Affairs*, *22*(1), e2271. https://doi.org/10.1002/PA.2271

Akanbi, M. T. (2024). Policy Innovations for Advancing Sustainable Agriculture in Developing Countries: Integrating Educational Programs, Resource Management Strategies, and Community Empowerment for Long-Term Growth. *Tensorgate Journal of Sustainable Technology and Infrastructure for Developing Countries*, *7*(6), 41–61. https://research.tensorgate.org/index.php/tjstidc/article/view/150

Amar, A. A., Kusnandar, F., & Budijanto, S. (2021). Karakteristik Fisikokimia Tepung Ubi Banggai dan Aplikasinya Dalam Beras Analog. *Jurnal Mutu Pangan : Indonesian Journal of Food Quality*, *8*(1), 43–52. https://doi.org/10.29244/jmpi.2021.8.1.43

Ardita, A., DWP, S., & Widjanarko, D. (2017). Kinerja Penyuluh Pertanian Menurut Persepsi Petani: Studi Kasus di Kabupaten Landak. *Journal of Vocational and Career Education*, *2*(1). https://doi.org/10.15294/JVCE.V2I1.10908

Atah, I. U., Mohammed Ali Nasr, W., & Omar Mohammed, M. (2018). The Role of Zakat as an Islamic Social Finance towards Achieving Sustainable Development Goals: A Case Study of Northern Nigeria. *Global Conference on Islamic Economics and Finance*, *October*, 83–98.

Babu, S. C., Manvatkar, R., & Kolavalli, S. (2016). Strengthening Capacity for Agribusiness Development and Management in Sub-Saharan Africa. *Africa Journal of Management*, *2*(1), 1–30. https://doi.org/10.1080/23322373.2015.1112714

Behera, U. K., & France, J. (2016). Integrated Farming Systems and the Livelihood Security of Small and Marginal Farmers in India and Other Developing Countries. *Advances in Agronomy*, *138*, 235–282. https://doi.org/10.1016/BS.AGRON.2016.04.001

Casnan, Purnawan, Triwahyuni, H., Farhan Wahyu Fuadi, E., & Firmansyah, I. (2021). Analisis Kendala Pembelajaran Daring Paud dan SD dengan Pendekatan Interpretative Structural Modeling (ISM). *Jurnal Pelita PAUD*, *6*(1), 33–40. https://doi.org/10.33222/pelitapaud.v6i1.1422

Chandramowli, S., Transue, M., & Felder, F. A. (2011). Analysis of barriers to development in landfill communities using interpretive structural modeling. *Habitat International*, *35*(2), 246–253. https://doi.org/10.1016/J.Habitatint.2010.09.005

Darwanto, D., & Raharjo, S. T. (2018). Pengembangan Produksi Usaha Mikro, Kecil Dan Menengah (Umkm) Sektor Pertanian Berbasis Potensi Lokal. *Jurnal Riset Ekonomi Manajemen (REKOMEN)*, *1*(2), 27–36. https://doi.org/10.31002/rn.v1i2.710

De Janvry, A., & Sadoulet, E. (2020). Using agriculture for development: Supply- and demand-side approaches. *World Development*, *133*, 105003.

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (2): 511-526, June 2025

https://doi.org/10.1016/J.Worlddev.2020.105003

Dethier, J. J., & Effenberger, A. (2012). Agriculture and development: A brief review of the literature. *Economic Systems*, *36*(2), 175–205. https://doi.org/10.1016/J.ECOSYS.2011.09.003

Dumasari, D. (2020). Pembangunan Pertanian; Mendahulukan yang Tertinggal. Pustaka Pelajar. Yogyakarta

Dzingirai, M. (2021). The role of entrepreneurship in reducing poverty inagricultural communities. *Journal of Enterprising Communities*, *15*(5), 665–683. https://doi.org/10.1108/JEC-01-2021-0016/Full/Xml

Eikelenboom, M., & Long, T. B. (2023). Breaking the Cycle of Marginalization: How to Involve Local Communities in Multi-stakeholder Initiatives? *Journal of Business Ethics*, *186*(1), 31–62. https://doi.org/10.1007/S10551-022-05252-5/FIGURES/6

Firmansyah, I., Budiasa, W., Paulus, C. A., Rahman, D. A., Sukwika, T., Hermawan, E., & Casnan. (2023). Ecosystem Services and Environmental Benefit Values on Komodo Island and Padar Island in Komodo National Park, Indonesia. *Environmental Engineering and Management Journal*, *22*(7), 1245–1257. https://doi.org/10.30638/eemj.2023.103

Hermawan, I. (2012). Analisis Eksistensi Sektor Pertanian terhadap Pengurangan Kemiskinan di Pedesaan dan Perkotaan. *MIMBAR : Jurnal Sosial dan Pembangunan*, *28*(2), 135-144. https://doi.org/10.29313/mimbar.v28i2.348

Hernita, H., Surya, B., Perwira, I., Abubakar, H., & Idris, M. (2021). Economic Business Sustainability and Strengthening Human Resource Capacity Based on Increasing the Productivity of Small and Medium Enterprises (SMEs) in Makassar City, Indonesia. *Sustainability.13*(6), 3177. https://doi.org/10.3390/SU13063177

Johns, T., Powell, B., Maundu, P., & Eyzaguirre, P. B. (2013). Agricultural biodiversity as a link between traditional food systems and contemporary development, social integrity and ecological health. *Journal of the Science of Food and Agriculture*, *93*(14), 3433–3442. https://doi.org/10.1002/JSFA.6351

Jumiyati, S., Possumah, N., Hadid, A., Bachri, S., & Dua, P. (2021). Eco-friendly utilization to increase income and efficiency of Banggai Yam farming in the Banggai Islands, Central Sulawesi, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *797*(1). https://doi.org/10.1088/1755-1315/797/1/012012

Kairupan, A. N., Joseph, G. H., Kindangen, J. G., Paat, P. C., Polakitan, A., Polakitan, D., Malia, I. E., Hutapea, R., Kairupan, A. N., Joseph, G. H., Kindangen, J. G., Paat, P. C., Polakitan, A., Polakitan, D., Malia, I. E., & Hutapea, R. (2022). Local Tubers Production and Value Chain: Evidence from Sangihe Island Regency, Indonesia. *Sustainable Agricultural Value Chain*. https://doi.org/10.5772/Intechopen.103711

Katili, H. A., Zaenuddin, R. A., Cahyani, R., Sariani, S., & Puspapratiwi, D. (2023). Carrying Capacity Of Non-Rice Featured Crops For Alternative Food Availability In Banggai Regency, Central Sulawesi. *Agrisocionomics: Jurnal Sosial Ekonomi Pertanian*, *7*(2), 416–428. https://doi.org/10.14710/Agrisocionomics.V7I2.17152

Kusio, T., & Fiore, M. (2022). Which Stakeholders' Sector Matters in Rural Development? That Is the Problem. *Energies 2022, Vol. 15, Page 454*, *15*(2), 454. https://doi.org/10.3390/EN15020454

Kusrini, N., Sulistiawati, R., Imelda, & Hurriyani, Y. (2017). Pemberdayaan Masyarakat Dalam Pemanfaatan Sumber Daya Lokal Di Desa Jeruju Besar Kecamatan Sungai Kakap. *JPM (Jurnal Pemberdayaan Masyarakat)*, *2*(2), 139–150. http://ejournal.unikama.ac.id/index.php/jpm

Listiani, R., Setiadi, A., & Santoso, S. I. (2019). Analisis Pendapatan Usahatani Pada Petani Padi Di Kecamatan Mlonggo Kabupaten Jepara. *Agrisocionomics: Jurnal Sosial Ekonomi Pertanian*,

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (2): 511-526, June 2025

3(1), 50–58. https://doi.org/10.14710/Agrisocionomics.V3I1.4018

Makoka, D., Drope, J., Appau, A., Labonte, R., Li, Q., Goma, F., Zulu, R., Magati, P., & Lencucha, R. (2017). Costs, revenues and profits: an economic analysis of smallholder tobacco farmer livelihoods in Malawi. *Tobacco Control*, *26*(6), 634–640. https://doi.org/10.1136/Tobaccocontrol-2016-053022

Marimin (2017). Sistem Pendukung Penagmbilan Keputusan dan Sistem Pakar. IPB Press. Bogor

McArthur, J. W., & McCord, G. C. (2017). Fertilizing growth: Agricultural inputs and their effects in economic development. *Journal of Development Economics*, *127*, 133–152. https://doi.org/10.1016/J.Jdeveco.2017.02.007

Megahwati, I., & Priadana, S. (2023). The Realization of the Government's Role in Creating Food Security in Indonesia. *Ekonomis: Journal of Economics and Business*, *7*(2), 847–851. https://doi.org/10.33087/Ekonomis.V7I2.1101

Mellor, J. W. (2017). Agricultural Development and Economic Transformation. In *Agricultural Development and Economic Transformation*. Springer International Publishing. https://doi.org/10.1007/978-3-319-65259-7

Munawir, A., Nurhasanah, N., Rusdiyanto, E., & Muna, S. U. N. (2022). Kebijakan Pemanfaatan Hutan Mangrove Berkelanjutan dengan Teknik Interpretative Structural Modeling di Taman Nasional Rawa Aopa, Sulawesi Tenggara. *Buletin Ilmiah Marina Sosial Ekonomi Kelautan dan Perikanan*, *8*(2), 127–140. https://doi.org/10.15578/Marina.V8I2.11693

Nassirou Ba, M. (2016). Strategic Agricultural Commodity Value Chains in Africa for Increased Food: The Regional Approach for Food Security. *Agricultural Sciences*, *07*(09), 549–585. https://doi.org/10.4236/AS.2016.79055

Nirmalasanti, N., Effendi, H., & Setyowati, R. (2021). Application of Interpretative Structural Modeling (ISM) to determine port waste management strategies for African Swine Fever (ASF) prevention at Tanjung Priok Port. *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan*, *11*(4), 532–541. https://doi.org/10.29244/jpsl.11.4.532-541

Noer, E., Siamsa, S., & Rimbayana, T. A. K. (2022). Government policy and stakeholder for local food in supporting food security. *IOP Conference Series: Earth and Environmental Science*, *1107*(1), 012103. https://doi.org/10.1088/1755-1315/1107/1/012103

Okereke, G., Igbabul, B., & Ikya, J. (2021). Evaluation Of Breads Made From Wheat Flour, Modified White Yam/Trifoliate Yam/Sweet Potato Starches And Moringa Oleifera Seed Flour Blends. *International Journal of Food Science and Nutrition.* 6(2). 107-119.

Pancawati, J., Yanuar, M., Purwanto, J., Widiatmaka, Nurisjah, S., & Pramudya, B. (2018). *Institutional Roles Development of Urban Lake Management*. *August 2018*, 91–105.

Peranginangin, M., Giri, & Astuti, L. T. W. (2022). Respon Petani Terhadap Program Optimalisasi Alat Dan Mesin Pertanian Kementerian Pertanian Di Kecamatan Medang Deras Kabupaten Batu Bara Provinsi Sumatera Utara. *Agrica Ekstensia*, *16*(2), 57–66. https://doi.org/10.55127/AE.V16I2.124

Putsenteilo, P., Klapkiv, Y., Karpenko, V., & Gvozdecka, I. (2020). The role of institutions in the development of agriculture. *Bulgarian Journal of Agricultural Science*, *26*(1), 23-33.

Qomariah, R., Amin, M., & Syarif, M. (2021). Analisis Usahatani. In *Balai Pengkajian Teknologi Pertanian Kalimantan Selatan*. Balai Penelitian dan Pengembangan Teknologi Pertanian (Balitbangtan) Kementerian Pertanian.

Rahajuni, D., Badriah, L. S., & -, A. (2022). Analysis of Income, Costs and Income Distribution of Coconut Sugar Craftsmen in Cilongok District. *Proceeding of International Conference Sustainable Competitive Advantage*, *2*(1). https://www.jp.feb.unsoed.ac.id/index.php/sca-1/article/view/2784

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (2): 511-526, June 2025

Rahyunanto, S., Hariadi, S. S., & Witjaksono, R. (2020). Peran Penyuluh Pertanian Terhadap Perilaku Petani Padi Dalam Menindaklanjuti Kegiatan Penyuluhan Di Kabupaten Magelang. *Widya Komunika*, *10*(2), 14. https://doi.org/10.20884/1.wk.2020.10.2.3352

Rohmah, W. G., Mustaniroh, S. A., Deoranto, P., & Nharawasthu, D. A. (2019). An Interpretive Structural Modelling (ISM) Approach for Institutional Analysis of Gadung Yam (Dioscorea Hispida Dennst) Chips Supply Chain in SMEs Tulungagung, East Java, Indonesia. *Journal of Management, Economics, and Industrial Organization*, *May*, 27–45. https://doi.org/10.31039/jomeino.2019.3.3.3

Sa'adah, L., & Umam, K. (2021). Dampak Covid-19 Terhadap Pendapatan Pedagang (Studi Kasus Di Pasar Peterongan Jombang). *Economicus*, *15*(1), 13–23. https://doi.org/10.47860/economicus.v15i1.225

Sariani, S., Saida, S., Boceng, A., & Katili, H. A. (2023). Evaluasi Lahan Sebagai Dasar Pengembangan Tanaman Buah-Buahan Unggulan Di Kecamatan Tinangkung Selatan Kabupaten Banggai Kepulauan. *Savana Cendana*, *8*(01), 18–24. https://doi.org/10.32938/SC.V8I01.1979

Sheliena, E., Hanani, N., & Riana, F. D. (2024). Analisis Pendapatan dan Kelayakan Usahatani Kentang Granola di Desa Wonokerso Kabupaten Probolinggo. *Jurnal Dinamika Sosial Ekonomi*, *25*(1), 95-106. https://doi.org/https://doi.org/10.31315/jdse.v25i1.12118.g6419

Siadjeu, C., Mayland-Quellhorst, E., & Albach, D. C. (2018). Genetic diversity and population structure of trifoliate yam (Dioscorea dumetorum Kunth) in Cameroon revealed by genotyping-by-sequencing (GBS). *BMC Plant Biology*, *18*(1), 1–14. https://doi.org/10.1186/S12870-018-1593-X/Figures/5

Sjafrina, N., Budiyanto, A., Lukas, A., Yani, A., Astuti, P., Arianto, A., Arif, A. Bin, Marimin, Udin, F., Anggraeni, E., & Mahendri, I. G. A. P. (2023). Institutional Model and Strategy for Downstream Development of Shallot Agroindustry in Indonesia. *Industrial Engineering and Management Systems*, *22*(4), 489–502. https://doi.org/10.7232/iems.2023.22.4.489

Soedarto, T., & Ainiyah, R. K. (2022). Teknologi Pertanian Menjadi Petani Inovatif 5.0: Transisi Menuju Pertanian Modern. Uwais Inspirasi Indonesia. Jawa Timur

Soekartawi (2016). *Analisis Usahatani*. Universitas Indonesia

Sumantri, B., Haryono, S., Firmansyah, I., & Casnan. (2020). National Quality Standard Approach for Business Competitiveness and Sustainability: A Study of Indonesian Public Market. *International Journal of Advanced Science and Technology*, *29*(06), 3764–3770. http://sersc.org/journals/index.php/IJAST/article/view/15738

Surya, B., Saleh, H., Hamsina, H., Idris, M., & Ahmad, D. N. A. (2021). Rural agribusiness-based agropolitan area development and environmental management sustainability: Regional economic growth perspectives. *International Journal of Energy Economics and Policy*, *11*(1), 142–157. https://doi.org/10.32479/ijeep.10184

Susanto, A., Purwanto, M. Y. J., Pramudya, B., & Riani, E. (2018). Model Peran Antar Kelembagaan Desa Dalam Penyediaan Air Baku Melalui Paradigma Kepedulian Air (Studi Kasus Desa Bendungan, Kecamatan Ciawi, Kabupaten Bogor). *Jurnal Matematika Sains dan Teknologi*, *19*(2), 89–105. https://doi.org/10.33830/JMST.V19I2.111.2018

Tuhuteru, S., Kaiwai, O., Douw, L., Wandikbo, O., Wilil, F., Agapa, R., Kogoya, I., Mabel, R., Karoba, D., & Tabuni, I. (2022). Pemberdayaan Masyarakat Kampung Kama Distrik Wesaput Dalam Memaksimalkan Singkong Dan Ubi Jalar Sebagai Solusi Ketahanan Pangan Di Masa Pandemik. *Jurnal Abdimas Indonesia*, *2*(1), 94–105. https://doi.org/10.53769/JAI.V2I1.189

Van der Ploeg, J. D. (2019). Labor, Markets, And Agricultural Production. *Labor, Markets, and Agricultural Production*. https://doi.org/10.1201/9780429043222

ISSN 2580-0566; E-ISSN 2621-9778
http://ejournal2.undip.ac.id/index.php/agrisocionomics
Vol 9 (2): 511-526, June 2025

Visetnoi, S., & Sirisoponsilp, S. (2019). Uplifting Thailand's agriculture through agricultural education: a paradigm shift for future farmers. *International Journal of Agriculture Innovation, Technology and Globalisation*, *1*(1), 44. https://doi.org/10.1504/Ijaitg.2019.099600

Wartoyo, & Haida, N. (2023). The Actualization Of Sustainable Development Goals (SDGs) And Indonesia's Economic Growth On Islamic Economic. *Iqtishaduna: Jurnal Ekonomi dan Keuangan Islam*, *14*(1), 107–124.

Wibowo, A., Suwarto, S., Lestari, E., & Rahayu, R. (2024). A watershed sustainability model based on the integration of livestock, conservation agriculture, and local wisdom in Indonesia. *IOP Conference Series: Earth and Environmental Science*, *1292*(1), 012030. https://doi.org/10.1088/1755-1315/1292/1/012030

Widiatmaka, W., Munibah, K., Sitorus, S. R. P., Ambarwulan, W., & Firmansyah, I. (2015). Appraisal Keberlanjutan Multidimensi Penggunaan Lahan Untuk Sawah Di Karawang - Jawa Barat. *Volume*, *5*(2), 113–131.

Wildan, A., Sumekar, W., & Suprijatna, E. (2021). The Impact Of Broiler Farmers' Behavior Using Brooding Period Equipment On Productivity And Income In Semarang Regency. *Agrisocionomics: Jurnal Sosial Ekonomi Pertanian*, *5*(2), 29–40. https://doi.org/10.14710/Agrisocionomics.V5I2.8496

Wirdaniati, W., Firmansyah, I., Mar'atusholikha, V., & Nurhajanah, S. (2022). Model Legalisasi Sertifikasi Tanah di Perdesaan dan Proyeksi terhadap Nilai Manfaat Kepemilikan. *Jurnal Hukum*, *38*(2), 122–137. https://doi.org/10.26532/JH.V38I2.18480

Yalindua, A., Manampiring, N., Waworuntu, F., & Yalindua, F. Y. (2021). Physico-chemical exploration of Yam Flour (Dioscorea alata L.) as a raw material for processed cookies. *Journal of Physics: Conference Series*, *1968*(1), 012004. https://doi.org/10.1088/1742-6596/1968/1/012004

Yusianto, R., Marimin, Suprihatin, & Hardjomidjojo, H. (2019). An Interpretive Structural Modeling (ISM) approach for Institutional Development in the Central Java Potato Agroindustry. *Proceedings - 2019 International Seminar on Application for Technology of Information and Communication: Industry 4.0: Retrospect, Prospect, and Challenges, iSemantic 2019*, 282–287. https://doi.org/10.1109/Isemantic.2019.8884325