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Analysis of Factors Influencing Farmers' Responses toward the Adoption of Hand Tractors in Palae Village, Sinjai Regency

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Abstract: This study aims to analyze the factors influencing rice farmers' responses toward the adoption of hand tractors in Palae Village, Sinjai Regency. The research employed a quantitative descriptive method using multiple linear regression analysis. The study population consisted of 772 farmers, with the sample determined using the Slovin formula. The results showed that, simultaneously, all independent variables significantly affected farmers' responses. Partially, the variables of age, education level, and farming experience had a negative and significant effect, while land area and time efficiency had a positive and significant effect on farmers' responses. Meanwhile, operational costs were found to have no significant effect. These findings indicate that practical benefits, such as time savings and ease of land cultivation, are the main driving factors behind farmers' positive responses toward agricultural mechanization in the research area.

Keywords: Farmers' Response, Hand Tractor, Technology Adoption, Multiple Linear Regression, Sinja

1. Introduction

Agriculture is an important sector in Indonesia's economic development because the majority of the population still depends on agricultural products for their livelihood. Rice, as a staple food, plays a vital role in meeting the population's consumption needs. The Indonesian government, through the Ministry of Agriculture, is highly focused on improving food crop farming, as evidenced by its intensive assistance to the food crop sector. One such effort is the provision of agricultural equipment and machinery. Hand tractors are one of the most widely used agricultural tools by farmers today.

A hand tractor is a power source used to pull implements for soil cultivation, such as plows. As a soil cultivation tool, hand tractors have a high adaptability to land conditions in Indonesia. Technically, using a hoe for soil cultivation provides a very low work capacity and work comfort level compared to using a hand tractor. One part of a hand tractor is the drive component, namely the tractor's iron wheel. The tractor's iron wheel has several components, including the wheel ring, iron wheel fins, flanges, wheel ring trellis, bolts, and nuts (Suyuti, 2019).

The process of plowing rice fields, which usually uses traditional tools such as

ox plows, hoes and pitchforks, takes a long time and requires a lot of energy, has now shifted to using rice field plowing machines. modern or commonly known as hand tractors, in addition to increasing plowing efficiency by reducing working time when compared to using traditional tools (Sulnawati et al., 2016).

Agricultural technology is any systematic approach to increasing the efficiency of human endeavor through the use of previously known knowledge and techniques (Arifin et al., 2024). The term "technology" refers to the body of knowledge that has been applied to the creation of usable tools, systems, and infrastructure. The authors define technology as the application of scientific knowledge to the creation of equipment such as machines, adjustments, arrangements, and processes that assist humans in daily tasks and provide efficient and useful answers to problems plaguing modern society. In today's digital age, technology is essential to everyday life, so a basic understanding of technology is crucial. Individuals can better integrate into today's technology-dependent society and benefit from current technological advances if they have a solid understanding of the subject.

Sinjai regency is known for its abundant agricultural potential, particularly in the production of rice, corn, and horticultural commodities. The hand tractors as a tool in rice cultivation is one effort to increase productivity and ease the workload for farmers. However, technology adoption is not always smooth, as farmer acceptance of modern equipment is influenced by several factors. Farmer responses consist of various methods and actions taken to overcome difficulties and capitalize on opportunities (Rusydi & Rusli, 2022).

The use of hand tractors on agricultural land has been widely carried out. So far, hand tractors have been known as tools that really help farmers in cultivating land, especially to speed up the plowing process and save energy. In many places, this tool is already quite commonly used. However, the reality is that the use of hand tractors by farmers is not always evenly distributed, depending on the situation in each region. Some farmers immediately adopt it because they see its benefits, while others simply follow trends or because other land management options are limited.

Although the use of hand tractors has become increasingly common in Palae Village, farmers' responses toward this technology remain dynamic and are influenced by various individual and technical backgrounds. So far, there has been no in-depth analysis of how characteristics such as age, education, and farming experience, as well as supporting factors such as land area and cost efficiency, interact in shaping farmers' attitudes. Therefore, this study aims to empirically analyze the factors influencing rice farmers' responses toward the adoption of hand tractors in Palae Village. The findings of this study are expected to serve as a policy reference for local governments in formulating more targeted agricultural mechanization strategies based on the local characteristics of farmers.

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2. Methodology

2.1 Types of Research Locations

The research location was carried out in Palae Village, South Sinjai District, where the majority of the location is. The population is predominantly rice farmers. This research was conducted from May to June 2025.

2.2 Population and Sampling Techniques

The population in this study is the population in this study is 772 farmers who cultivate rice and utilize agricultural machinery or tools in Palae Village, South Sinjai District Sinjai. The sample used in this study was a purposive sampling technique. Where data sources are taken with certain considerations. "For example, the person is considered to know the most about what we expect, or perhaps because they are in power, this will make it easier for researchers to explore the object/ social situation being studied" (Sugiyono, 2012). The subjects of this study were rice farmers in Palae Village who met the criteria listed above. Sampling in this study uses simple random sampling, also known as simple random sampling. This sampling technique provides an equal opportunity for every member of the population to be included in the research sample. The population in this study was all members of the farmer groups from five hamlets, totaling 772 people. The selection of respondents was carried out by considering the representation of farmers who had shifted from traditional methods to the use of hand tractors for at least the last two planting seasons, so that the perception data obtained would be valid and based on direct experience. The Slovin formula was used to

determine the sample size:

$$N = \frac{N}{1 + N(e)2}$$

Information:
n = Sample Size
N = Total Population
e = Error Tolerance

There are two provisions in the Slovin formula for determining error tolerance, namely:
1) The value of e = 10% (0.1) if the population is large.
2) The value of e = 20% (0.2) if the population is small. Slovin's formula is used if the population size is known

2.3 Types, Sources and Data Collection Technique

This research uses two types of data, namely:
1) Primary data is information obtained from observations or interviews with people in the field. The names of respondents, potential human resources, and the use of machinery by farmers are the three main pieces of information required.
2) Secondary data, namely data obtained from various sources or other related agencies, such as sub-district offices and agricultural extension offices. (Kolkman & Blackburn, 2014).

2.4 Data Analysis Technique

This test aims to determine the partial significance of the role of the independent variable on the dependent variable and assumes that other independent variables are considered constant by classifying their responses into 5 groups by analyzing the measurement of observation indicators using a "*Rating Scale*" or value scale is data analysis to answer questions (Singaribun and Efendy, 2006) The raw scores from the Likert scale were then transformed into interval data to meet the basic assumptions of multiple linear regression analysis, allowing the causal relationships among variables to be measured parametrically. with the following provisions:

Strongly Agree : 5
Agree : 4
Doubtful : 3
Don't Agree : 2
Strongly Disagree : 1

To measure the level of farmer response to the use of hand tractors, the following test methods are used, namely:

1) Research Instrument Test
   Research instrument testing is used to ensure that the research instrument can produce valid, reliable and accurate data so that the research results can be trusted and have good quality. The research instrument tests used were validity tests and reliability tests. The equation can be said to describe the functional relationship of a group of independent variables to the dependent variable, if the variables fulfill the Classical Assumptions, the assumptions seen are the assumption of following a normal distribution, the assumption of being free from collinearity and the assumption of not being heteroscedastic.
2) Hypothesis Testing
   Hypothesis testing aims to determine whether the sample data obtained supports or rejects a previously formulated hypothesis. The hypothesis tests used in this study are the Simultaneous Test (F Test), the

Coefficient of Determination Test (R2 Test), and the T-Test (Significance Test).

3) Multiple Linear Regression Test

To determine whether each independent variable (X, X2, X3, and so on) individually has a significant influence on the dependent variable (Y), multiple linear regression analysis was used to determine what factors influence farmers' responses to the use of hand tractors in Palae Village. Multiple linear regression analysis was calculated using the formula:

$$Y = a + b1\ X1 + b2\ X2 + \ldots.. + b6\ X6$$

Keterangan :

Y : Response
a : Constant
b : Regresion Coefisient
X1 : Age
X2 : Level Of Education
X3 : Farming Experience
X4 : Land Area
X5 : Time Efficiency
X6 : Operating Cost

Hipotesis Testing:

Ho : $b1 = b2 = b3 = b4 = b5 = b6$
Po : Proporting Of Population (50%)
X : The number of samples that have a high response in rice cultivation
N : Total numbers of sampels
Ha : $b1 \neq b2 \neq b3 \neq b4\ b5 \neq b6 \neq b7$
Ho : There is no influence between age, education level, farming experience, land area, time efficiency and operational costs of farmers
Ha : There is an influence between age, level of education, farming experience, land area, intensity of attending extension services, perceptions, and farmer motivation.

3. Results and Discussion

3.1. Respondent Charasteristic

Based on the results of data processing, the majority of respondents in this study were male farmers, as many as 44 people, while female farmers numbered 33 people. When viewed by age group, most were in the 46 to 60 year age range. In terms of education, elementary school level was the most, namely 31 people. Judging from farming experience, most farmers had between 11 and 30 years of experience, with a total of 51 people. Meanwhile, based on the area of land cultivated, the majority of farmers managed rice fields less than 0.5 hectares, namely 41 people. In terms of processing land, most of the respondents, namely 47 people, used agricultural equipment in the form of rented hand tractors.

3.2. Result and Discussion

Farmer response is a way for someone to show their expression to a certain stimulus. In this case, the use of hand tractors as a form of modern agriculture with farmers' assessments can be positive if farmers consider the technology useful, or negative if farmers consider the technology not suitable for their needs or conditions (Azwar, 2016). This study examines variables X and Y. Where variable X consists of X1 farmer age, X2 farmer education, X3 farming experience, X4 land area, X5 time efficiency, and X6 operational costs.

3.2.1 Uji T

Table 1. T-test

Varible	T Count	T Table	Information
X1	-95,559	0,220	Significant
X2	-23,207	0,220	Significant
X3	-2,185	0,220	Significant
X4	2,661	0,220	Significant
X5	7,586	0,220	Significant
X6	0,058	0,220	Not Significant

Source: Primary Data Processed 2025

1) The influence of the farmer's age factor (X1) on the use of hand tractors in Palae Village

Age can be defined as the length of time a person has lived since birth. In the agricultural context, older farmers typically have more experience than younger farmers. On the other hand, young farmers tend to be more open to new challenges and willing to take risks, so they gain experience in farming activities more quickly.

Based on the T-test results, the farmer's age variable obtained a calculated T of -95.559, which in absolute terms far exceeds the T table (0.220). This condition indicates that the influence of farmer age on the response to tractor use is statistically significant. The negative sign on the coefficient indicates an inverse relationship, namely that the older the farmer, the lower their tendency to give a positive response to this technology. Elderly farmers tend to be less interested in technological developments because they feel less familiar and require adjustments that are not always easy to do, such as requiring special skills. This finding emphasizes the importance of adopting different assistance approaches for senior farmers and younger farmers, where senior farmers require more intensive and practical technical training to overcome psychological barriers toward new technology.

Meanwhile, younger farmers generally show a more open attitude to technological developments, learning how new technologies work more quickly and being more willing to try methods they believe can increase productivity. This aligns with the findings of Khan et al. (2024) who stated that age influences the rate of hand tractor adoption, with younger farmers more receptive to technological changes than older farmers.

2) The Influence of Farmer Education Factor (X2) on the Use of Hand Tractors in Palae Village

Farmer education (X2) has a calculated T of -23.207, which absolutely exceeds the T table of 0.220 with a significance value of <0.05. This finding indicates that education has a significant effect on farmers' responses in using hand tractors. Like the farmer's age variable (X1), a negative coefficient value indicates an inverse relationship in the opposite direction between the level of education and positive farmer responses. This indicates that the higher the farmer's education, the lower their tendency towards a positive response to the use of hand tractors. This could be due to broader considerations from highly educated farmers, such as maintenance costs, long-term effectiveness, or even alternative technologies that are considered more advanced than hand tractors.

Farmers with lower levels of education generally place more emphasis on immediate benefits. This finding aligns with research by Huang, Liu, and Wang (2023), who found that more educated farmers often consider long-term costs and more modern technological alternatives, while farmers with lower levels of education focus more on practical benefits, such as ease of land cultivation and labor savings. This perspective influences farmers' mindsets and priorities when deciding to implement agricultural technology.

3) The Influence of Farming Experience Factor (X3) on the Use of Hand Tractors in Palae Village

The test results show that farming experience (X3) has a significant effect on farmers' responses to the use of hand tractors, with a calculated T value of -2.185 which absolutely exceeds the T table of 0.220 and a significance of <0.05. The negative coefficient here means that farmers with longer experience tend to provide more different responses than those who have just started farming. Research by Hulu, Gulo and Harefa (2022) shows that farmers with long experience are more cautious in adopting two-wheeled tractors than relatively new farmers. This is because the work methods they have used so far are traditional, making technology adoption slower, for farmers with short experience are more receptive to agricultural innovations. This emphasizes the importance of socialization and training strategies that consider the background of experience to improve technological experience among farmers in Palae Village.

4) The Influence of Land Area Factor (X4) on the Use of Hand Tractors in Palae Village

Based on the results of the T-test on land area (X4), it was proven to have a significant effect on the response of rice farmers to the use of hand tractors. The calculated T value of 2.661, which exceeds the T table of 0.220 with a significance level of less than 0.05, indicates a positive relationship between the two variables. This means that farmers utilize hand tractors in their farming activities. Arifin, Puspitasari, and Lestari (2024) found that the larger the cultivated land, the higher the tendency of farmers to use mechanization, because tractors can save labor and speed up the land processing process. This phenomenon can be linked to the increasing demands for time and energy efficiency on large areas of land, so that mechanization technology becomes a more practical and effective choice.

5) The Influence of Time Efficiency Factor (X5) on the Use of Hand Tractors in Palae Village

The T-test results show that time efficiency significantly influences farmers' responses to using hand tractors. This is evidenced by the calculated T-value of 7.586, which significantly exceeds the T-table of 0.220, with a significance value below 0.05. This positive relationship reflects that the greater the perceived time advantage, the greater the tendency of farmers to adopt this technology in their farming activities.

The speed offered by hand tractors allows for shorter land cultivation times compared to traditional methods. A study by Sihombing (2018) also found that farmers' perceptions of time efficiency were a dominant factor in the acceptance of agricultural machinery. By saving time, farmers can not only reduce their physical workload but also utilize the remaining time for other activities, both in the agricultural and non-agricultural sectors. This not only saves energy but also gives farmers the flexibility to adjust planting schedules and maximize production yields. This perception could be a significant driver of agricultural technology acceptance in Palae Village.

6) The Influence of Operational Cost Factors (X6) on the Use of Hand Tractors in Palae Village

Based on the analysis, operational costs were not proven to significantly influence farmers' responses to hand tractor use. This finding indicates that farmers in Palae Village prioritize work effectiveness and certainty of planting time over short-term cost efficiency, considering that the risk of losses due to delays in land preparation is far greater than the cost of renting a tractor. This is evident from the calculated T-value of 0.058, which is lower than the t-table value of 0.220, with a significance level above 0.05. This statistically proves that operational costs are not a determining factor in farmers' decisions to use hand tractors.

Productivity is often considered more important than cost of use. This result may be because the savings in time and energy are more valuable than the costs incurred. Furthermore, assistance, subsidies, or cooperation between farmers in the use of tools can also reduce costs (Ministry of Agriculture, 2020). Thus, in Palae Village, cost considerations were not a major factor in the acceptance of hand tractor technology.

The results of this study indicate that the response of rice farmers in Palae Village, South Sinjai District, Sinjai Regency is quite high, with the most influential factors being farmer education, farming experience, land area, and time efficiency. Operating costs did not have a significant impact. This condition indicates that the majority of farmers in Palae Village have a positive attitude and are willing to accept the technology. The scores obtained reflect

farmers' readiness to continue the sustainable use of hand tractors. In addition to technical aspects, farmers assess that hand tractors provide real benefits, especially in saving time and facilitating land cultivation work.

3.2.2 Uji F

Table 2. F-Test Result

F Count	F Table	Information
1633.445	2,25	Ho

Source: Primary Data Processed 2025

The results of the Persian F Test show that Ho is accepted and Ha is rejected, because the calculated F value is 1633.445 and the F table value at a significance level of 5% is 2.25. In other words, the combination of independent variables, consisting of farmer age, farmer education, farming experience, land area, time efficiency, and operational costs used is good. So, the hypothesis that states there is no influence between dependent variables is declared wrong and can be rejected. This model is suitable for use in the analysis.

From a policy perspective, the results of this study can serve as a basis for local governments and agricultural extension workers to expand agricultural machinery assistance programs and increase the intensity of outreach on equipment operation and maintenance. With high farmer acceptance, the government's agricultural mechanization policy has the potential to deliver optimal results if accompanied by ongoing technical assistance.

However, several factors act as both drivers and barriers to the continued use of hand tractors. These include farmer education and experience, which contribute to increased understanding of the technology's benefits; significant time savings; and support from extension services and farmer groups, which strengthen the adoption process. Conversely, inhibiting factors that still require attention include operational costs, which, although small, can still burden farmers with limited capital; the limited number of tractors, which still require some farmers to rely on rentals; and the unequal distribution of technical skills among farmers.

Thus, a high response score indicates that farmers are sufficiently prepared to continue using hand tractors. To ensure their continued use and effectiveness, strategic steps are needed, including providing adequate equipment, improving the quality of extension services, and strengthening farmer group institutions. This will not only ensure the continued use of hand tractors but also contribute to increased productivity and efficiency of rice farming in Palae Village. This research aligns with several previous studies, such as: Oelfatun Sa'diyyah et al. (2020) in their research in Prigi Village, Watulimo District, Trenggalek Regency, found that farmers' perceptions of hand tractor use were in the good category, especially after extension services. These results reinforce the findings of this study that education or increased knowledge plays a significant role in influencing farmer responses.

Rachmad Nuzulmi Ramadhan et al. (2022), who studied farmers' perceptions of agricultural mechanization in Sidoarjo Regency, concluded that while farmers initially rejected it, over time they accepted mechanization technology due to socialization and cost efficiency. This finding aligns with this study, which also found that time efficiency significantly influenced farmers' responses.

Dwi Febrimeli et al. (2022) examined the adoption rate of two-wheeled tractors by farmers in South Nias Regency, showing a very high adoption rate (82.94%), with income, innovation characteristics, group leader role, and extension worker role significantly influencing the adoption rate, while age and land area did not. The difference with this study is that in Palae Village, land area significantly influenced the adoption rate, indicating that regional context and farmer characteristics influence yields.

Arif Nasoi et al. (2019) examined the influence of farmers' perceptions on the use of UPJA-based hand tractors in Bantul, Yogyakarta. The results showed a significant influence of farmers' perceptions on the use of hand tractors. This is in line with the findings of this study, which found that farmer education and knowledge are key determinants of agricultural technology acceptance. Begho et al. (2022), in a systematic review of sustainable

agricultural practices in South Asia, found that income, as a proxy for costs, did not significantly influence agricultural technology adoption. This means that although costs are often considered a barrier, in practice, farmers' decisions are more influenced by other factors such as direct benefits, availability of support, and ease of use of the technology. This is reinforced by a study of digital technology adoption, which showed that learning and depreciation costs accounted for only 0.9–1.5% of total costs, making them unlikely to be major determinants of adoption (Irfan, 2024).

4. Conclusion

Based on research findings on farmer responses to the use of hand tractors in rice farming in Palae Village, South Sinjai District, Sinjai Regency, it can be concluded that the overall response was high. This indicates that the majority of farmers have a positive attitude and are well-prepared to accept and utilize agricultural mechanization technology, particularly hand tractors, as a tool for land cultivation. Therefore, local governments are advised to shift their focus from merely procuring agricultural machinery units toward strengthening farmer group institutions and providing official repair workshops at the village level to ensure the sustainability of this technology.

The results of the multiple linear regression analysis indicate that farmer age, education level, and farming experience have a significant negative influence on farmer responses. This means that the higher the age, education level, and farming experience, the tendency for positive responses to the use of hand tractors tends to decrease. Conversely, land area and time efficiency have a significant positive influence, indicating that farmers with larger land areas and those who perceive the benefits of time savings are more likely to accept and use hand tractors. Meanwhile, operational costs do not have a significant influence on farmer responses, indicating that cost considerations are not a primary factor in the decision to adopt this technology.

Simultaneously, all independent variables studied were shown to significantly influence farmer responses, thus the research model was deemed suitable for explaining the factors influencing hand tractor acceptance at the study site. These findings confirm that practical benefits, particularly time efficiency and ease of use, are the primary reasons for the high farmer acceptance of hand tractors.

Thus, this study concludes that the use of hand tractors has good prospects for continued sustainable development in Palae Village. To increase the effectiveness and sustainability of their use, support is needed in the form of improving the quality of extension services, equalizing farmers' technical skills, and providing adequate tools and assistance. This will allow agricultural mechanization to contribute more optimally to increasing the productivity and efficiency of rice farming.

Author Contributions

Conceptualization: Hasrini Aminarti, Megawati
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Investigation: Fadilah Nurdin
Methodology: Hasrini Aminarti and Megawati
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