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SUSTAINABILITY ANALYSIS OF ONION CULTIVATION IN DEMAK DISTRICT, CENTRAL JAVA PROVINCE

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ABSTRACT

Sustainable agriculture on a global scale is no exception in Demak Regency which aims to improve food productivity and has positive side effects on goods, services and the environment. Sustainable agriculture indicators vary from region to region. The purpose of this study was to determine the income and profitability and sustainability of shallot farming. The samples taken in this study were 175 shallot farmers respondent. The research method used is a survey method with three data analyses, namely income and profitability analysis and Structural Equational Modeling (SEM) analysis with the AMOS program. The results showed that the income of shallot farmers in Mijen District, Demak Regency was Rp 119,319,173 per planting season with an average land area of 7,600 m^2. The profitability value is 159.35%, indicating that the profitability of shallot farming is much higher than bank deposit rates, which means that this business is feasible to develop. SEM analysis shows that the exogenous variables of respondent characteristics and production input factors have a positive and significant effect on farming performance. Furthermore, exogenous environmental, social, economic and institutional variables have a positive effect on sustainability, while technological variables have no significant effect on sustainability variables. Agricultural performance has a positive relationship with sustainable agriculture. Farmers' knowledge of the use of technology in cultivation activities needs to be increased for the success of sustainable agriculture in each indicator.

Keywords: *shallots, profitability, sustainability*

BACKGROUND

The development of the agricultural sector in Indonesia is essentially aimed at increasing the welfare of farmers and supporting the success of national development. Shallots are an important commodity for most Indonesian farmers. Central Java is the highest shallot producer in Indonesia, namely 5,924,887 quintals in 2020. This amount contributes 33.86% to national shallot production. The highest shallot production in Central Java is Brebes Regency with a total production in 2020 of 3,835,111 quintals. Then followed by Demak Regency with 781,655 quintals. Shallot cultivation in Demak Regency still faces many obstacles, such as the threat of land conversion, the price of high-quality seeds and the use of production inputs that are less than optimal. Another obstacle is the fluctuating selling price, the level of farmers' knowledge and farmers' access to financial institutions is still low and some areas are not yet available. Globally, the challenge of shallot farming is continuous efforts to achieve sustainable agricultural development.

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Government has attempted to create a horticultural development policy that is no longer focused only on efforts to increase commodity production alone, but has considered strategic issues at the global level. level. The horticultural development policy is in accordance with the concept of the Food Agricultural Organization (FAO) regarding sustainable agricultural development. FAO offers a mechanism to implement concrete actions towards achieving Sustainable Agriculture and Rural Development. Sustainability is a multidimensional concept that includes environmental integrity, human rights and well-being, a resilient economy, and transparent governance (Food and Agriculture Organization, 2014).

Various studies have been conducted to measure indicators of sustainable agriculture covering various aspects, such as comparisons of sustainable and conventional agriculture, biodiversity and biosecurity, use of information and communication technology, ensuring land quality and management, and maximizing resource efficiency (Firth et al. , 2020). To realize sustainable agriculture, every farm must be oriented towards the process of achieving profitable and efficient production with an emphasis on improving management, preventing disease and conserving soil, water, energy and biological resources (Tatlıdil et al., 2009). Many studies related to sustainable agriculture have been carried out in Indonesia. But with a variety of different indicators. The most commonly used indicators are environmental, social and economic. This study has more complex indicators to describe sustainability which concentrates on five indicators of sustainable agriculture, namely environmental, social, economic, technological and institutional. In addition to discussing sustainability, this study also concentrates on the benefits obtained by farmers in conducting shallot farming which is then linked to the sustainability of farming. The aims of this study are: 1) To analyze the income and profitability of shallot farming in Demak Regency; 2) Analyze the sustainability of shallot farming in terms of environmental, economic, social, institutional and technological factors.

RESEARCH METHODS

Time and Location of Research

The research was carried out from 1 August to 14 September 2022. The research location was in Mijen District, Demak Regency, Central Java Province using a survey method. Determination of the research location was carried out purposively.

Types and Sources of Data Used

This study uses primary data and secondary data. Primary data is data obtained directly from farmers. Primary data obtained through interview sessions with respondents. Secondary data were obtained from the Central Bureau of Statistics of Demak Regency and the Central Bureau of Statistics of Central Java, related literature, scientific journals, internet and other sources that support research findings. Data collection in the research was carried out by means of interviews, questionnaires and documentation.

Population and Sample

The population in this study were shallot farmers in Mijen District, Demak Regency , totaling 2,239. The selected village locations were Pasir, Bantengmati and Gempolsongo villages with the consideration of the third largest planting area. Determining the number of samples for Structural Equation Modeling (SEM) analysis uses the formula for the number of indicators x 5 to 10 (Syamsul

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& Fahkry, 2021). Because the number of indicators used in this study was 35, the number of samples used in this study was 175 respondents. In this study, data was collected based on a stratified random sampling approach using a structured questionnaire.

Instrument

The instruments in this study consisted of seven exogenous variables and two endogenous variables. Exogenous variables consist of respondent characteristic variables which consist of four indicators and production inputs which consist of four indicators that have a relationship with business performance. In addition, environmental, economic, social, technological and institutional variables are related to sustainability variables. The number of indicators for each variable is five. Determination of indicators and variables is based on theory from FAO (2014) and several previous studies. The instruments in this study are more complex than most previous studies. This is adjusted to the conditions of shallot farming in the study area. Each indicator on each variable is measured using a Likert scale with a score of 1 "strongly disagree" and a score of 4 "strongly agree".

Data Analysis Technique

The first data analysis is the analysis of income and feasibility. Business income can be calculated by subtracting gross income from all expenses incurred. Knowing the level of income of shallot farmers earned during one growing season, can be calculated by analyzing through the income approach according to Soekartawi (2016) which is the result of reducing total costs and income. Farming feasibility can be known through feasibility analysis. One way to determine feasibility is to use profitability analysis. Profitability analysis is calculated using the profit after tax formula divided by the total cost of production. The second data analysis is a sustainability analysis. The sustainability was analyzed using SEM analysis with AMOS 22.0. SEM techniques have now been widely adopted in behavioral studies as well as many other empirical disciplines such as agriculture, ecology, natural resource management, forestry, food science, and psychology as well as model building for agricultural development (You, 2017). SEM is able to explain the interrelationships of variables in a complex manner as well as the direct or indirect influence of one or several variables on other variables. Each dependent and independent variable can be in the form of a factor or construct built from several indicator variables or in the form of a single variable which is directly observed in a process research (Wijaya, 2009).

RESULT AND DISCUSSION

Characteristics of Respondents

Age, education and length of farming are used to describe the characteristics of farmers (Table 1). Age is one of the factors that can affect the absorption and decision-making power of farmers. The largest number of shallot farmers are in the age range of 41 to 50 years or 36.01%. Age 41 to 50 years is the most age of all respondents, where this age is an age that has been established in farming. The least number of respondents is in the age range of 21 to 30 years or 2.85% of the total respondents. In this age range a person is in prime physical condition and responsive to change. The level of education is the level of education that is determined based on the level of development of students, the goals to be achieved and the will to be developed. Formal education forms value for someone, especially in accepting new things (Gumanti & Nauly, 2022). The highest number of

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farmers who graduated from junior high school was 92 respondents or 52.57%, while the respondents with the least number were at the Academy/Higher Education level with 3 respondents or 1.71%. Most of the shallot farmers are at the level of education in junior high school, followed by elementary school, high school, and university. Education can have a big influence on a person's mindset. Farmers with a high educational background tend to make more informed decisions than farmers with a low educational background (Mbana et al., 2021). There are 83 farmers or 47.42% who have been farming for 0-10 years. As many as 83 respondents (47.42%) were farmers who worked in the shallot business for 11-20 years, 80 respondents (45.72%) worked for 11-15 years. Farmers who have been doing farming for more than 20 years are 12 people or 6.86%. The amount of experience will broaden farmers' insights, thus it will also increase their absorption of new things, including those related to sustainable agriculture.

Table 1. Characteristics of Respondents

Indicator	Number of people	Percentage (%)
Age (years)		
21-30 Years	5	2.85
31-40 Years	46	26.28
41-50 Years	63	36.01
51-60 Years	45	25.72
61-70 Years	16	9.14
Education		
Elementary	55	20.01
Junior	92	52.57
High School	45	25.71
University	3	1.71
Length of time in business (years)		
0 – 10	83	47.42
11–20	80	45.72
>20	12	6.86

Source: Primary Data, 2022

Revenue and Profitability Analysis

The total cost required for shallot farming for each period is Rp 92,431,601/ha. Fixed costs in this study Fixed Costs consist of land rental costs, equipment depreciation costs, and electricity costs. while Variable Costs consist of fertilizer costs, labor costs, pesticide purchase costs, seed costs, fuel oil costs, and irrigation costs. The income of shallot farmers is Rp 249,258,459/ha. These results were obtained with an average production of 9,001.32/ha. The income of shallot farmers is 156,826,857/ha. The profitability ratio of shallot farming is 159% with an average farmer's land area of 7,600 m2. This can be interpreted that there is a difference between profitability and the prevailing interest rate. The profitability of the shallot farming business is greater than BRI bank deposit interest in 2022. Most of the farmers obtain capital for shallot farming assisted by financial institutions such as banks and cooperatives. This is because the costs required for cultivation activities from harvest to post-harvest are quite large, which ranges from an average farmer area of 7000 m^2 which will cost Rp 64,702,120.

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Structural Equation Modelling Analysis

Table 2. Indicators of Shallot Farming Sustainability

Variable	Indicator	Code
Characteristics of respondents	Education	KR1
	Age	KR2
	Land area	KR3
	Long tried	KR4
Production inputs	Pesticide use	IP3
	Use of seeds	IP4
	Venture capital	IP5
	Labor	IP6
Business performance	Income	PU1
	Profitability	PU2
Environmental factor	Crop rotation	FL1
	Weeding	FL2
	Avoid burning plant residues	FL3
	Keep pest predators away	FL4
	Use of irrigation water	FL5
Economic factor	Use of superior seeds	FE1
	Area of land ownership	FE2
	Post harvest action	FE3
	Marketing location	FE4
	Price information	FE5
Social factors	Farmer's health	FS1
	Social life	FS2
	Family support	FS3
	Time outpouring	FS4
	Farmer motivation	FS5
Technological factor	Improvement of skills and knowledge	FT1
	Organic fertilizer manufacturing technology	FT2
	Land management technology	FT3
	Road access	FT4
	Production facility	FT5
Institutional factors	Farmer group membership	FK1
	Extensionist access	FK2
	Access to financial institutions	FK3
	Understand the implementation of agricultural policies	FK4
	Inter-agency coordination	FK5

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Table 3. Reliability and Validity

Variable	Construct Reliability (CR)	AVE
IP	0.885	0.812
KR	0.887	0.817
PU	0.750	0.775
FL	0.852	0.734
FE	0.876	0.766
FS	0.898	0.799
FT	0.908	0.815
FK	0.897	0.798
KB	0.772	0.793

Source: Primary Data, 2022

SPSS and AMOS software are used to perform structural equation modeling analysis procedures. SEM analysis requires a multivariate sample from normally distributed data (Junaidi, 2021) . Previously the researcher conducted a validity and reliability analysis to ensure that the data set could be trusted. Validity and reliability tests show that all variables are reliable and valid. The validity and reliability values can be seen in Table 3.

Based on the results of the normality test, the skewness value for each variable indicator was obtained between -2.58 to +2.58, both univariate and multivariate. This proves that there is no violation of the SEM normality assumption in the input data of this study. Validity and reliability values are acceptable, then produce a fit test model which can be seen in table 2. RMSEA values (0.043), GFI, AGFI, TLI, CFI (0.810, 0.773, 0.948, 0.953) and CMIN/DF (1.324). Based on this value, there are four suitable or fit criteria. The model as a whole can be said to be in accordance with the data and can be analyzed further. This opinion is also reinforced (Syamsul & Fahkry, 2021) which states, if two or more of all the GOFs used have shown a good fit, then the model can be said to be good.

SEM analysis using AMOS will form a structural model (Figure 1) to examine the direct effect of exogenous variables on endogenous variables and between endogenous variables. As shown in Table 4, production inputs and the characteristics of the respondents have a direct influence on business performance. Furthermore, environmental, economic, social and institutional exogenous variables have a direct influence on sustainability. One exogenous variable, namely the technology variable, has no direct influence on sustainability. The endogenous variable of business performance has a direct influence on the endogenous variable of sustainability.

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Relationship Between Variables

The relationship between exogenous and endogenous variables and endogenous and endogenous variables can be seen in the structural model below:

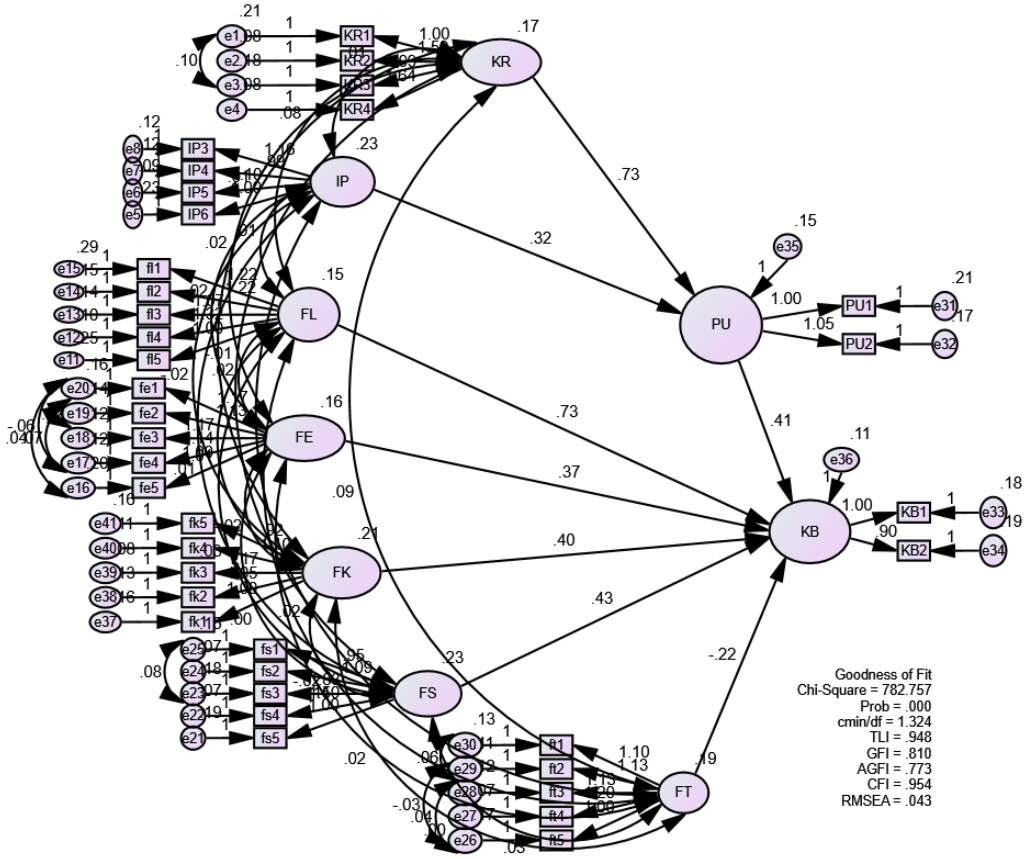

Figure 1. Structural Model

Table 4. Assessment of the Goodness Criteria of Fit Indices

Goodness of Fit Index	Value cut	Model Results	Information
Chi Box	Expected small	782	Marginal Pass
CMIN/DF	≤ 2.00	1.324	Suitable
RMSEA	≤ 0.08	0.043	Suitable
TLI	0.90 ≤ TLI < 1.00	0.948	Suitable
GFI	0.90 ≤ GFI < 1.00	0.810	Marginal Pass
AGFI	0.90 ≤ AGFI < 1.00	0.773	Marginal Pass
CFI	0.90 ≤ CFI < 1.00	0.9534	Suitable

Source: Primary Data, 2022

Based on Table 4, it can be seen that the model is feasible to use because most of the goodness of fit values have three Good Fit conditions and four Marginal Fit conditions. In empirical research, a researcher is not required to fulfill all goodness of fit criteria, but depends on the judgment of each researcher. The marginal value is the condition of the suitability of the measurement model with absolute fit or incremental fit criteria. However, it can still be continued for further analysis because it approaches the goodness of fit criteria. Therefore the overall model can be said to be in accordance

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with the data and can be analyzed further. This is also reinforced by the opinion of Santoso (2015) which states, if two or more of all the GOF used have shown a good match, then the model can be said to be good.

Once it is known that the model in this analysis is fit, then the next analysis is to determine the level of relationship and the significance or significance of the relationship between variables in this study. The test results with the AMOS program provide structural equation model results which show a relationship between exogenous, endogenous, and mediating variables. After knowing the description of the relationship between the variables of this study, the results of hypothesis testing will then be presented. The results of the SEM analysis will present values. The path coefficients between the following variables and the significance of the results of the hypothesis test in Table 5.

Table 5. Path Coefficient Values and Hypothesis Testing

Variable			Estimation	SE	CR	P
PU	<---	KR	.727	.126	5,780	***
PU	<---	I P	.323	.090	3,603	***
KB	<---	PU	.405	.096	4,222	***
KB	<---	FL	.728	.375	1,941	.049
KB	<---	FS	.427	.091	4,692	***
KB	<---	FT	-.217	.319	-.679	.497
KB	<---	FE	.369	.109	3,400	***
KB	<---	FK	.402	.095	4,219	***

Source: Primary Data, 2022

The structural equation model is as follows:

PU = 0.727*KR + 0.323*IP + e

KB = 0.728*FL + 0.369*FE + 0.427*FS – 0.217*FT + 0.402*FK + 0.405*PU + e

Based on the path coefficient value, it can be explained that sustainability (endogenous latent construct) has a statistically direct effect on business, environmental, social, economic, and institutional performance. But the impact of sustainability on technology is not statistically significant. This is because the significance value is more than 0.05. This is in accordance with FAO (2014), sustainability is a multidimensional concept that includes environmental integrity, human rights and welfare, a strong economy, and transparent government. In addition, FAO also states that there are four aspects of agricultural sustainability, namely environmental, socio-economic and governance aspects. The core notion of sustainability incorporates a variety of disciplines, interests and challenges. The condition of shallot farming in Mijen District shows that most farmers think that agricultural technology has not been able to have a positive impact on the farming being carried out, this is also evidenced by the adoption of technology in research sites which is still very limited. Most of the farmers still use manul technology for the cultivation process starting from the nursery to post-harvest. The actions needed to achieve sustainability vary depending on the challenge, goals and methods of achieving the goals and their relationship to the socio-ecological system. Sustainability uses various theories/approaches depending on the situation to improve human well-being. According to research from Sarkar et al. (2021), agricultural sustainability in developing countries is mostly concentrated in the context of eco-environmental aspects and other aspects are underestimated or ignored.

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Exogenous variables of the characteristics of respondents and production inputs have a direct effect on business performance variables. Apart from being an endogenous variable, the business performance variable is also an exogenous variable which is associated with the endogenous variable of sustainability. Respondent characteristic variables are determined by four indicators, namely education, age, land area and length of farming, with loading factors of 0.671, 0.918, 0.729 and 0.920 respectively. Based on these results, planting time plays an important role in improving farming performance and sustainable shallot farming practices. Production input variables are determined by the use of pesticides, use of seeds, labor and business capital, with loading factors of 0.849, 0.811, 0.868 and 0.709 respectively. Therefore, it is important to pay attention to the fulfillment of labor in order to improve business performance and the sustainability of shallot farming. The results of research on the characteristics of respondents and production inputs affect farming performance supported by research (Herdiana et al., 2016). The results of the study found that there was a significant influence between the variable characteristics of the respondents on income. Income in this study is included in the endogenous variable of business performance so that Herdiana's research is in line with that of shallot farmers in Mijen District. The better the characteristics of the farmer respondents and the affordability of production inputs will have a good impact on the sustainability of shallot farming.

Business performance is an endogenous variable from the characteristics of respondents and production inputs. Endogenous business performance variables have a direct relationship with sustainability variables. The results of business performance variables that affect the sustainability of farming are supported by research (Elviati et al., 2021). The results of the study found that the sustainability of farming was influenced by the price received by farmers, the higher the price received by farmers, the higher the income of farmers. The higher the farmer's income, the better the performance of the business being run. The business performance of shallot farmers in the study area is currently in good condition. This is supported by the selling price of shallots which is stable and above the breakeven point. Sustainable development will be more optimal if it is synergized with a commitment to build partnerships between agribusiness actors. The problem of price fluctuations often arises in shallot farming, this is because there is no cooperation or partnership system between business actors. When many areas enter the harvest season causing the availability of red onion products to be abundant, the yields cannot be absorbed properly which will cause prices to fall.

Environmental variables are represented by five indicators, namely crop rotation, weeding, avoiding burning crop residues, keeping pest predators at bay and using irrigation water, with loading factors of 0.655, 0.776, 0.746, 0.855, 0.612. Based on these values, it can be concluded that farmers pay attention to pest predators, in order to protect the cultivation environment from pest attacks and excessive use of chemicals. The use of irrigation water shows a low factor loading value, meaning that information or knowledge regarding the proper use of irrigation water needs to be increased.

Economic variables are determined by five indicators, namely the use of superior seeds, land ownership area, post-harvest measures, marketing locations and information on price developments, with factor loading values of 0.762, 0.778, 0.808, 0.799 and 0.673 respectively. Postharvest measures aim to maintain shallot quality and will affect the selling price. Recent knowledge or information regarding post-harvest actions really needs to be considered by related parties such as the government and farmer groups so that farmers really understand and understand it. The dissemination of information on price developments needs to be improved through coordination between farmers and institutions considering the factor loading value is still low.

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Social variables are determined by indicators of farmer health, social life, family support, time, and farmer motivation, with loading factor values of 0.758, 0.895, 0.689, 0.895 and 0.738 respectively. Social life is related to the environment where farmers live, a comfortable living environment without conflict creates calm in the farmer's household. Most farmers already feel comfortable in social life. Farmer motivation is related to the encouragement of farmers in farming, the higher the motivation of farmers, the more serious they are in carrying out farming activities.

The next variable is institutional which is determined by farmer group membership, access to counseling, access to financial institutions, marketing institutions and understanding of agricultural policies. Each of these indicators has a loading factor value of 0.753, 0.794, 0.879, 0.831 and 0.726. Farmers in the study areas feel helped by the ease of accessing financial institutions. The amount of capital used in shallot farming makes most farmers have to deal with financial institutions. The relationship between farmers and financial institutions must always be maintained properly so that they can provide a mutually beneficial relationship.

The use of technology in shallot cultivation in the research area has not received much attention. So this makes the technology variable not have a positive effect on the sustainability of farming. The existence of new technology allows additional production costs as well as increased risk and uncertainty. Regardless of the various problems that exist, it is necessary to identify problems at the cultivation level and map technological innovations that can overcome these problems. Conversely, increased production depends on the available technology and the willingness of farmers to apply the factors of production as a component of that technology. Institutional innovations in the form of counseling, financial support, and government policies, play an important role in driving technology adoption (Kwag & Oh, 2019).

CONCLUSION AND SUGGESTION

The income of shallot farmers per planting season in Mijen District, Demak Regency is Rp 119,319,173.00 with an average land area of 7,600 m^2. Profitability value of 159.35%. This value indicates that the average profitability of shallot farmers is greater than BRI bank deposit rates in 2022, meaning that the business is feasible to run. Respondent characteristics and production inputs have a positive effect on farming performance. Four exogenous environmental, economic, social, and institutional variables have a significant effect on the endogenous variables of sustainability, then the technological variables have no significant effect on sustainability. Business performance variables have a significant effect on the sustainability of farming.

The suggestions submitted based on the results of the analysis and discussion are also intended as recommendations for improving shallot farming so that it has a sustainable farming category. Recommendations are intended for the government, farmers and further researchers. Sustainability of farming is a national development goal that can be achieved through coordination between related parties. Appropriate coordination methods will provide a large understanding effect, especially for farmers who mostly have lower human resources than the government. Suggestions for appropriate coordination methods include embracing all farmers and conveying some information related to sustainability in a relaxed manner, such as during breaks in the garden or when there is an agenda for meetings between farmers. the technology variable is still a variable that has no significant relationship to sustainability. This situation will certainly be different if the research is carried out at different times and places or at the same place with further exploration regarding the indicators

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forming technological variables. Limitations in this study is only using quantitative methods. Future researchers can use qualitative analysis or a combination of qualitative and quantitative analysis to get better and clearer results.

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