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RESEARCH ARTICLE

Assessment of Agricultural Mechanization's Influence on WIP Costs at PT. Great Giant Pineapple PG4 Lampung Timur

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Abstract

The advancement of the times, marked by progress in science and technology, has had a profound impact on human life. As thinking beings, humans continuously strive to develop various aspects of life to improve their quality of living. This process of change is ongoing, especially in the agricultural sector, which plays a crucial role in human life, and in industries such as PT. Great Giant Pineapple, one of the largest fruit plantation companies in Indonesia that has exported its pineapple products to nearly every corner of the world. The objective of this study is to determine and analyze the differences in Work In Progress (WIP) costs before and after the implementation of mechanization in the Banana Department at PT. Great Giant Pineapple PG4. The data used in this study are quantitative, and the methods for data collection include documentation and interviews. For data analysis, a two-sample independent t-test was employed. The results of the data analysis show that the Sig. (2-tailed) value from the Independent Samples Test table is 0.014, which is less than 0.05. Based on the decision criteria for the t-test, it can be concluded that Ha is accepted and Ho is rejected, indicating that there is a significant difference in WIP costs before and after the implementation of mechanization at PT. Great Giant Pineapple PG4 Banana Department. Prior to mechanization, there was an overcost of IDR 1,674,000,000, which was reduced to IDR 749,998,500 after mechanization, resulting in a total saving of IDR 924,001,500. This reduction is attributed to the shift from using 12 manual laborers to just 1 laborer operating a machine, which cut down the workforce by 11 people and simultaneously increased productivity and quality, processing land from 1 hectare to 7 hectares.

Keyword: Mechanization Concepts

Introduction

The advancement of science and technology has significantly impacted human life. With the ability to think critically, humans continuously seek ways to improve their quality of life across various sectors, including agriculture. Agriculture is a vital sector that sustains human life, and companies like PT. Great Giant Pineapple play a crucial role as one of the largest fruit plantation industries in Indonesia and the country's largest pineapple exporter.

To achieve high productivity and quality, PT. Great Giant Pineapple relies not only on human labor but also on agricultural mechanization. Mechanization here is defined as the use of mechanical tools or equipment driven by various energy sources, such as engines or electricity, to perform agricultural operations. Agricultural mechanization helps to optimize Work In Process (WIP) costs and improve the quality of the products produced.

Work In Process (WIP) refers to the activities involved in producing goods or products, and WIP costs are the total costs incurred during this process. Effective management of WIP is crucial for determining the cost of goods sold (COGS) and, ultimately, the selling price of products. Chandler, as cited in Rangkuti (2018), defines strategy as a company's long-term objectives and the deployment and allocation of all critical resources to achieve those objectives.

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At PT. Great Giant Pineapple, the primary focus of management strategy is on the maintenance of agricultural land, specifically for banana cultivation at PG4 Lampung Timur. Currently, the maintenance of the beds or bunds for banana plants is done manually, relying heavily on human labor. This results in high maintenance costs and variable quality. For example, maintaining 1 hectare of banana land requires 12 workers at a cost of Rp. 83,000 per worker, leading to a total cost of Rp. 996,000 per hectare.

To reduce costs and improve efficiency, PT. Great Giant Pineapple needs to utilize mechanization technology. By employing a modified tractor and plow implements, land maintenance costs can be reduced. Experiments have shown that this agricultural mechanization results in lower costs and better quality beds compared to manual methods.

Table 1. STD Manual Bedder and Mechanized Bedder

Description	Unit	MANUAL BEDDER	MECHANIZED BEDDER
Labor/Ha	Ha	12	1
Wage/Labor	Rp	83,000	83,000
Labor Cost	Ha	996,000	83,000
Tools			
Hoe	12 units/Ha	120,000	-
Tractor	1 Unit/Ha	-	416,999
TOTAL		120,000	416,999
Cost/Ha		1,116,000	499,999

Source: PT. Great Giant Pineapple

Table 1 compares the Standard Operating Procedures (STD) for Manual Bedder and Mechanized Bedder, showing the resulting Cost per Hectare (Cost/Ha) for both methods.

Table 2. Historical Total Costs for 2018-2019 Manual Bedder and Mechanized Bedder

Year	Area (Ha)	Activity	Total Cost
2018	1500	Manual Bedder	1,674,000,000
2019	1500	Mechanized Bedder	749,998,500

Source: PT. Great Giant Pineapple

Table 2 shows the comparison of total WIP costs from 2018 to 2019 for Manual Bedder and Mechanized Bedder activities, demonstrating a decrease in costs in 2019.

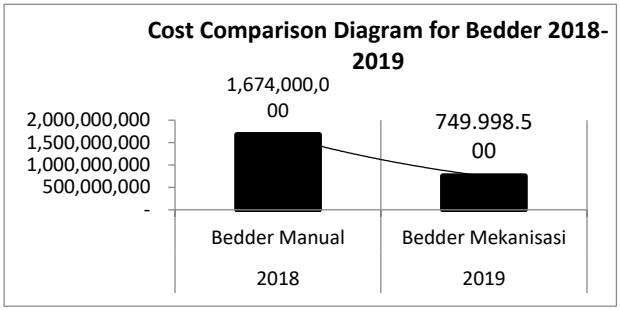

Fig 1. Cost Comparison Diagram for Bedder 2018-2019 Source: PT. Great Giant Pineapple

Figure 1 illustrates the comparison of WIP costs from 2018 to 2019. The 2018 WIP cost was based on the Manual Bedder with an application area of 1500 hectares, while the 2019 WIP cost shows a reduction in cost due to the implementation of the Mechanized Bedder model over the same 1500-hectare area.

Mechanization in the agricultural sector, including at PT. Great Giant Pineapple, plays a crucial role in reducing Work In Process (WIP) costs. By adopting mechanization, the company can enhance efficiency and product quality while reducing reliance on human labor, which has variable productivity and performance outcomes. Mechanization allows for the use of mechanical tools powered by energy sources such as combustion engines and electricity, which significantly lower costs and improve production outcomes.

Based on the background explanation, the problem identified is the high WIP costs before the implementation of mechanization and the failure to meet the company's targets. From this identification, the research question that arises is whether there is a difference in WIP costs before and after the implementation of mechanization at PT. Great Giant Pineapple PG4 Banana Department. This study aims to analyze the difference in WIP costs, with the hope of providing better insights into the effectiveness of mechanization in reducing costs and improving production efficiency at the company.

Method

This study employed several techniques to collect and analyze data in a scientific and systematic manner. The data collection methods used in this research include two main approaches: documentation and interviews. According to Sugiyono (2011), documentation involves the use of existing documents from relevant institutions, such as texts, images, or monumental works, to gather information on management strategies and the analysis of mechanization's impact on Work In Progress (WIP) costs at PT. Great Giant Pineapple Lampung Timur in 2019. These documents were analyzed using a quantitative approach to evaluate the data obtained from field research.

Additionally, interviews were conducted as a method of data collection. Bungin (2011) describes interviews as a method that involves a direct question-and-answer process between the researcher and the respondent to obtain necessary information for the research objectives. Riyanto Yatim (2012) adds that interviews require direct communication between the researcher and the subject or respondent. For this study, semi-structured interviews were used to provide flexibility in obtaining detailed and relevant information from respondents.

For data analysis, this study employed a meticulous and systematic approach in line with scientific research procedures. The technique used for data analysis in this study was the independent two-sample t-test. Hasan (2008) explains that comparative analysis, a type of data analysis used to identify differences between two data groups, employs statistical tests for comparative hypothesis testing. In this study, the independent two-sample t-test was applied to compare WIP costs before and after the implementation of mechanization at PT. Great Giant Pineapple PG-4 Banana Department in Lampung Timur, with the aim of assessing the effectiveness of mechanization in reducing costs and improving efficiency.

Data Collection Methods

Documentation: According to Sugiyono (2011), documentation involves using existing documents from relevant institutions to gather information on management strategies and the analysis of mechanization's effects on WIP costs. This technique involves analyzing written records, images, and other documents to evaluate data from field research.

Interviews: Bungin (2011) defines interviews as a method involving a direct question-and-answer process between the researcher and the respondent to collect information for research purposes. Riyanto Yatim (2012) further describes interviews as requiring direct communication between the researcher and the subject or respondent. For this study, semi-structured interviews were used to allow for flexibility in obtaining in-depth and relevant information from the respondents.

Data Analysis Technique

Independent Two-Sample T-Test: Hasan (2008) defines comparative analysis as a method used to determine differences between two data groups through statistical tests for hypothesis testing. In this study, the independent two-sample t-test was used to compare WIP costs before and after the implementation of mechanization at PT. Great Giant Pineapple PG-4 Banana Department in Lampung Timur, in order to assess the effectiveness of mechanization in reducing costs and improving efficiency.

Results And Discussion

Mechanization refers to the effort to simplify various tasks across different fields, especially those that are complex and require precision, such as agriculture. However, mechanization also brings negative impacts that affect how individuals view themselves, their work, and their relationships with others. According to Marcuse, mechanization involves a uniformity of thought and behavior. Mechanization can be applied in various industries, from aircraft manufacturing to household tasks. In the context of agriculture, mechanization aims to increase labor productivity, improve land efficiency, and reduce production costs. The use of tools and machines in production is intended to enhance efficiency, effectiveness, productivity, and quality of results, as well as to reduce the workload of farmers.

Experiences from Asian countries show that agricultural mechanization starts with land preparation, water management, and the adoption of biological and chemical technologies. For example, the failure of mechanization in Sri Lanka was due to the application of imported machinery without adapting it to local conditions, whereas Japan succeeded by modifying machines according to local conditions before producing them for their farmers (Hamilton et al., 1996). In Indonesia, inadequate agricultural infrastructure makes it difficult to effectively introduce agricultural machinery (Robbins, 2015).

The scope of agricultural mechanization continues to expand with advances in technology and modernization, encompassing electronics, sensors, nuclear technology, image

processing, and robotics. These technologies are used in production, harvesting, and processing agricultural products (Mugniesyah, 2010). Key steps in developing agricultural mechanization include planning or improving land conditions, and providing timely infrastructure and facilities to support modern agriculture (Anonim, 2011).

Indicators of Mechanization

Mechanization is often used in large-scale operations to achieve cost efficiency in Work In Progress (WIP) at PT. Great Giant Pineapple. The success indicators for mechanization include:

Reduction Cost: Organizations can test new processes that require additional tools to ensure productivity or quality improvements before purchasing the equipment.

Increased Productivity & Quality: Mechanization boosts productivity and quality as machines can produce products with high consistency.

Accelerated Achievement of Targets: Mechanization helps achieve targets with time and labor efficiency.

With these indicators, companies can consider steps for advancement through mechanization.

Hypothesis

A hypothesis is a preliminary assumption in research that must be proven true or false. In this study, the hypotheses are:

Ha: There is a difference in WIP costs before and after the implementation of mechanization at PT. Great Giant Pineapple PG4 Banana Department.

Ho: There is no difference in WIP costs before and after the implementation of mechanization at PT. Great Giant Pineapple PG4 Banana Department.

Data Description

Table 3. Research Data of Manual Bedder and Mechanized Bedder

No	Description	Unit	2018	2019
			Cost of Mechanization Before Bedder Mechanization	Cost of Mechanization After Bedder Mechanization
1	Area	Ha	1500	1500
2	Labor/Ha	Ha	12	1
3	Wage/Labor	Rp	83,000	83,000
4	Labor Cost	Rp	996,000	83,000
	Tools			
6	Hoe	12 units/Ha	120,000	-
7	Tractor	1 Unit/Ha	-	416,999
TOTAL			120,000	416,999
Cost of WIP Bedder/Year		1,674,000,000	749,998,500	
Cost/Ha		1,116,000	499,999	

Source: PT. Great Giant Pineapple

Table 4 illustrates the difference in the Work In Progress (WIP) costs before and after the implementation of mechanized bedder at PT. Great Giant Pineapple PG4 Banana Department. The data shows that in 2018, the WIP cost for using the manual bedder was Rp1,674,000,000, while in 2019, the WIP cost with the mechanized bedder decreased to Rp749,998,500. The calculation reveals that the cost for manual bedder included the expense of Rp600,000 for 12 laborers using hoes (Rp50,000 per hoe x 12 workers) and was divided over five uses per 5 hectares, resulting in a cost of Rp120,000. In contrast, the mechanized bedder, represented by the cost of the tractor, incurred an expense of Rp416,999. This change led to a significant reduction in the annual WIP cost by Rp924,001,500, demonstrating the efficiency and cost-effectiveness of mechanization in this agricultural process.

Data Analysis

Table 4. Independent Samples Test

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
cost WIP	Equal variances assumed	4.062	.034	.041	4	.014	3.081E8	6.112E8	-1.389E9	2.005E9
	Equal variances not assumed			.041	2.771	.014	3.081E8	6.112E8	-1.731E9	2.347E9

Sumber:spss 16.0

To determine whether the hypothesis is accepted or rejected, a significance level of 0.05 is used. If the significance value is less than or equal to 0.05, the alternative hypothesis (Ha) is accepted and the null hypothesis (Ho) is rejected, with a 5% margin of error.

Based on the Independent Samples Test table, the Sig. (2-tailed) value is 0.014, which is less than 0.05. Therefore, as per the decision rule for the dependent t-test, it can be concluded that Ha is accepted and Ho is rejected, indicating that there is a significant difference in WIP costs before and after the implementation of mechanization at PT. Great Giant Pineapple PG4 Banana Department.

Table 5. Research Data on WIP Cost Indicators Before and After Mechanization

No	Before & After	Mechanization Indicator on WIP Cost	2018	2019	Variance 2018-2019
1	Before	Over Cost	1,674,000,000	-	-
	After	Reduction Cost	-	749,998,500	924,001,500
2	Before	Decreased Productivity and Quality	12 Workers	-	-
	After	Increased Productivity and Quality	-	1 Worker	11 Workers
3	After	Target Achievement and Lead Time	1 Ha	-	-
	Before	Accelerated Target Achievement	-	7 Ha	6 Ha

Source: Researcher

Mechanization at PT. Great Giant Pineapple involved converting traditional land processing methods from manual hoeing to mechanized tractor operations, which led to the changes described in the table above.

Table 6 details the WIP cost data before and after mechanization and the resulting variances. It shows that before mechanization, there was an over cost amounting to IDR 1,674,000,000, which was reduced to IDR 749,998,500 after mechanization, resulting in a cost saving of IDR 924,001,500.

This cost reduction is due to several factors. Initially, there was a decrease in productivity and quality because of the reliance on 12 workers, which was improved by reducing the workforce to just one worker operating the machinery. This change saved 11

workers and improved both productivity and quality. Additionally, mechanization increased the area processed from 1 hectare per day to 7 hectares per day, significantly improving target achievement.

Conclusions And Suggestions

Based on the data analysis and discussion, it can be concluded that the implementation of mechanization at PT. Great Giant Pineapple PG4 Banana Department led to a significant reduction in Work In Progress (WIP) costs, decreasing from IDR 1,674,000,000 in 2018 to IDR 749,998,500 in 2019, resulting in a cost saving of IDR 924,001,500. This reduction demonstrates the effectiveness of mechanization in lowering operational expenses. Additionally, the shift from manual labor using 12 workers with hoes to a single worker operating a tractor resulted in improved productivity and quality. Mechanization also increased the land processing capacity from 1 hectare per day to 7 hectares per day, reflecting greater efficiency and faster target achievement. The statistical analysis confirmed the significance of these cost savings, with a p-value of 0.014, indicating that the difference in costs is statistically significant. To build on this success, it is recommended that PT. Great Giant Pineapple explore further mechanization opportunities in other operational areas, continuously monitor and optimize mechanization practices, provide comprehensive training for personnel on new technologies, investigate additional cost-reduction strategies, and invest in research and development for future innovations. By following these suggestions, PT. Great Giant Pineapple can continue to leverage mechanization for improved efficiency and maintain a competitive edge in the agricultural sector

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