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A Comparative Analysis of Rice Farming Income Between the *Mist Blower* System and the Manual System in Wonua Village, Konda Subdistrict, South Konawe Regency

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Abstract

The objective of this study was to analyze the income from irrigated rice farming under each cropping system and to determine whether there were significant differences in income between the two. The study was conducted in Wonua Village, Konda Subdistrict, South Konawe Regency, from October 2025 to July 2026. The sample size was determined using the Slovin formula with a simple proportional stratified random sampling technique, resulting in 71 respondents consisting of 43 Tabela Mist Blower farmers and 28 Tabela Manual farmers. Data analysis involved an analysis of farm income and a statistical test of the difference in means between two independent samples (independent sample t-test). The results showed that the average income of Tabela Mist Blower farmers, at Rp24,407,081/ha/MT, was higher than the average income of Tabela Manual farmers, at Rp22,229,311/ha/MT. The results of the independent sample t-test indicate that there is a significant difference in income between the Tabela Mist Blower system and the Tabela Manual system for irrigated rice farming, as evidenced by a calculated t-value of 8.269, which is greater than the critical t-value of 1.995.

Keywords: ***Mist Blower, irrigated rice, farm income, Manual Tabela, Mist Blower Tabela***

INTRODUCTION

Indonesia is an agrarian country where the agricultural sector continues to play a vital role in supporting the national economy and meeting the population's food needs. Indonesia's geographical location in the tropics offers great potential for the development of various agricultural commodities, particularly food crops (Wargo et al., 2021; Mulyana et al., 2023). As

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Indonesia's population is projected to reach approximately 284.44 million by mid-2025 (BPS Indonesia, 2025), national food demand continues to rise, both in terms of quantity and quality. Therefore, increasing productivity in the agricultural sector—particularly for rice, the primary food source for the Indonesian people—has become a key priority in national agricultural development (Ministry of Agriculture's Data and Information Center, 2025).

Irrigated rice is a strategic commodity because it produces rice, the staple food for the majority of the Indonesian population (Rahmadani et al., 2021). In an effort to meet the ever-increasing demand for rice, the government continues to promote agricultural modernization through the adoption of mechanization and innovations in cultivation technology (Gadjah Mada University, 2025). One emerging innovation is the direct seeding system (*Tabela*), a technique for planting rice without going through the nursery stage or transplanting seedlings to the paddy field (Kusumah et al., 2024). This system is considered capable of saving planting time, reducing labor requirements, and lowering production costs, making it an alternative increasingly adopted by farmers, particularly in areas facing agricultural labor shortages (Marpaung et al., 2021; Kurniati et al., 2025).

Advances in agricultural mechanization are encouraging farmers to utilize various tools that can improve the efficiency of cultivation activities. One technology that is beginning to be adopted in the Tabela system is the use *of a mist blower*. Generally, *a mist blower* is a sprayer that can be modified to disperse dry materials such as seeds and fertilizer by utilizing a high-pressure airflow (Pramuhadi et al., 2024). In irrigated rice cultivation, this tool is used to accelerate seed distribution while achieving a more even seed distribution compared to manual methods. In addition to its use in the planting process, *the mist blower* is also utilized in fertilization activities, thereby reducing labor requirements, shortening work time, and improving the efficiency of production input use.

The adoption of the Tabela system aided by *the Mist Blower* continues to expand across various rice-producing regions, including in Southeast Sulawesi Province. According to data from the Southeast Sulawesi Provincial Central Statistics Agency, the harvested rice area in 2024 reached approximately 130,000 hectares, with a production of 555,836 metric tons of milled dry paddy—representing increases of 14.10% and 15.94%, respectively, compared to the previous year (Southeast Sulawesi BPS, 2025). One of the regions contributing the most to rice production in the province is South Konawe Regency, with production reaching 83,804 metric tons of milled dry paddy in 2024. Within this regency, Konda Subdistrict is one of the major rice-producing centers, with a harvested area of approximately 2,584.7 hectares and a production of 9,299.37 metric tons of milled rice (South Konawe Regency BPS, 2024).

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The adoption of *mist blowers* in Konda Subdistrict has shown rapid growth since their introduction by the Agricultural Extension Center in 2020. One area experiencing significant growth is Wonua Village. This village has the largest number of irrigated rice farmers in Konda Subdistrict, totaling 245 farmers (Konda Subdistrict Agricultural Extension Center, 2025). Initially, *mist blowers* were used by only about 5–10 farmers in 2022, but adoption continued to rise, reaching approximately 147 farmers—or about 60% of all paddy field farmers—by 2026. This trend indicates that the technology is gaining acceptance among farmers because it is seen as capable of speeding up the planting process, improving seed distribution, and reducing labor requirements compared to manual seed-sowing methods.

Nevertheless, about 40% of farmers in Wonua Village still use the manual "Tabela" system. These differences in planting methods have the potential to lead to variations in the use of production factors, farming costs, productivity, and the income received by farmers. However, most farmers do not yet have clear information regarding the magnitude of the economic benefits derived from each method; consequently, decisions regarding technology adoption are still largely based on experience and habit rather than on measurable economic analysis.

Several previous studies have examined rice farm income based on differences in planting systems, such as comparisons between the transplanting system (*Tapin*) and the direct-seeding system (*Tabela*) (Rahmadani et al., 2021; Rosmalah et al., 2024; Rohman et al., 2025). The results of these studies indicate that the adoption of the Tabela system can improve cost efficiency and labor utilization compared to the transplanting system. However, these studies have not yet examined variations in the technology used within the Tabela system, particularly the comparison between the use of *a Mist Blower* and manual seed-sowing methods. Thus, there remains *a research* gap regarding the extent to which the use of *a Mist Blower* can provide higher economic benefits compared to the manual Tabela system.

The novelty of this study lies in the comparative analysis of rice farming income between the Tabela system using *a mist blower* and the manual Tabela system in a location with a relatively high level of technology adoption, namely Wonua Village, Konda Subdistrict, South Konawe Regency. This study not only compares the amount of income received by farmers but also evaluates differences in production costs as a basis for decision-making regarding the adoption of rice cultivation technologies.

Based on the above description, this study aims to analyze and compare the income from irrigated rice farming between the Tabela system using *a mist blower* and the manual Tabela system in Wonua Village, Konda Subdistrict, South Konawe Regency. The results of this study

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are expected to serve as a source of information for farmers in determining more efficient planting methods and as a basis for consideration by local governments and agricultural extension workers in developing agricultural mechanization tailored to farmers' needs.

METHOD

This study employed a quantitative approach using a survey method to compare rice farming income between the Tabela system using a mist blower and the manual Tabela system. The study was conducted in Wonua Village, Konda Subdistrict, South Konawe Regency, Southeast Sulawesi, from October 2025 to July 2026. The research location was selected through purposive sampling, considering that Wonua Village has the largest number of irrigated rice farmers in Konda Subdistrict and is home to two farmer groups implementing the Tabela system—one using a mist blower and the other using manual methods. These conditions allowed for a comparative analysis of the two cultivation systems.

The study population consisted of 245 paddy farmers, comprising 147 farmers using the Tabela Mist Blower system and 98 farmers using the manual Tabela system (Konda Subdistrict Agricultural Extension Office, 2025). The sample size was determined using the Slovin formula with a 10% margin of error, resulting in 71 respondents. Sampling was conducted using the Proportional Stratified Random Sampling technique because the population consisted of two distinct strata: farmers using the Tabela Mist Blower system and farmers using the manual Tabela system. Based on proportional calculations, the sample comprised 43 farmers using the Tabela Mist Blower system and 28 farmers using the manual Tabela system.

The data used included primary and secondary data. Primary data were obtained through field observations, structured interviews using questionnaires, and documentation of the respondents' farming activities. The information collected included farmer characteristics, use of production inputs, production costs, revenue, production output, and farm income. Meanwhile, secondary data were obtained from the Central Statistics Agency (BPS), the Konda Subdistrict Agricultural Extension Office, as well as various scientific literature, books, and previous research findings relevant to this study.

Farm income was analyzed using income analysis, namely by calculating the difference between total revenue (*TR*) and total production costs (*TC*), which is formulated as:

$$\pi = TR - TC$$

Notes:

π = farm income (Rp/ha/MT)

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TR (*Total Revenue*) = total revenue (Rp/ha/MT)
TC (*Total Cost*) = total production costs (Rp/ha/MT)

To determine whether there is a difference in income between farmers using the Tabela Mist Blower system and the manual Tabela system, a comparative analysis was conducted using an independent samples t-test. Before testing the hypotheses, normality and homogeneity tests were first conducted as prerequisites for parametric analysis. The entire data analysis process was performed using IBM SPSS Statistics version 27 software with a significance level of 5%. According to Sugiyono (2013), when the number of samples differs ($n_1 \neq n_2$) and the variances are homogeneous ($\sigma_1^2 = \sigma_2^2$), the pooled variance formula can be used, with degrees of freedom (df) = $n_1 + n_2 - 2$. Mathematically, the pooled variance formula is expressed as follows:

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Notes:
x̄1 = Average income of farmers in the Mist Blower group
x̄2 = Average income of farmers in the Manual group
$S1^2$ = Variance of the sample income for the Mist Blower group
$S2^2$ = Variance of the sample income for the Manual group
n1 = Number of farmers in the Mist Blower group
n2 = Number of farmers in the Manual group
The research hypotheses were formulated as follows:

RESULTS AND DISCUSSION

The respondents in this study were paddy farmers using the Tabela system in Wonua Village, Konda District, divided into two groups: farmers using the Tabela *Mist Blower* (43 farmers) and those using the Manual Tabela (28 farmers). All 43 *Mist Blower* Tabela farmer respondents in this study were farmers who personally owned *Mist Blower* equipment (rather than renting or borrowing it from others; therefore, the depreciation costs of the *Mist Blower* equipment included in the fixed cost analysis of this study were entirely borne by each respondent personally.

Analysis of Income for Paddy Farmers Using the *Mist Blower* and Manual Tabela Systems

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Farm income analysis is used to determine the amount of income earned by farmers through the difference between total revenue and total production costs. Total revenue is calculated by multiplying the production volume by the selling price, while income is obtained after deducting all costs incurred during the farming process. This analysis is used to compare the income from irrigated rice farming under the Tabela Mist Blower system and the Tabela Manual system. To determine the amount of farmers' income from irrigated rice farming using the Tabela *Mist Blower* and Manual Tabela systems in Wonua Village, Konda Subdistrict, South Konawe Regency, three types of analysis were used: cost analysis, revenue analysis, and income analysis.

1. Production Costs

Production costs consist of all expenses incurred by farmers in the irrigated rice farming process, including both fixed and variable costs. The level of production costs is one of the factors influencing the income level earned by farmers. In this study, production cost analysis was used to determine the differences in expenditures between irrigated rice farming using the Tabela Mist Blower system and the manual Tabela system in Wonua Village, Konda Subdistrict, South Konawe Regency.

Table 1. Average Fixed Costs per Hectare for Rice Farming Using the Tabela *Mist Blower* System and the Manual Tabela System in Wonua Village

No.	Type of Fixed Cost	Tabela (Rp/Ha/MT)	
		Mist Blower	Manual
1.	Depreciation Expense		
	a. Hoe	20,969	26,131
	b. Sickle	14,808	18,616
	c. Sprayer	89,457	99,921
	d. *Mist Blower*	144,005	0
2.	Land Tax	33,240	33,226
Total Fixed Costs		302,480	177,894

Based on Table 1, it is evident that the average fixed costs for irrigated rice farming using the Mist Blower Tabela system are higher than those of the manual Tabela system, at Rp302,480/ha/MT and Rp177,894/ha/MT, respectively. The fixed cost components for both systems include equipment depreciation and land taxes. In the Tabela Mist Blower system, the largest depreciation cost comes from the Mist Blower equipment at Rp144,005/ha/MT, while in

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the manual Tabela system, the highest depreciation cost comes from the sprayer at Rp99,921/ha/MT. Meanwhile, land tax costs for both systems are relatively similar, at Rp33,240/ha/MT and Rp33,226/ha/MT, respectively.

The high fixed costs in the Tabela Mist Blower system are due to the additional depreciation costs for the Mist Blower equipment, which are not present in the manual Tabela system. As a piece of agricultural mechanization equipment, the Mist Blower has a relatively high investment value, thereby increasing the depreciation cost component within the farm cost structure. Nevertheless, the use of this equipment has the potential to improve efficiency during the cultivation phase by reducing time and labor requirements. These results are consistent with the study by Narsi and Pirngadi (2024), which showed that differences in the use of mechanization technologies also influence the farm cost structure through differences in the depreciation costs of the equipment used.

Table 2. Average Variable Costs per Hectare for Paddy Farmers Using the *Mist Blower* System and the Manual System in Wonua Village

No.	Type of Variable Cost		Tabela (Rp/Ha/MT)	
			Mist Blower	Manual
1.	Seeds		595,287	584,143
2.	Fertilizer			
	a.	Urea	306,977	312,054
	b.	NPK Phonska	608,876	613,333
3.	Pesticides			
	a.	Insecticides		
		1). Fostin	193,811	219,167
		2) Spontaneous	285,023	312,000
		3) Starban	361,221	393,750
		4) Dangke	289,116	259,143
	b.	Herbicides		
		1) Apuri	223,256	232,381
		2) Antas	359,049	391,369
		3) Ti-Gold	178,605	197,571
	c.	Molluscicide		
		1) Besnoid	151,550	164,333
4.	Petroleum Products (BBM)		65,704	0

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5.	Non-Family Labor			
	a.	Land Cultivation	2,010,078	2,011,706
	b.	Planting	0	94,048
	c.	Fertilization I-II	0	357,738
	d.	Spraying I–IV	339,018	400,000
	e.	Harvest	3,292,287	3,101,964
Total variable costs			9,260,305	9,644,700

Based on Table 2, it is evident that the average variable cost of rice farming using the Tabela Mist Blower system is Rp9,260,305/ha/MT, which is lower than that of the manual Tabela system at Rp9,644,700/ha/MT. This difference indicates that the use of the Mist Blower system can improve variable cost efficiency, particularly by reducing labor costs for planting and fertilization activities. In the manual Tabela system, seed sowing and fertilization are carried out conventionally using manual labor, thus requiring additional labor costs—averaging Rp94,048/ha/MT for planting and Rp357,738/ha/MT for fertilization. In contrast, farmers using the Mist Blower can perform both activities independently with the machine, thereby avoiding the need for non-family labor costs. Although the use of the Mist Blower incurs an additional fuel cost of Rp65,704/ha/MT, this amount is relatively small compared to the labor savings achieved.

In addition to planting and fertilization, differences in variable costs are also evident in pesticide use and harvesting costs. The average cost of pesticides in the Mist Blower Tabela system is Rp2,042,079/ha/MT, lower than that of the manual Tabela system at Rp2,169,714/ha/MT, while harvesting costs constitute the largest variable cost component in both systems because they utilize combine harvester services under a profit-sharing arrangement. Harvesting costs in the Tabela Mist Blower system reached Rp3,292,287/ha/MT and in the manual Tabela system amounted to Rp3,101,964/ha/MT. Overall, although the Tabela Mist Blower system incurs additional fuel costs, the savings in labor costs— —during the cultivation stage help reduce total variable costs, making them lower than those of the manual Tabela system. These results are consistent with Gunawan et al. (2022), who stated that differences in labor requirements are one of the main factors influencing the structure of variable costs in rice farming.

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Table 3. Average Total Costs per Hectare for Paddy Farmers Using the Tabela *Mist Blower* and Manual Tabela Systems in Wonua Village

No.	Cost Type	Mist Blower (Rp/Ha/MT)	
		Mist Blower	Manual
1.	Fixed Costs	302,480	177,894
2.	Variable Costs	9,260,305	9,644,700
Total Costs (Rp/Ha/MT)		9,562,785	9,822,594

Based on Table 3, it is evident that the average total cost of irrigated rice farming using the Mist Blower Tabela system is Rp9,562,785/ha/MT, which is lower than that of the manual Tabela system at Rp9,822,594/ha/MT, with a difference of Rp259,809/ha/MT. This difference is influenced by the cost structure of each system. Fixed costs in the Tabela Mist Blower system are higher—at Rp302,480/ha/MT—compared to the manual Tabela system at Rp177,894/ha/MT, due to the depreciation costs of the Mist Blower machine. However, in terms of variable costs, the Tabela Mist Blower system shows lower costs because it reduces labor requirements during the planting and fertilization stages through the use of machinery.

Although the use of the Mist Blower increases fixed costs due to equipment investment, the resulting labor efficiency reduces variable costs, so that total farming costs remain lower than those of the manual Tabela system. This indicates that the adoption of mechanization does not necessarily increase overall production costs if it can generate savings in other cost components. This finding is consistent with Mareng et al. (2025), who state that the use of agricultural mechanization technology can improve cost efficiency by reducing labor use, even though it requires investment costs and equipment depreciation.

2. Farm Income

Farm income is the value farmers derive from the sale of their produce during a single growing season. According to Soekartawi (2016), farm income is calculated by multiplying the quantity of production by the selling price of the product. In line with this, Fatmawati (2020) explains that the farm income from irrigated rice is determined by the volume of production and the selling price received by farmers. In this study, income calculations used Harvested Dry Paddy (GKP) production—that is, paddy harvested and sold directly by farmers without undergoing further drying—so the production and selling price data used refer to GKP conditions. The average income of respondents engaged in irrigated rice farming using the Tabela system with *a mist blower* and the manual Tabela system is shown in Table 4.

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Table 4. Average Income Per Hectare for Rice Farmers Using the *Mist Blower* and Manual Tabela Systems in Wonua Village

No.	Type of Cost	Table (Rp/ha/MT)	
		Mist Blower	Manual
1.	Yield (kg/ha)	5,857	5,526
2.	Price (Rp/kg)	5,800	5,800
Revenue		33,969,866	32,051,905

Based on Table 4, the average revenue from irrigated rice farming using the Tabela Mist Blower system is Rp33,969,866/ha/MT, which is higher than that of the manual Tabela system at Rp32,051,905/ha/MT, with a difference of Rp1,917,961/ha/MT. This difference in income is influenced by the level of production achieved, where farmers using the Tabela Mist Blower system achieved an average yield of 5,857 kg/ha, while those using the manual Tabela system achieved 5,526 kg/ha at the same selling price for green paddy (GKP), namely Rp5,800/kg. These results indicate that the use of the Mist Blower not only enhances the efficiency of the cultivation process but also has the potential to increase crop yields through more optimal seed distribution.

The high productivity of the Tabela Mist Blower system is linked to a more even seed distribution pattern compared to the manual method. In the manual Tabela system, spreading seeds on waterlogged land makes seed distribution difficult to control, potentially leading to seed accumulation or shortages in certain areas of the field. These conditions can increase competition among plants or result in suboptimal growing space. In contrast, the use of the Mist Blower produces a more consistent seed distribution with a range of up to 7 meters, resulting in a more even plant population and more optimal land utilization. Consequently, the productivity and income of farmers using the Tabela Mist Blower are higher compared to the manual Tabela system. These results align with those of Novianti et al. (2024), who state that the application of appropriate technology in rice farming can increase productivity through more efficient cultivation processes.

3. Income

According to Soekartawi (2016), farm income is the difference between revenue and all costs. Farm revenue is the product of the production obtained and the selling price, while farm costs are all expenses incurred in farming activities. The farm revenue for irrigated rice farming using the Tabela *Mist Blower* and Manual Tabela systems in Wonua Village, Konda Subdistrict, South Konawe Regency is shown in Table 5

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Table 5. Average Income Per Hectare for Rice Farmers Using the Tabela *Mist Blower* and Tabela Manual Systems in Wonua Village

No.	Type of Cost	Tabela (Rp/Ha/MT)	
		Mist Blower	Manual
1.	Revenue	33,969,866	32,051,905
2.	Total Expenses	9,562,785	9,822,594
Revenue		24,407,081	22,229,311

Based on Table 5, the average revenue per hectare for farmers using the Tabela *Mist Blower system* is Rp24,407,081/Ha/MT, which is higher than that of farmers using the Tabela Manual system at Rp22,229,311/Ha/MT, with a difference of Rp2,177,770/Ha/MT. The higher income of Tabela *Mist Blower* farmers results from a combination of greater revenue due to higher productivity and lower total costs per hectare compared to the Tabela Manual system. This is supported by findings from a study by Robertha *et al*. (2024), which showed that paddy farmers who use mechanical planting equipment (*rice transplanters*) earn significantly higher income compared to farmers who plant conventionally, due to differences in productivity and labor cost efficiency between the two systems.

Comparative Analysis of Paddy Farming Income

The apparent difference in average income between the farmers in the Tabela *Mist Blower* system group and the Tabela Manual system group cannot yet be directly concluded as a significant difference, as this difference may also be due solely to *random* variation among samples. Therefore, a statistical test is required to determine whether the difference in income between the two farmer groups is truly statistically significant or not. The statistical test used was the *Independent Samples t-Test*, conducted to determine whether there was a significant difference in income between rice farmers using the Tabela *Mist Blower* system and those using the Tabela Manual system in Wonua Village, Konda Subdistrict, South Konawe Regency. This analysis was performed using SPSS version 27 to compare the average income per hectare of the two farmer groups, which constitute independent samples. The results of the statistical test are presented in Table 6.

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Table 6. Results of the Independent-Samples t-Test for Farm Income from Paddy Rice Cultivation Using the Tabela *Mist Blower* System and the Tabela Manual System in Wonua Village

Description		*Levene's Test for Equality of Variances*		*t-Test for Equality of Means*		
		F	Sig.	t	df	Sig. (2-tailed)
Penda Patan	*Equal variances assumed*	.595	.443	8.269	69	.000
	Equal variances not assumed			7,798	46,659	.000

Based on Table 6, the calculated t-value for farm income with *equal variances assumed* is 8.269. This value is then compared with the t-table value at a 95% confidence level (α = 5%) with df = 69, yielding a t-table value of 1.995 (attached). Since the calculated t-value of 8.269 is greater than the t-table value of 1.995, H_o is rejected and H_1 is accepted; this is also supported by the Sig. (2-tailed) value of 0.000, which is less than 0.05. Therefore, it can be concluded that there is a statistically significant difference in rice farming income between the Tabela *Mist Blower* system and the Tabela Manual system in Wonua Village, Konda Subdistrict, South Konawe Regency.

This difference in income is primarily driven by the higher grain productivity in the Tabela *Mist Blower* system (average 5,857 kg/ha/MT) compared to the Tabela Manual system (average 5,526 kg/ha/MT). The use of *the Mist Blower* allows for more even seed distribution, covers a larger cultivated area, and reduces labor costs—particularly during planting and fertilization—thereby generating higher net income compared to the Manual Tabela system. This is supported by the findings of Kaloso *et al.* (2022) and Rohman *et al.* (2025), who state that the application of efficient agricultural technology can significantly increase farmers' income. Thus, the use of *the Mist Blower* in the Tabela system has been proven to increase production scale, reduce certain variable cost components, and ultimately generate higher net income compared to the Manual Tabela system

CONCLUSION

The research results show that the average income from irrigated rice farming using the Mist Blower Tabela system in Wonua Village was Rp24,407,081/ha/MT, while the average income from irrigated rice farming using the Manual Tabela system was Rp22,229,311/ha/MT.

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There is a statistically significant difference between the income from rice farming using the Tabela Mist Blower system and the Tabela Manual system in Wonua Village, Konda Subdistrict, South Konawe Regency. This is evidenced by the results of the independent sample t-test, which showed a calculated t-value of 8.269 > the t-table value of 1.995 (α = 5%, df = 69), so H_o is rejected and H_1 is accepted.

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