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ARAŞTIRMA MAKALESİ **RESEARCH ARTICLE**

Factor Determining the Smallholder Farmer's Perception on Organic Farming: A Case of Makmur Sejahtera Farmers Group, Batu City, Indonesia*

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Abstract

The perception of farmers in dealing with the phenomenon of climate change is to minimize the impact of reducing the productivity of agricultural products. Climate change which has an impact on the agricultural sector is also caused by unsustainable agricultural practices. Several studies have examined the adoption of organic farming innovations that are sustainable from an environmental aspect and increase farmer income. However, there has been no research on farmers' knowledge and perceptions of implementing organic farming as a climate change adaptation strategy. This research aims to analyze the factors that shape farmers' negative perceptions of organic farming and characteristics of the farmers. The sampling technique in this research uses a probability sampling approach with a total of 80 farmers with interviews using two languages, namely Javanese (local language) and Indonesian to make it easier to understand the research questions. This research used Second Order CFA with WarpPLS 5.0. The basic theory that is found in this study is farmers pay more attention to the attributes of innovation, observability of yields, and access to information. Farmers in Makmur Sejahtera Farmers Group are classified as laggards and late majority. The visible results from the demo plot of organic farming are lower than the results from land that applies conventional farming. Farmers prefer to use pesticides and chemical fertilizers to deal with pest explosions due to climate change. Based on the results, the adoption of organic farming for an adaptive climate change impact with a management policy was recommended.

Keywords: Climate change; Confirmatory factor analysis, Innovation adoption, Laggard, Negative perception

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1. Introduction

Green Revolution with the aim of increasing food production massively sacrificed soil health due to excessive use of chemical fertilizers. Starting from this, theories and concepts regarding organic farming emerged to help overcome the problems of soil degradation and fertility. The concept of organic farming is the formation of an agricultural system that optimizes the biological potential of the soil and preserves underground water resources without chemicals. Interactions between soil biota that are stable and according to capacity can provide profitable and sustainable agricultural results (Palaniappan and Annadurai, 2018).

The agricultural sector contributes about 24% of global carbon emissions (IPCC, 2014). In the agribusiness sub-system, Mzoughi (2011) described the use of intensive chemicals such as pesticides is increasingly opposed because it causes environmental damage. According to Berg and Tam (2018), they have the opposite effect on agricultural output, which can reduce productivity and profits in the long run. For example, Tran-Nam and Tiet (2022) reported that the excessive use of pesticides can cause resistance to plant pests and result in environmental degradation. According to Mayrowani (2012) conventional farming systems can damage the soil and reduce the productivity of agricultural products in the long term. By reducing the use of synthetic fertilizers, herbicides, pesticides, and fungicides, organic farming provides an alternative to sustainable farming practices (Bhat et al., 1994). The application of organic farming focuses on agroecological health which can increase soil fertility and crop quality (Kuepper, 2010). Compared to conventional farming, organic farming has 30% higher species diversity with varying percentages (Bengtsson et al., 2005). The advantages of organic farming, when viewed from an environmental perspective, are that it is environmentally friendly and does not leave harmful residues because it does not use synthetic chemical compounds such as fertilizers, pesticides, and plant growth regulators (Astuti et al., 2016). Organic farming can also increase farmers' income due to more effective use of resources and not depend on more expensive chemical inputs (Eviyati, 2007).

Organic farming has developed significantly in various countries. In Europe, as many as 350,000 producers manage 12.7 million hectares of organic land (11.2 million hectares from the European Union). 25% of the world's organic land is in Europe. North America and Europe generate the most sales of organic products (90 percent of organic food and beverage sales). Many organic crops grown in the region are intended for export. The global market for organic food and drink has nearly quadrupled between 2000 (US$18 billion) and 2015, and Organic Monitor projects growth will continue (Willer et al., 2017). In the last two decades, there has been an increase in consumer interest in organic food as seen from the global demand for organic food (Muhie, 2022). In line with research in the United States, every 1% increase in organic farming area can reduce GHG emissions by 0.049% (Squalli and Adamkiewicz, 2018). Organic farming can eliminate emissions from waste by converting organic waste into compost to be used as fertilizer and play an important role in maintaining optimal soil health and reduce N20 emissions (Squalli and Adamkiewicz, 2018; Petersen et al., 2006). The economic value of ecosystem services in organic farming can range from $1610 to $19,420 per hectare (ha) per year versus $1270 to $14,570 in conventional farming (Sandhu et al., 2008). On the other hand, it examines that organic farming has guaranteed livelihoods, food security, and increased income as economic motivation (Jensen et al., 2009).

In contrast to organic farming in Europe and other developed countries, in Indonesia, the development of organic farming is still develop. The origins of the Indonesian organic farming movement can be traced back to the 1970s (Schreer and Padmanabhan, 2020). The Indonesian government supports the development of organic agriculture, as stated in the Ministry of Agriculture's Strategic Plan 2015-2019 regarding horticulture-based organic village development programs, one of which is the 1000 Organic Village Program, which is scheduled to be completed in 2020 (Kementan, 2016). One of the organic farming centers in Indonesia is Batu City. Batu City is located in the highlands with low air temperatures and high humidity. Such climatic conditions are suitable for the development of agriculture, especially types of horticultural crops. The Batu City Agriculture Service also aligns with the “Go Organic Batu Program”. The land in Batu City is mechanical soil that contains lots of minerals from volcanic explosions, making it suitable for developing organic farming. In the economic structure of Batu City, especially in the Bumiaji District, the agricultural sector makes a significant contribution to the Gross Regional Domestic Product (Badan Pusat Statistik Kota Batu, 2018).

With regard particularly to the 1000 Organic Village Program, such program did not succeed as indicated by the low participation from the farmers. Vu et al. (2020) explain that insufficient knowledge of farmers about the

harmful effects of using chemicals, information and subsidies for organic fertilizers. According to Tran-Nam and Tiet (2022) the influence of socio-psychological factors in promoting organic farming including the influence of peers, social norms, and personal norms. Farmers in one of the villages in Batu City (Giripurno Village) allegedly have different perceptions of organic farming, so only a few wants to implement organic farming systems. This indication is supported by the fact that Giripurno Village that only 5 out of 2,228 active farmers have implemented organic farming. The obstacles faced by farmers in developing organic farming include the absence of a benchmark price that is suitable for farmers, the need for expensive investments at the start of cultivation, and the uncertainty of the local market, so farmers are reluctant to produce (Mayrowani, 2012).

Farmers are the target actors for adopting organic farming innovation. Simin and Janković (2014) argue that the theory of innovation diffusion is still relevant for the field of study in understanding the adoption of organic farming innovations. Adoption is classified by Feder et al., (1985) into two categories, namely individual adoption and aggregate adoption. Innovation adoption that occurs among farmers is included in individual adoption. At the farmer level, the level of use of new technology in long-term equilibrium can occur when farmers have complete information about new technology and its potential. This implies technology adoption occurring and continuing over a relatively longer period of time.

Rogers (1983) The Diffusion of Innovation Theory explains this process by mentioning several stages that a person will enter before adopting new technology. These stages are knowledge, persuasion, decision, implementation, and confirmation. Individuals in this case are farmers reaching the persuasion stage after developing attitudes towards technology. This attitude can be positive or negative which influences the decision stage and will lead to acceptance or rejection of the innovation. The elements of the persuasion stage consist of innovation characteristics which include relative advantage, compatibility, complexity, triability, and observability. Unfortunately, when innovation rejection occurs, there is not much research that examines why this rejection occurs? What factors lead to resistance at the decision stage? Therefore, identifying innovation rejection factors in terms of the persuasion stage based on the characteristics of this innovation is important to study. Exploration of situational factors that cause farmers to be reluctant to adopt innovation, namely organic farming, is very important to study further. So, in the future, the program launched by the government can be realized as the right target, and proper strategic management can be found to change the mindset of farmers regarding organic farming and increase the number of organic farmers in Indonesia.

2. Materials and Methods

This study took a quantitative method. This study looked at the situational aspects that influence farmers' perceptions about organic farming. Data was analyzed using inferential statistical tests in the form of confirmatory factor analysis (CFA). Giripurno Village, Bumiaji District, Batu City, East Java, Indonesia was the site of the study. The location determination was carried out purposively or deliberately with the consideration that several villages selected to run the Batu Go Organic Program, Giripurno Village is a representation of horticultural farmers funded by the government to develop 10 hectares of organic farming in the field of horticulture. The Indonesian government has provided assistance in processing organic land certification. However, in recent years the progress of farmers in Giripurno Village has not progressed significantly, so researchers chose this village to study the failure factors of the innovation decision process.

The sampling technique in this study uses a probability sampling approach. According to (Plano Clark and Creswell, 2015), the use of the probability sampling method is carried out when the elements of the population have the same opportunity to be selected as the sample. The sampling is simple random sampling, a technique for obtaining samples directly carried out at the sampling unit. Each sampling unit is a population element with the same opportunity to be sampled or represent the population. The choice of simple random sampling was used because the members of the population were considered homogeneous, namely the majority of farmers in Giripurno Village had not yet implemented organic farming. The number of samples used in this study refers to Hair et al. (2010) statement that the number of samples provides representative results of 5-10 times the indicator variable. This study used a sample of 80 people. The validity data was obtained from the number of indicators as much as 13 multiplied by 6.

In this study, the types of data used are primary and secondary data. Primary data collection was carried out using several techniques, namely interviews and observation with Javanese (local language) and Indonesian to make it easier to understand the research questions. The interview was conducted in a structured manner through planned and

prepared questions. Interviews will be carried out with the help of a questionnaire consisting of closed and open questions. Interviews were conducted while observing to directly observe the activities of farmers in the research location and aim to provide additional data on the research results. Secondary data related to the research is in the form of village monograph data, village general description, village geographical conditions, village demographic conditions, and village economic conditions.

Farmers' perceptions and characteristics of innovation belong to latent variables that cannot be measured. However, to be measured, indicators are needed to represent these variables. In categorizing farmers' perceptions of organic farming based on the farmers' characteristics, it is obtained that the interpretation criteria for the average score are made by calculating class intervals or the width of the interval. The highest score is 5 and the lowest is 1, thus the range R = 5-1 = 4 is obtained. The number of classes is set at 5, according to the design of giving a response score to the questionnaire. The width of the interval (k) is obtained from the range / highest score, namely k = 4/5 = 0.8, and a score is obtained with the following criteria:

1 – 1.8 = Positive

1.81 – 2.6 = Neutral

2.61 – 3.4 = Negative

Confirmatory factor analysis determines the factors contributing significantly to forming farmers' perceptions of organic farming. This research uses Second Order Confirmatory Factor Analysis (CFA) because the latent variables are multidimensional. The latent variables formed from the dimensional latent variables include unidimensional constructs with the direction of reflective and formative indicators (Solimun et al., 2017).

This latent variable is included in a multidimensional construct because the situational factors that shape farmers' perceptions are also formed from five latent variables: the characteristics of innovation and the direction of the relationship between formative indicators. Meanwhile, the five innovation characteristics can be measured with indicators that reflect the direction of the relationship. This study uses a multidimensional construct with type 2, which means the first-order-reflective and second-order-formative constructs. The use of confirmatory factor analysis consists of latent variables and indicator variables. Latent variables are variables that cannot be formed and built directly, while indicator variables are variables that can be directly observed and measured.

3. Results and Discussion

3.1 Characteristics of Farmers

The data on the characteristics of the farmers presented were obtained from the results of the analysis of primary data obtained from interviews with questionnaires. Farmer characteristics consist of age, education level, farming experience, and land area. The following is the result of a descriptive analysis of personal factors on organic farming based on the average score of the respondents' answers which will be explained in *Table 1*.

Table 1. Scores of farmers' perceptions of organic farming

No.	Personal Factors	Dominant Characteristics	Average Score	Perception category
1.	Age	46–55 year	3,28	Negative
2.	Education	Elementary school	3,28	Negative
3.	Farming experience	More than 30 years	3,26	Negative
4.	Land area	Less than 0,2 acre	3,3	Negative

In *Table 1*, the results show that farmers have a negative perception of the application of organic farming systems in vegetable cultivation. The momentum of a farmer's adoption of an innovation is related to the proportion of people who adopt it in the social system. Not all farmers can adopt technology at the same time because it is influenced by social factors such as level of education and farming experience. The diffusion of an innovation follows an S-shaped cumulative adoption curve (Rogers, 1983). This explains that organic farming does not appear to be superior, cheaper, or more reliable than conventional farming, organic farming is not by individual values and experiences and is difficult to understand and apply, organic farming cannot be tried in a limited way and the result of an innovation has not proven

successful. Farmers' decisions to adopt organic farming depend on various factors, such as economic characteristics and farm structure, characteristics of farmers and households, such as age, education, and household size. Farmers with an average age above 45.2 years are classified as Laggards (challenging to accept innovation) in organic farming (Läpple and Rensburg, 2011). However, based on the level of education and in-depth interviews, it was revealed that farmers have not adopted organic farming because their neighbors or farmers close to their land have not implemented organic farming, so the results are not yet visible. Doubt arises because of the fear of failure. So, farmers in Giripurno Village can be categorized into the late majority type. Rogers (1983) describes the late majority as people who approached with a skeptical and cautious air, and the late majority does not adopt until most others in their social system have done so.

When compared with young farmers, older farmers are usually less risk-averse and have less time to invest in the long term (Sapbamrer and Thammachai, 2021). The level of education affects the speed of adopting innovations in organic farming because the level of education influences the mindset and insights of farmers in farming. Farmers with low education are more likely to be profit-oriented and yield yields without regard to the long-term sustainability of the ecosystem. The level of education will affect a person cognitively. That is, highly educated people are more likely to have high reasoning (Suwaryo and Yuwono, 2017). Farmers in Giripurno Village are classified as Laggards and the Late Majority have difficulty adopting organic farming. In tune with implementing organic farming practices on narrow land will make it easier to manage in fulfill the required organic regulations. Early adopters were the youngest to adopt organic farming (Läpple and Rensburg, 2011). However, at the same time, farmers do not have experience in organic farming, as a result, farmers are increasingly reluctant to take risks (Sriyadi and Yekti, 2021).

3.2 Perception of Farmers in terms of Characteristics of Innovation

The model used has been tested as valid and reliable. Then we can see the factors that shape farmers' perceptions of organic farming by looking at the value of the effect size indicator in the Warp PLS 5.0 application for each indicator and dimension variable forming perceptions. Interpretation of the second level of confirmatory factor analysis is used to determine the most dominant situational factors in shaping farmers' perceptions of organic farming. Situational factors that shape farmers' perceptions are formed from the contribution values of the five latent variables from the persuasion stage described in the model for innovation-decision process in Diffusion of Innovation Theory in *Figure 1* are relative advantage, compatibility, complexity, triability, and observability.

The measurement indicators for each latent variable were identified from several previous studies and adapted to the conditions at the research location. The measurement indicators for each latent variable were identified from several previous studies and adapted to the conditions at the research location. Argiles and Brown (2010) in organic and conventional farming there are differences in the composition of labor costs and agricultural production facilities. The composition of labor costs is of course closely related to the allocation of cultivation time. Hidayat and Lesmana (2011) stated that the difference in cost composition will have an impact on the amount of financial profit from the prices of organic and conventional vegetables. Cullen et al. (2016) also highlighted the importance of access to information and knowledge sharing among farmers in facilitating the dissemination of organic farming practices. From the consumer side, the indicator studied is demand. In the last two decades, there has been an increase in consumer interest in organic food as seen from the global demand for organic food (Muhie, 2022).

According to Schiffman et al. (2016), Perception is a process that describes individual beliefs in selecting, organizing, and interpreting stimuli about what is valid or what is true for that individual. When this belief has been formed, it will become the basis of one's knowledge about what is expected of a particular object. In this case, farmers have a negative perception of organic farming, which is good for the environment, so it can be seen that farmers do not have confidence in organic farming systems. Organic farming is an innovation in sustainable and environmentally friendly agricultural cultivation practices. This is also a new thing for farmers who previously practiced conventional cultivation. This study examines the factors that shape farmers' perceptions of innovations, namely organic farming, concerning the five characteristics of innovations from Rogers (1983): relative advantage, compatibility, complexity, triability, and observability. These variables contribute to farmers' perception by 21%; 21.3%; 17.9%; 13.7%; and 26.1%. Based on this, it can be seen that easily observable factors of 26.1% dominate the dominant situational factors forming farmers' perceptions of organic farming. The results of the model evaluation for each variable for the parameters measuring validity and reliability follow the rule of thumb, namely the p-value <0.05; composite reliability value> 0.7; and the value of AVE (Average Variance Extracted) > 0.5 (Solimun et al., 2017).

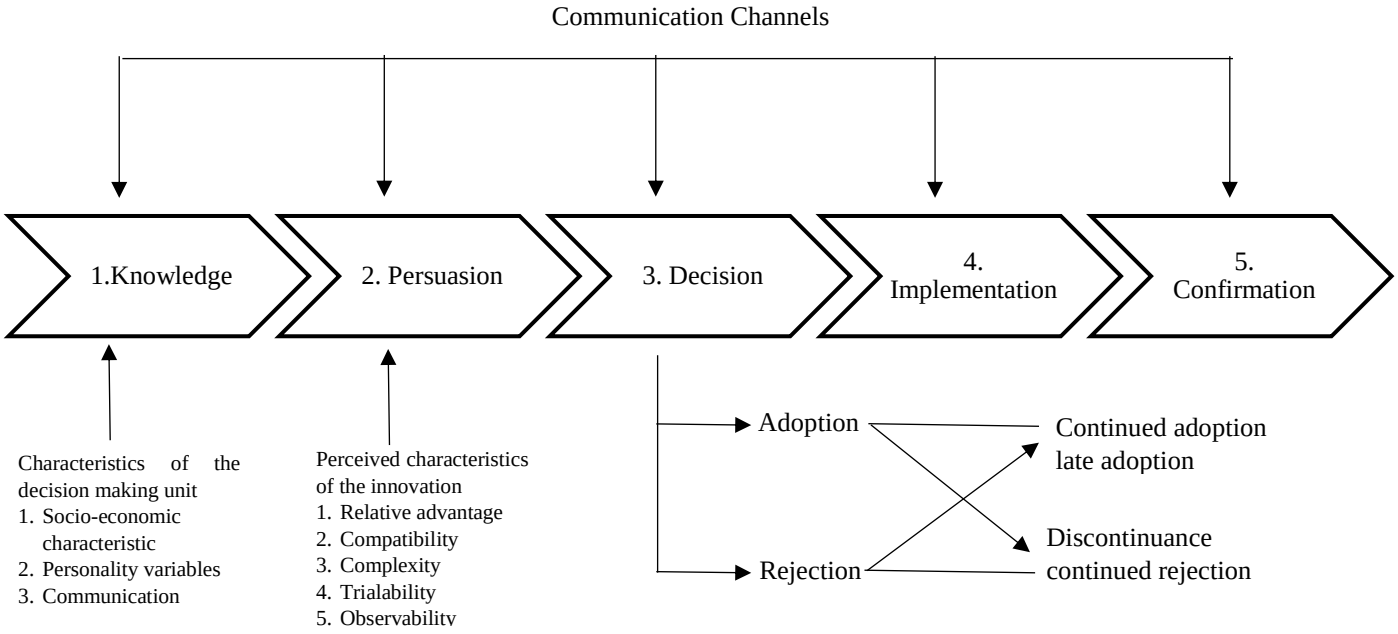

Figure 1. Model for innovation-decision process Rogers (1983)

The low adoption rate of organic farming is due to various reasons, such as high production costs and low demand for organic products in the market (Bui and Nguyen, 2021). The most dominant factors forming the perception of farmers in Giripurno Village are crop yields and limited access to information obtained by farmers (*Figure 2*). The lack of farmer information is caused by the majority of farmers in Giripurno Village not joining farmer groups, even though assistance and subsidies are distributed through farmer groups. Extention agencies in each farmer group provide information to farmers (Yaseen et al., 2016). Cullen et al. (2016) also highlighted the importance of access to information and knowledge sharing among farmers in facilitating the dissemination of organic farming practices. Successful agricultural extension can help accelerate the adoption of new technology and its implementation on farmers' land (Läpple and Rensburg, 2011). But, according to Modirwa (2019), only large-scale farmers and those with higher education levels can get information from extension workers. Neighbors and relatives also alternative access to information from farmers. Farmers tend to follow other farmers in adopting innovations such as organic farming. Wollni and Andersson (2014) found that farmers were more likely to adopt sustainable agricultural practices if they believed their neighbors valued their adoption. There needs to be encouragement to help farmers behave more positively towards organic farming (Streletskaya et al., 2020). Besides that, organic vegetable yields in demo plot land found holes bitten by pests, varying sizes of vegetables or fruit, paler leaf color, and small yields because they were not given plant growth stimulants prohibited for use in organic farming cultivation. So, farmers' perceptions that organic farming results cannot be proven to be better than conventional agricultural products.

The second element after complexity is compatibility which describes farmers' perceptions that organic farming is not following the values and experiences of farmers. Organic farming is not following farmers' habits in using chemical substances to control pests and diseases of cultivated plants. Farmers are used to using their entire land area for planting vegetables so that they can produce more. However, when switching to organic cultivation, making a buffer zone or ditch with a width of about 3 meters is recommended. Farmers tend to prefer instant and practical applications rather than having to take their time off to make botanical pesticides and biological agents collectively.

Following are the results of the Second Order Type 2 model used in this study:

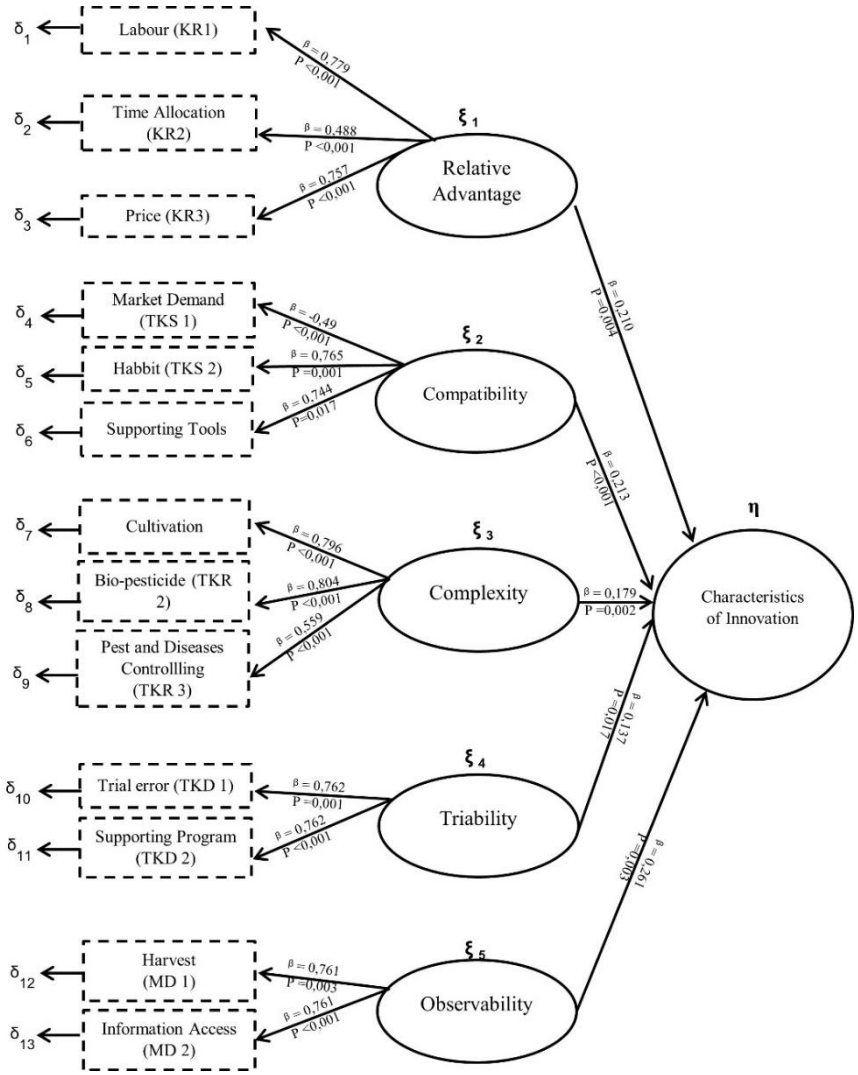

Figure 2. Indicator Effect Size value of situational factors of farmers' perceptions of organic farming

There is currently no policy of subsidizing organic farmers with guaranteed income and access to farm credit to encourage them to convert their farms to organic farming (Darnhofer et al., 2005). The development of the country's agriculture depends also on the development of rural areas. Government programs and policies help sustain farmer production (Sari Gedik and Yilmaz, 2023). Small-scale farmers feel they need more support to access government support and subsidies to apply organic farming (Tran-Nam and Tiet, 2022). Läpple and Rensburg (2011) state that not all farmers adopt technology simultaneously because there are differences between early, middle, and late adopters in responding to economic and non-economic factors to consider whether to practice organic farming or not. Risk considerations by growers limit late adoption. On the other hand, the impact of sharing information on the demand for organic agricultural products between business actors is still poorly understood (Yu et al., 2021).

The application of organic farming requires more intensive care, such as a more significant number of workers or an increased number of working hours. The selling price of organic agricultural products is the same as non-organic products because there is still little market demand for organic products in the marketing area of Giripurno Village. Farmers' decisions are also influenced by economic factors, including agricultural policies, market structure, and the availability of technology (Jaime et al., 2016). In making adoption decisions, farmers are generally influenced by families (Yilmaz et al., 2019). Farmers also still used to rely on agricultural inputs such as pesticides, fertilizers, and crop protection inputs (Tran-Nam and Tiet, 2022).

4. Conclusions

Farmers in one of the villages in Batu City (Giripurno Village) allegedly have different perceptions of organic farming, so only a few wants to implement organic farming systems. This indication is supported by the fact that Giripurno Village that only 5 out of 2,228 active farmers have implemented organic farming. There are many factors that can influence a farmer's adoption decision. It is explained in Rogers' theory (1983) that individuals in this case are farmers reaching the persuasion stage after developing attitudes towards technology. This attitude can be positive or negative which influences the decision stage and will lead to acceptance or rejection of the innovation. Therefore, identifying innovation rejection factors in terms of the knowledge and persuasion stage based on the characteristics of this innovation is important to study. This research aims to analyze the factors that shape farmers' negative perceptions of organic farming and characteristics of the farmers used Second Order CFA with WarpPLS 5.0.

Situational factors that shape farmers' perceptions are formed from the contribution values of the five latent variables from the persuasion stage described in the model for innovation-decision process in Diffusion of Innovation Theory in Figure 1 are relative advantage, compatibility, complexity, triability, and observability.The measurement indicators for each latent variable were identified from several previous studies and adapted to the conditions at the research location. The measurement indicators for each latent variable were identified from several previous studies and adapted to the conditions at the research location

Apparently, Farmers in Giripurno Village are classified as laggards and late majority who have difficulty adopting organic farming. The most dominant factors forming the perception of farmers in Giripurno Village are crop yields and limited access to information obtained by farmers. Perception is a process that describes individual beliefs in selecting, organizing, and interpreting stimuli about what is valid or what is true for that individual. When this belief has been formed, it will become the basis of one's knowledge about what is expected of a particular object. Besides that, we found that farmers were more likely to adopt sustainable agricultural practices if they believed their neighbors valued their adoption. There needs to be encouragement to help farmers behave more positively towards organic farming. Suggestions from researchers for future researchers are advised to review this research more specifically using qualitative research methods and in-depth interviews so that the results obtained are maximized.

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Ethical Statement

There is no need to obtain permission from the ethics committee for this study

Conflicts of Interest

We declare that there is no conflict of interest between us as the article authors.

Authorship Contribution Statement

Concept: Annisa FIRDAUZI and Titik EKOWATI; Design: Annisa FIRDAUZI, Titik EKOWATI, and Agus Subhan PRASETYO; Data Collection or Processing: Annisa FIRDAUZI and Titik EKOWATI; Statistical Analyses: Annisa FIRDAUZI, Agus Subhan PRASETYO, and Joko MARIYONO; Literature Search: Annisa FIRDAUZI, Titik EKOWATI, Agus Subhan PRASETYO, and Joko MARIYONO; Writing, Review and Editing: Annisa FIRDAUZI, Titik EKOWATI, Agus Subhan PRASETYO, and Joko MARIYONO

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