

The Effect Of Wood Production Costs And Machine Spare Parts Costs On Wood Product Defects In PT AKJSA Gresik Indonesia

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Article Information		Abstract
Submission date	4 February 2026	Research aim : This study aims to analyze the effect of quality control costs, production costs, and spare parts costs on product defects in PT AKJSA Usaha. The first purpose of this study is to find out and analyze the simultaneous influence between the two independent variables on product defects. The second objective is to analyze the partial influence of each independent variable, namely production costs and spare parts costs on product defects. The third objective is to find out which variables are the most dominant to product defects Design/Method/Approach : The method used in this study is multiple linear regression analysis to test the relationship between independent and dependent variables Research Finding : The results of the study show that simultaneously, production costs and spare parts costs have a significant effect on product defects. However, the partial influence shows that only the cost of production which has a significant influence, while the cost of spare parts does not have a significant impact on product defects. Among the two independent variables, production costs have a more dominant influence on product defects. Theoretical contribution/Originality : Heizer & Render (2017) Practitioner/Policy implication : This research provides implications for companies to focus more on managing production costs in an effort to reduce product defects and improve the quality of production results. Research limitation : affected by production cost Keywords : Production cost Spare parts cost, Product Defects
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1. Introduction

In the world of the manufacturing industry, product quality plays a crucial role in the success of a company. Quality products not only meet customer expectations, but also help companies in maintaining competitiveness and increasing profitability. Therefore, manufacturing companies face a major challenge to ensure that the products produced meet predetermined quality standards. One of the industrial sectors that relies heavily on the quality of wood products. PT AKJSA, which is engaged in wood processing production, is an example of a company that focuses on product quality to ensure customer satisfaction and reduce losses caused by product defects [1].

PT AKJSA has product defects that often occur during the production process, which can affect the company's image and cause significant losses. These product defects can be physical defects in the processing product that lead to the inability of the product to meet predetermined specifications. This can lead to additional costs for repairs or replacement of defective products, as well as lower customer satisfaction levels which in turn can affect the company's reputation in the market [2]. Therefore, it is important for PT AKJSA to understand more deeply about the factors that affect the level of product defects, including the cost of production and maintenance of spare parts used in the production process.

The level of product defects in the packaging industry, especially at PT AKJSA, can be affected by the production costs used. Production costs that do not meet expected quality standards may lead to defects in the final product. For example, raw materials with poor quality, unprofessional labor, inconsistent processing can cause inconsistency in the results. Therefore, controlling production costs is an important factor in the production process to ensure good and correct production results.

In addition to production and maintenance costs, spare parts are also crucial factors that can affect the quality of the products produced. Spare parts that are not properly maintained or often damaged can interfere with the production process and produce products that do not meet quality standards. The cost of machine spare parts must be done periodically by following the predetermined instructions in order to reduce product defects and reduce the risk of loss. Therefore, good and scheduled machine maintenance on a regular basis is very important. A study conducted by [3] also shows that the cost of machine spare parts regularly will minimize damage.

In Cost management, which is not good, will burden the company's production costs, and if the management is good, there will be efficient and effective costs. A study conducted [1] states that companies must find a balance between cost management and improving product quality. Therefore, this study aims to analyze how production costs and machine maintenance costs affect the level of product defects at PT AKJSA. With a deeper understanding of the relationship between these costs and product defects, it is hoped that companies can optimize cost management and improve the quality of the products produced. According to company data, the number of defective products has increased, this is due to a reduction in the workforce of QC (quality control) employees in the sub-division of sorting and production processes. The defect results although the number is relatively small, but when examined less carefully, the last production process will be rejected or the product fails, as well as the occurrence of small tears that cannot be detected when the production cost will make the final product defective. The following is the data on defective products during 2022 Until 2024 :

Table 1. Number of Defective Products and Value of Losses in 2022-2024

Year	Period	Number of Products Defective (units)	Cash Loss Value (Rp)
2022	January – March	147.113	36,740,200
	April – June	148.956	37,239,500
	July – September	149.518	37,394,250
	October – December	151.025	36,756,250
2023	January – March	153.105	38,251,500
	April – June	154.257	40,846,310
	July – September	156.106	41,338,560
	October – December	157.851	41,812,300
2024	January – March	159.327	42,323,125
	April – June	160.232	42,471,925
	July – September	159.773	42,420,100
	October – December	162.562	43,081,700

Based on the data in Table 1, there is an increase in the quarterly product damage ratio during the 2022-2024 period. This increase shows an increasingly significant trend in damage every period, so it has a direct impact on the company's high financial losses. Quarterly data is used as a basis for analysis because the production process in the company runs continuously. The production manager said that one of the main causes of this increase in damage is the uncontrolled cost of the production process where there is no standard which results in a decrease in production output

In addition, the reduction in the budget for incentives for employees who successfully monitor the production process, as well as the reduction in the number of sorting workers, further worsened the situation. When defective products are not properly filtered, this leads to low quality of the final product. Products with substandard quality lead to a decrease in consumer interest, and ultimately affect the company's competitiveness in the market.

To prevent product defects, production costs play a very important role. These costs are allocated to ensure that the costs incurred meet certain quality standards. This control includes activities such as testing, inspection, and selection of production costs before entering the production line. According [4] theory, the cost allocated for quality control of production costs is an important investment that can reduce the risk of product defects and improve operational efficiency.

On the other hand, machine maintenance also plays an important role in ensuring the smooth production process. The machines used in production must be maintained periodically to maintain their functionality. The cost of spare parts includes routine servicing, replacement of spare parts, and checking the condition of engine components. At PT AKJSA, the machines used come from various countries, such as China, Germany, and Indonesia. These machines are designed to produce products with high precision and meet hygiene standards. However, in order for the machine to operate optimally, periodic maintenance is a must.

Although most of the production process has used computerized technology, some stages still require manual precision from the operator. The automatic machines that function according to the program ensure that products are produced with high precision, so that they can meet the needs of consumers with consistent quality.

The combination of production costs and spare parts costs if one of the components is eaten will result in the fatality of many defective products, therefore the company must have a mechanical team to check the engine sparpert before production. Periodic evaluation and monitoring of these cost allocations is also important to ensure that the budget spent provides optimal results for the company:

Table 2 Production Cost and spare parts cost

Year	Period	Production Cost(Rp.)	Spare parts cost (Rp.)
2022	January – March	33.684.810	24.005.000
	April – June	41.584.955	17.502.000
	July - September	30.164.825	16.750.100
	October - December	38.975.102	23.152.500
2023	January – March	35.423.651	18.474.800
	April – June	33.254.200	22.536.605
	July - September	31.548.202	18.425.105
	October - December	29.685.452	20.254.825
2024	January – March	27.958.402	19.458.265
	April – June	26.193.943	17.958.455
	July - September	22.652.510	16.154.825
	October - December	23.566.850	15.054.825

Source : Internal Company, 2025

Production costs and spare parts costs are used so that the existing production process can be maintained and also production quality can increase sales, so that product defects can be suppressed.

1.1. Statement of Problem

In this study the Company always complains about the existence of defective products produced in production, where this can result in company losses, indeed there are many factors that can affect this condition, for the problem faced is the extent of the influence of production costs on the number of defective products, the extent of the influence of spare parts costs on the number of defective products, And which cost is the most dominant between production costs and spare parts costs for defective products produced

1.2. Research Objectives

In this study, the following objectives are:

- 1.2.1. The company hopes that defective production can be reduced to a minimum or as little as possible
- 1.2.2. The company aims to provide policies on production costs incurred
- 1.2.3. The company aims to analyze the cost of spare parts used in the production process, there are those who are responsible for the use or replacement

2. Method

This study involved two independent variables, namely Production Cost (X1) and Spare part Cost (X2), which were analyzed for their influence on the dependent variable, namely Product Defect (Y).

a. Independent Variables

1. Production Cost (X1)

It is a cost incurred to ensure that production costs meet quality standards, including wages and commissions for selection workers. The data is taken from PT AKJSA's expenditure in the 2022–2024 period and expressed in rupiah (Rp).

2. Spare part fee (X2)

Includes preventive and repressive spare parts costs to maintain optimal engine condition. Data on machine maintenance costs was also obtained from the 2022–2024 period, expressed in rupiah (Rp).

b. Bound Variables

Product Defects (Y)

Refers to the number of products that are damaged during the production process. The data is measured based on total product defects per year in units in the 2022–2024 period.

Population, Sample and Sample Extraction Techniques

A population as a set of objects or subjects with certain characteristics that are the focus of research to be analyzed and produce conclusions [5]. In the context of this study, the population includes data related to production costs and spare parts costs as well as the number of defective products at PT AKJSA during the period 2022 to 2024. The research sample includes specific data that are directly related to production costs, spare parts maintenance costs, and product defect levels in the same period, namely for three consecutive years.

Data Analysis Techniques

In this study, the analysis used is dependent on the statistical method used for multiple linear regression analysis, the regression equation method is:

$$Y = b_0 + b_1X_1 + b_2X_2 + e$$

Description :

Y = Product defects

X1 = Raw Material Quality Control Cost

X2 = Machine Maintenance Cost

e = Standard error

b₀ = Constant

b = regression coefficient

3. Results and Discussion /Hasil dan Pembahasan

Descriptive Analysis of Research Data

Before statistical analysis was carried out, the author first conducted a descriptive analysis of the variables used in the research. Descriptive analysis is used to describe descriptively the results of the research, namely product defects, production control costs, spare parts costs

1. Production cost (X1)

Production costs are costs incurred to ensure that Quality (standard) can be reflected in the final result. The following is the data from the summary of the calculation of the descriptive analysis of production costs presented in the form of the following table:'

Table 3 Production Costs

Year	Period	Production Cost (Rp.)
2022	January – March	43.684.000
	April – June	41.585.000
	July – September	40.154.800
	October – December	38.955.100
2023	January – March	35.582.650
	April – June	33.254.175
	July – September	31.548.310
	October – December	29.685.550
2024	January – March	28.958.420
	April - June	26.193.960
	July - September	22.641.500
	October - December	24.567.800

Source : *Internal Company, 2025*

Based on the information contained in Table 3, it can be concluded that production costs reached the highest figure in the period from January to March 2022, with an amount of IDR 43,684,000. On the other hand, the lowest average production cost was recorded in the period from July to September 2024, which was only IDR 22,641,500. However, in the last quarter of 2024, namely the period from October to December, there was an increase in the average production cost which reached IDR 24,567,800.

2. Spare Parts Cost

The cost of spare parts covers all costs incurred to keep the machine functioning optimally, both through preventive and reparative measures [10]. The main objective is to ensure that the machine remains in a ready-to-use condition, The following is a summary

of the results of the calculation of the maintenance costs of the machine presented in the form of a table to give a clearer picture of its expenses:

Table 4. Spare Parts Cost

Year	Period	Spare parts cost (Rp.)
2022	January – March	25.007.000
	April – June	17.502.000
	July – September	16.750.050
	October - December	24.152.500
2023	January – March	18.474.800
	April – June	22.536.605
	July – September	18.426.000
	October - December	20.254.825
2024	January – March	19.458.265
	April – June	17.958.455
	July – September	16.154.825
	October - December	15.054.825

Source : *Internal Company, 2025*

Based on Table 4 above, it can be seen that the cost of spare parts was recorded as the highest in the period from January to March 2022, with a total of IDR 25,057,000. On the other hand, the lowest spare parts cost occurred in the period from October to December 2023, which only reached IDR 18,426,000. In the first quarter of 2022, there was a surge in spare parts costs to reach IDR 25,007,000

3. Product defects (Y)

Product defects refer to the number of products that have been damaged during the production process at PT AKJSA. The following is a summary of the descriptive analysis related to product defects, presented in the form of a table to facilitate understanding of the existing data:

Table 5 Average Product Defect Data

Year	Period	Production	Damage rate Products	% Damage
2022	January - March	57.308.500	147.120	0.256
	April - June	57.596.920	148.958	0.258
	July - September	57.730.894	149.521	0.251
	October - December	57.799.988	151.026	0.260
2023	January - March	57.931.568	153.102	0.264
	April - June	57.915.108	154.254	0.266
	July - September	57.928.908	156.105	0.269
	October - December	57.930.950	157.846	0.270
2024	January - March	58.271.108	159.326	0.275
	April - June	58.373.070	160.246	0.270
	July - September	57.570.900	159.778	0.279
	October - December	57.579.850	162.560	0.285

Source : *Internal Company, 2025*

From Table 5. above, it can be seen that the highest product defects occurred in October – December 2024, which was 162,560 units. Meanwhile, the lowest product defects occurred in January – March 2022, which was 147,120. In the period from January 20221 to December 2023, the average product defect was 162,560 units. In terms of the percentage of comparison between finished products and damaged, every period is increasing.

Data Analysis

Multiple Linear Regression Analysis

Based on the results of the calculation, the multiple linear regression equation is obtained as follows:

Table 6. Results of Multiple Linear Regression Analysis

<i>Models</i>	<i>Unstandardized Coefficients</i>		
	<i>B</i>	<i>Std. Error</i>	<i>Sig.</i>
Constant	177824.1	2078.505	0.000
Production Cost (X1)	-0.001	0.000	0.000
Spare parts cost (X2)	0.0000321	0.000	0.801

Source : Data Processed

Based on the results of the calculation mentioned above, the multiple linear regression equation is obtained as follows:

$$Y = 177823.2 - 0.001 X_1 + 0.0000321 X_2 + \text{egg}$$

The interpretation of the regression model above is as follows:

1. (β_0) = constant 177814.1, if the variable of production cost (X_1) and spare part cost (X_2) or equal to 0, then the value of product defect (Y) is 177814.1.
2. The value of the production cost coefficient (β_1) of -0.001 indicates that if the variable of Production Cost (X_1) is increased, it will result in a decrease in product defects by 0.001, assuming the other variables are constant.
3. The value of the Spare Part Cost coefficient (β_2) of 0.0000320 indicates that if the Spare Part Cost variable (X_2) is increased by one unit, it will result in an increase in product defects by 0.0000321, assuming the other variables are constant.
4. ei interfering factors outside the model studied.

Hypothesis Test

In relation to the formulation of the problem and the research hypothesis proposed as described in the previous section, it can be explained that the variables that affect product defects are production costs (X_1) and spare parts costs (X_2). In this study, the bound variable is product defect, namely the Y variable.

F test (simultaneous)

The simultaneous test (F test) showed that all independent variables consisting of production cost (X_1) and spare parts cost (X_2) had a significant effect on the dependent variable (Product defect).

Table 7.Results of F Test Calculation

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3E+008	2	136775347.8	118.303	.000 ^a
	Residual	10405297	9	1156144.073		
	Total	3E+008	11			

Source :, Data Processed

Test Steps :

1. Hypothesis

H_0 : $b_1 = b_2 = 0$ means the variables X_1 and X_2 does not affect the bound variable (Y).

H_1 : $b_1 \neq b_2 \neq 0$ means variables X_1 and X_2 exerts an influence on the bound variable (Y).

2. Magnitude of the value

F table = F_α (df regression, residual df)= F_α (k, n – k – 1)

F table = $F_{0.05}$ (2.9) = 4.26

Since F is calculated > F table which is $118.303 > 4.26$, H_0 is rejected at a significance level of 5% so that it can be concluded that simultaneously all independent variables (production cost variables and spare parts costs) have a significant effect on the Y-bound variable (Product defect).

T-test (partial)

At this stage, a test is carried out on the influence of the independent variable contained in the formed model to determine whether the independent variable (X) in the model partially has a significant influence on the bound variable (Y).

Table 8. Results of the t-test calculation

Model Anova		Sig
Production Cost (X_1)	-13.003	0.000
Spare Parts Cost (X_2)	0.261	0.801

Source : Appendix 3, Data Processed

From the calculation carried out, it was obtained that the calculation of -13,005 was smaller than the t_{table} of -2.26, then H_0 was rejected at a significance level of 5% so that the conclusion was partially that the variable Production Cost had an influence on the product defect. Based on the calculation, the calculation of 0.261 is smaller than the t_{table} of 2.26, H_0 is accepted at a significance level of 5% so that the conclusion is partially that the spare part cost variable has no effect on product defects.

Discussion

The Effect of Raw Material Quality Control Costs on Product Defects

In the first hypothesis test regarding the effect of production costs on product defects, a tcal value of -13,003 was obtained, which is smaller than the t_{table} of -2.26 at a significance level of 5%. These results indicate that H_0 , which states that production costs have no significant effect on product defects, is rejected. This means that there is a significant influence between production costs and partial product defects.

This shows that the higher the costs incurred for production control, the greater the chance of reducing the defects of the resulting product [8]. Production costs have a very important role in meeting the standards that have been determined to minimize product defects [9]. The theory underlying these findings is in line with the opinion of [4], who states that effective production practices can reduce the risk of product defects and improve overall quality.

The Effect of Machine Maintenance Costs on Product Defects

On the other hand, testing the effect of spare parts costs shows different results. Based on the calculations, a calculated t-value of 0.261 was obtained which was smaller than the t_{table} 2.26 at a significance level of 5%. Thus, H_0 stating that the cost of maintaining the machine has no effect on the defect of the product is accepted. This means that partially, the cost of maintaining the machine does not have a significant influence on product defects at PT AKJSA.

These results show that while machine maintenance is important to maintain smooth operations and ensure that the machine is functioning properly, this factor does not directly contribute to the reduction of product defects [7]. This is possible because although regular

maintenance is necessary to keep the machine in good condition, the quality of the product is not only affected by the state of the machine, but also by other variables such as the quality of raw materials and the skills of the operator. In addition, although machine maintenance can reduce the potential for damage or disruption to the production process, in the context of this company, the results show that other variables, such as raw material quality control, are more dominant in influencing the degree of product defects.

Overall Analysis of the Effect of Production Costs and Spare Parts Costs on Product Defects

From the results of the tests conducted, it can be concluded that production costs have a significant influence on product defects, while spare parts do not have a significant impact on product quality [6]. These findings indicate that companies should focus more attention and resources on production as these factors have a direct influence on product defects. Good Production Cost can reduce the defect rate and improve production efficiency in the long run. Although spare parts costs are also important for the smooth operation of a company, the results of this study show that these factors are not significant enough to be a major determining factor in the reduction of product defects. Therefore, companies need to evaluate the machinery maintenance policies implemented and consider other aspects that may have more influence on production results, such as the quality of raw materials or even the skills and training of machine operators

4. Conclusion

Based on the results of the research conducted on the influence of production costs and spare parts costs on product defects at PT AKJSA Gresik, several important things can be concluded as follows:

1. Production costs have been proven to have a significant influence on product defects. This shows that in managing production costs can reduce product defects and the quality of a product
2. In contrast, spare parts costs do not show a significant influence on product defects. Although the cost of spare parts is important for maintaining a smooth production process, this factor does not directly contribute to the reduction of product defects.
3. Overall Effect on Product Defects: Overall, production cost management is more influential in reducing product defects compared to spare parts costs. This emphasizes the importance of companies to focus more attention on production costs in order to achieve higher quality products and minimize losses due to product defects.

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