# THE INFLUENCE OF RAW MATERIAL SUPPLIES, PRODUCTION PROCESS AND EQUIPMENT MAINTENANCE ON PRODUCT QUALITY IN SMALL RED BRICK INDUSTRIES IN CILEGON CITY



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***ABSTRACT***

*The aim of this research is to determine the impact of raw material supplies, production processes and equipment maintenance on product quality in the Small Red Brick Industry in Cilegon City, whether the influence is partial or simultaneous. The used method is quantitative and associative research, with a sample of 77 respondents. Data collection using questionnaires and the results were processed using the SPSS 26 program. The research results showed that raw material supplies, production processes and equipment maintenance had an impact on product quality simultaneously. Partially, raw material supplies have an impact on product quality, the production process has no impact on product quality. And equipment maintenance has an impact on product quality.*

***Keywords:*** *Raw Material Supplies; Production Process; Equipment Maintenance*

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## INTRODUCTION

According to Zakaria (2023), industry is a business or enterprise with activities in changing raw materials or semi-finished goods into final products of high value. According Nuha et al (2020) Even though some industries may not be large scale, most of the developing industries are categorized as business and medium-sized industries. Nuha et al (2020) also said small and medium industries play an important role as the backbone of the national economy because they are the sector that makes up the majority of the population in Indonesia.

Every industry must be able to defend itself and grow in the face of globalization which affects the business and industrial sectors. Thus, each industry must be more competitive compared to other industries. If producers want to remain competitive in the global market, they must be able to understand their products (goods or services) so that consumer desires can be fulfilled. Fulfilling consumer desires refers to one of the industry's goals, namely producing high quality products, because the importance of product quality for the survival of the industry is determined by the results of the product quality, because the industry always strives to develop and maintain the sustainability of its operations.

Industry benefits from paying attention to product quality by: raw material inventory, production processes and equipment maintenance. According Nuryanti dan Satpatmantya (2021), good product quality can be achieved by good quality raw materials, production processes and equipment maintenance. Likewise, Nuha et al (2020) said that to create high product quality you must pay attention to several factors, namely raw materials, production processes and equipment maintenance.

Raw material supplies are basic raw materials supplied by industry that will be used in the production process. Raw material supplies play an important role for industry because the selection and use of appropriate raw materials in the production process greatly influences the performance of the industrial sector. If the supply of raw materials is of low quality, the resulting product will also be of low quality. On the other hand, if the existing raw material supply is of good quality, such as being free from damage, it will produce high quality products, and can satisfy customers and according to plan.

Successful and appropriate implementation of production processes is essential to produce high-quality products. According to Nuha et al (2020) the quality of the product produced is greatly influenced by the smoothness of the production process. Nuryanti and Satpatmantya (2021) said that the entire industry hopes that the production process will run well, because producing good quality product depends on whether the production process is good or bad. Even though the industry uses good raw materials, low product yields will be obtained if the production process is not carried out properly and correctly. On the other hand, if the raw materials used are of ordinary quality, but the production process is carried out carefully and appropriately, then good quality products can still be produced.

Good product quality will be created if an industry implements equipment maintenance that is running well. According to Firmansyah (2014) product quality is greatly influenced by machine maintenance. According to Kusnanto & Sugianto (2021) Production equipment maintenance refers to the maintenance of machines and equipment used in the production process, such as machine maintenance planning, machine cleaning schedules, machine and equipment replacement times, and when equipment and machines need to be completely replaced.

Raw material supplies, production processes and equipment maintenance must always be considered to ensure the production of high quality goods. So the red brick

industry is a sector that is highly dependent on raw material supplies, production processes, equipment maintenance and product quality. An efficient maintenance of production machines produces high quality products and ensures a smooth production process.

After conducting observations in the field, Banten Province is a province that has various types of home industries that produce goods needed by the community. One type of industry that is experiencing rapid growth is red brick production. This industry is increasingly developing in various areas of Banten, especially in Cilegon City. This red brick industry uses local natural resources and a simple production process.

**Table 1**
**Quantity of Red Brick Industries Per District in Cilegon City (2019-2022)**

| No | District | 2019-2021 | 2022 |
|---|---|---|---|
| 1. | Cibeber | 55 | 100 |
| 2. | Citangkil | 27 | 18 |
| 3. | Ciwandan | 25 | 6 |
| 4. | Cilegon | 9 | 5 |
| 5. | Purwakarta | 1 | - |
| | TOTAL | 117 | 129 |

Data Source: Cilegon City Industry and Trade Service, 2023

The red brick industry has become a part that is nothing new for the residents of Cilegon City. The majority of Cilegon residents still rely on red brick as the main material in their building construction. In addition, the red brick industry is also a significant source of daily employment for local residents.

**Table 2**
**Quantity of Red Brick Industries Production Results in Cilegon City (2023)**

| Month | Red Brick Production (2023) | | |
|---|---|---|---|
| | Quality Products (Units) | Defective or Failed Product (Unit) | Total |
| January | 3.188.600 | 2.310 | 3,190,910 |
| February | 3.178.000 | 2.230 | 3,180,230 |
| March | 3.386.500 | 2.650 | 3,389,150 |
| April | 3.081.900 | 2.130 | 3,084,030 |
| Mey | 3.419.500 | 2.170 | 3,421,670 |
| June | 3.435.200 | 1.780 | 3,436,980 |

Data Source : 16 Red Brick Industry Owners in Cilegon City, 2023

Based on the table of pre-survey results from the 16 owners above, there are problems faced by the Red Brick Industry in Cilegon City regarding the ups and downs of quality products and defective or failed products from January to June 2023.

So, based on the problems above, it can be determined that if you want the quality of the product produced to be good, you need to increase the supply of raw materials, run the production process smoothly and implement good equipment maintenance.

This encourages researchers to test the relationship between raw material supplies, production processes and equipment maintenance on product quality.

## LITERATURE REVIEW

### Raw Material Supplies

According to Kasmir (2018) Inventory is the number of goods stored by a company in a warehouse or elsewhere which are used to produce or sell when needed. According to Rudianto (2018), inventory is a number of raw materials and goods in the production stage that are owned by a company with the intention of reselling or further processing. Raw materials are one of the main components of the production process. The production process cannot be carried out by a company without raw materials. The indicators used are from Lestari (2022) and Supriadi (2023), as follows:

1. The amount or volume of production is the amount of production produced by the industry within a certain period of time.
2. Safety stock, is a reserve stock of raw materials to anticipate shortages of raw materials during the production process.
3. Availability and adequacy of raw materials, meaning that the amount of raw materials available is sufficient to produce products in accordance with consumer demand.
4. Ease of obtaining raw materials, is the ability of an industry to obtain the raw materials needed to carry out its operations easily and efficiently.

### Production Process

According to Zahri (2018), the production process is needed to make products, so the production process plays an important role in an industry. According to Rahayu and Fauzi (2022), the production process is the process of changing input into output, with all actions or efforts that create goods or services, as well as other actions that support or aim to produce the product. The indicators used are from Ramli (2018) and Supriadi (2023), as follows:

1. Labor, namely implementers who are responsible for the operation of production systems and operations to carry out or carry out activities aimed at producing products, whether goods or services.
2. The machines used are tools that assist human work on goods or product components and are driven by energy.
3. Costs incurred.
4. Production schedule, namely the production agenda or schedule that has been set by the industry.

### Equipment Maintenance

According to Anggraini and Maulana (2016), maintenance is an effort to maintain factory facilities and equipment as well as carry out necessary repairs, modifications and replacements to ensure smooth production operations according to schedule, so that the facilities can be used in the production process before the specified time limit. According to Yusup and Aspiranti (2017), a machine is a device or tool that is driven or controlled with power to assist humans in working on a product or part of a product. The indicators used are from Anggraini and Maulana (2016), Gumilar and Siregar (2017), as follows:

1. Repairs are carried out when the machine no longer functions or is damaged.
2. Spare part replacement, namely replacing machine components periodically to prevent machine disruption during the production process.
3. Cleaning is the activity of cleaning or maintaining machines after carrying out the production process with the aim of increasing the life of the production machine.

4. Set-up, namely activities before starting the production process, setting up or preparing the machine.

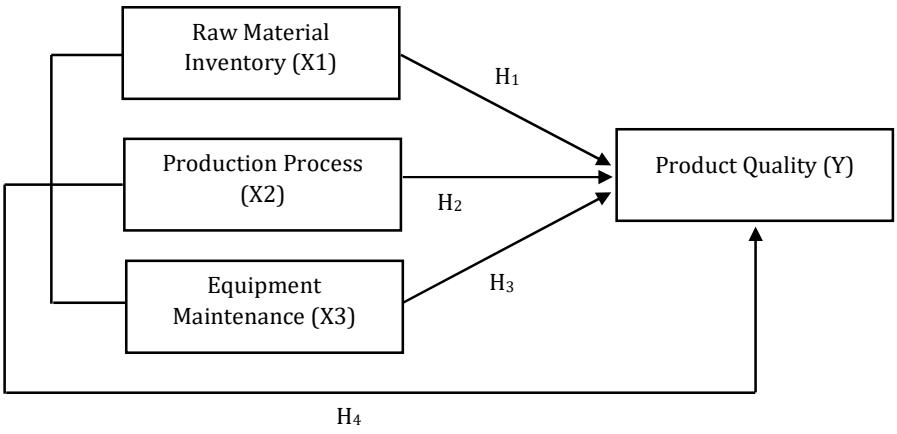
**Product Quality**

According to Satdiah et al (2023), product quality is a product that has the ability to perform various functions, such as reliability, accuracy and durability along with other important attributes. According to Widyana and Naufal (2018), product quality is all the elements involved in making a product in a way that meets customer expectations, including marketing, planning, production and maintenance. The indicators used are from Liana et al (2023) and Supriadi (2022), as follows:

1. Product shape, in the form of size or physical structure of the product.
2. Reliability is the level of product reliability or the small possibility that a product will experience damage or defects.
3. Durability - the level of strength that a product has to last for a certain economic life.
4. Product features are product characteristics that can provide value and interest to customers, such as the color of the product.

**Research Framework**

The purpose of the thinking framework is to determine the process flow that will be carried out in a research. The framework for thinking in this research is that there are several variables, namely raw material inventory (X1), production process (X2) and equipment maintenance (X3) as independent variables and product quality (Y) as the dependent variable. So the framework for this research can be described as follows:




Source : Contructed by authors, 2024

**Figure 1**
**Research Framework**

**HYPOTHESES**

The hypothesis in this research is based on the framework :

H1: Raw material supplies has an impact on product quality
H2: The production process has an impact on product quality
H3: Equipment maintenance has an impact on product quality
H4: Raw material supplies, production processes, and equipment maintenance have an impact on product quality.

## METHOD

This research uses an associative type of quantitative research. The variables linked are Raw Material Inventory (X1), Production Process (X2), Equipment Maintenance (X3) to Product Quality (Y).

According to Sudana and Setianto (2018), population refers to all groups of individuals, events or objects in a study. In this research, it was obtained based on data from the Cilegon City Industry and Trade Service, namely that the number of Red Brick Industries in Cilegon City in 2022 will be 129 Red Brick Industry owners.

A sample is only a representative portion of the population. According to Sugiyono (2018), the sample size required in research that applies linear regression analysis must be ten times larger than the number of variables. In this research, there are 4 research variables, of which there are 3 independent variables and 1 dependent variable, meaning that the minimum number of samples in this research is 10 x 4 = 40 respondents. The minimum sample size means the smallest number, so the researcher will take more than 40 respondents. So this research determined 77 samples. This research uses a simple random sampling technique, because each member of the population has an equal opportunity to be selected as the research sample. The types of data used are primary and secondary data, and data collection techniques include observation, interviews and questionnaires.

Data processing and analysis for this research used the IBM SPSS Statistics 26 program, which include validity test, reliability test, classic assumption test (normality test, heteroscedasticity test, multycollinearity test), multiple linear regression test, T test, and F test.

## RESULTS AND DISCUSSION

### Validity Test

According to Sudana and Setianto (2018), validity testing focuses on the accuracy of the instruments, procedures and measurement techniques used to assess phenomena. The criteria for assessing the validity of statements used in this research are:

1. If the calculated R value > R table then the statement item is valid.
2. R value < R table then the statement item is invalid.

In the results of this research, the R table value was obtained with N=77 at a significance of 5%, so DF = 77 – 2 = 75. Based on the distribution of the R table statistical values, the R table value was 0.2242.

**Table 3**
**Validity Test Results**

| Statement | Korelasi Rank Spearman | Sig (2-Tailed) | R | Sig | Explanation |
|---|---|---|---|---|---|
| Raw Material Inventoy (RMI) | | | | | |
| RMI1 | 0,699 | 0,000 | >0,2242 | <0,05 | Valid |
| RMI2 | 0,765 | 0,000 | >0,2242 | <0,05 | Valid |
| RMI3 | 0,674 | 0,000 | >0,2242 | <0,05 | Valid |
| RMI4 | 0,705 | 0,000 | >0,2242 | <0,05 | Valid |
| Production Process (PP) | | | | | |
| PP1 | 0,747 | 0,000 | >0,2242 | <0,05 | Valid |
| PP2 | 0,668 | 0,000 | >0,2242 | <0,05 | Valid |
| PP3 | 0,678 | 0,000 | >0,2242 | <0,05 | Valid |
| PP4 | 0,641 | 0,000 | >0,2242 | <0,05 | Valid |
| Equipment Maintenance (EM) | | | | | |
| EM1 | 0,624 | 0,000 | >0,2242 | <0,05 | Valid |
| EM2 | 0,680 | 0,000 | >0,2242 | <0,05 | Valid |
| EM3 | 0,830 | 0,000 | >0,2242 | <0,05 | Valid |
| EM4 | 0,720 | 0,000 | >0,2242 | <0,05 | Valid |
| Product Quality (PQ) | | | | | |
| PQ1 | 0,689 | 0,000 | >0,2242 | <0,05 | Valid |
| PQ2 | 0,746 | 0,000 | >0,2242 | <0,05 | Valid |
| PQ3 | 0,755 | 0,000 | >0,2242 | <0,05 | Valid |
| PQ4 | 0,734 | 0,000 | >0,2242 | <0,05 | Valid |

Source: Data Analyzed, 2024

Based on the results of the table above, it is known that the validity test results for each statement of the variables Raw Material Inventory (X1), Production Process (X2), Equipment Maintenance (X3) and Product Quality (Y) have a value of R table > T table (0, 2242) and a significance value <0.050. This means that every statement used in this research is considered valid.

## Reliability Test

According to Sudana and Setianto (2018), reliability testing refers to the level of accuracy or reliability of the measuring instrument (method or procedure) applied in a measurement. This study employs the Cronbach Alpha approach to asses reliability, because if the reliability coefficient rn > 0.6 then the assessment criteria are considered reliable using the Cronbach alpha technique.

**Table 4**
**Reliability Test Results**

| Variable | Cronbach Alpha | Critical Value | Remarks |
|---|---|---|---|
| Raw Material Inventory | 0,666 | 0,60 | Reliable |
| Production Process | 0,612 | 0,60 | Reliable |
| Equipment Maintenance | 0,679 | 0,60 | Reliable |
| Product Quality | 0,704 | 0,60 | Reliable |

Source: Data Analyzed, 2024

Based on the Table 4, the results show that the raw material inventory variable (X1) has a Cronbach alpha value of 0.666 > 0.60, meaning that the statement item is considered reliable. The production process variable (X2) has a Cronbach alpha value of 0.612 > 0.60, meaning that the statement item is declared reliable. The equipment maintenance variable (X3) with a Cronbach alpha value of 0.679 > 0.60 means the

statement item is declared reliable. The product quality variable (Y) has a Cronbach alpha value of 0.704 > 0.60, meaning that the statement item is said to be reliable.

## Classic Assumption Test

*Normality Test*

According to Pratama and Permatasari (2021), The normality test can be used to find out whether a data set is normally distributed or not. In this study, the Kolmogorov Smirnov test was administered, and SPSS version 26 wa used for analysis. According to Pratama and Permatasari (2021), decision making on the normality test:

a. Significance value is > 0.05, it is declared normal.
b. Significance value is <0.05, it is declared abnormal.

**Table 5**
**Kolmogorov-Smirnov Normality Test Results**

| | | ***Unstandardized Residual*** |
|---|---|---|
| N | | 77 |
| Normal Parameters[a,b] | Mean | 0.0000000 |
| | Std. Deviation | 1.84317713 |
| Most Extreme Differences | Absolute | 0.065 |
| | Positive | 0.065 |
| | Negative | -0.050 |
| Test Statistic | | 0.065 |
| Asymp. Sig. (2-tailed) | | 0.200 |

Source: Data Analyzed, 2024

Based on the results from the table above, the value of Asymp. Sig. (2-tailed) namely 0.200 > 0.05. This shows that the assessment data is normally distributed, indicating that Product Quality (Y) as the dependent variable, can be predicted using a regression model by including the independent variables Raw Material Inventory (X1), Production Process (X2), and Equipment Maintenance (X3).

*Heteroscedasticity Test*

According to Wahid *et al* (2017) The heteroscedasticity test is used to determine the presence of inequality of variance in the regression model between residuals from different observations. In this research, the author uses White's method to determine whether this research contains symptoms of heteroscedasticity or not. According to Christalia A et al (2015) The application of the white test is:

a. $c^2$ value < $c^2$ table: there are no symptoms or free from the heteroscedasticity test.
b. $c^2$ value > $c^2$ table : there are symptoms or it is not free from the heteroscedasticity test.

**Table 5**
**Heteroscedasticity Test Results with White Test**

| | | ***Model Summary*** | | |
|---|---|---|---|---|
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| 1 | 0.407 | 0.166 | 0.054 | 3.70197 |

Source: Data Analyzed, 2024

The calculation in finding calculated c2 and table c2 is using the following formula:

c2 value = n (number of samples) x r square
= 77 x 0.166
= 12,782
c2 table = 16.918 (df : 9, a = 0.05) obtained from the chi-square table

So the calculated c2 value is 12.782 < c2 table (16.918), meaning that in this test it is stated that there are no symptoms of heteroscedasticity.

*Multicollinearity Test*

According to Effiyaldi *et al* (2022), this test aims to determine whether the regression model used by the researcher shows that there is a correlation between the independent variables. If look at the variance inflation factor or VIF, may determine if the variable is multicollinear or not. In particular, this implies that :

a. Tolerance value < 0.10 or VIF > 10 means multicollinearity occurs
b. Tolerance value > 0.10 or VIF < 10 means multicollinearity does not occur.

**Table 6**
**Multicollinearity Test Results**

***Coefficients[a]***

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Tolerance | VIF |
| 1 | (Constant) | 5.214 | 1.843 | | 2.829 | 0.006 | | |
| | Raw Material | 0.265 | 0.114 | 0.275 | 2.325 | 0.023 | 0.654 | 1.529 |
| | Inventory Production | 0.106 | 0.103 | 0.112 | 1.037 | 0.303 | 0.783 | 1.277 |
| | Product Equipment Maintenance | 0.272 | 0.112 | 0.306 | 2.428 | 0.018 | 0.576 | 1.737 |

Source: Data Analyzed, 2024

Based on the table 6, it is found that the raw material supply variable (X1) has a tolerance value of 0.654 > 0.10 with a VIF value of 1.529 < 10. The production process variable (X2) has a tolerance value of 0.783 > 0.10 with a VIF value of 1.277 < 10 , and the equipment maintenance variable (X3) has a tolerance value of 0.576 > 0.10 with a VIF value of 1.737 < 10. So the conclusion from this test is that there are no symptoms of multicollinearity between each independent variable in the regression model.

## Multiple Linear Regression Test

The purpose of multiple linear regression testing is to ensure that there is an impact between variable X on variable Y.

**Table 7**
**Multiple Linear Regression Test Results**

**Coefficients[a]**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 5.214 | 1.843 | | 2.829 | .006 |
| | Raw Material Inventory | 0.265 | 0.114 | 0.275 | 2.325 | 0.023 |
| | Production Process | 0.106 | 0.103 | 0.112 | 1.037 | 0.303 |
| | Equipment Maintenance | 0.272 | 0.112 | 0.306 | 2.428 | 0.018 |

a. Dependent Variable: Product Quality
Source: Data Analyzed, 2024

According to the table above, the regression equation is as follows:
Y = a + b1X1 + b2X2 + b3X3 + e
Y = 5,214 + 0,265 + 0,106 + 0,272

Based on the equation above, it can be interpreted:

1. The constant value (a) is 5.214 which has a positive value, shows that the independent variable and dependent variable have a positive impact. This shows that the product quality value (Y) is 5.214 if all independent variables including raw material inventory (X1), production process (X2), and equipment maintenance (X3), do not change at all or have a value of 0 percent.
2. The raw material inventory variable (X1) with the regression coefficient value of 0.265, which shows a unidirectional (positive) influence on product quality. This means that the product quality variable will increase by 0.265 if the raw material supply variable increases by 1%. Assuming that other variables remain constant.
3. The production process variable (X2) with the regression coefficient value of 0.106 which shows a unidirectional (positive) influence on product quality. This means that the product quality variable will increase by 0.106 if the production process variable increases by 1%. Assuming that other variables remain constant.
4. The equipment maintenance variable (X3) with the regression coefficient value of 0.272, which shows a unidirectional (positive) influence on product quality. This means that the product quality variable will increase by 0.272 if the equipment maintenance variable increases by 1%. Assuming that other variables remain constant.

## T-Test (Partial)

According to Nuryanti & Satpatmantya (2021), partial test show the extent to which each independent variable influences the dependent variable as a whole. The calculation to find the T table is by looking at the statistical table. In determining the T table, first calculate df (Degree of Freedom) with the formula:
T table = t (a = 0.05/2 ; n-k-1).
Information = n (sample), k (number of independent variables), and a (level of confidence).

Then it can be calculated:

T table = 0.05/2 ; 77-3-1 = 0.025 ; 73 = 1.993

**Table 8**
**Partial Test Results**

***Coefficients[a]***

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 5.214 | 1.843 | | 2.829 | .006 |
| | Raw Material Inventory | 0.265 | 0.114 | 0.275 | 2.325 | 0.023 |
| | Production Process | 0.106 | 0.103 | 0.112 | 1.037 | 0.303 |
| | Equipment Maintenance | 0.272 | 0.112 | 0.306 | 2.428 | 0.018 |

a. Dependent Variable: Product Quality
Source: Data Analyzed, 2024

It can be explained as follows in light of the partial test finding shown in the above table.

1. The raw material inventory variable (X1) result a significant value of 0.023 < 0.05 and a calculated t value of 2.325 > t table (1.993), meaning that Ha is accepted. So, raw material inventory (X1) has a significant impact on product quality (Y).
2. The production process variable (X2) result a significant value of 0.303 > 0.05 and a calculated t value of 0.629 < t table (1.993), meaning that Ha is rejected. So, production process (X2) has no impact on product quality (Y).
3. The equipment maintenance variable (X3) result a significant value of 0.018 < 0.05 and a calculated t value of 2.428 > t table (1.993), meaning Ha is accepted. So, equipment maintenance (X3) has a significant impact on product quality (Y).

## F-Test (Simultaneous)

According to Nuryanti and Satpatmantya (2021), the F-test (simultaneous) aims to determine the influence of independent variables together on the independent variable. If the calculated F value > F Table indicates that the independent variables have a significant impact together on the dependent variable, or vice versa.

**Table 9**
**Simultan Test Results**

***ANOVA[a]***

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 128.325 | 3 | 42.775 | 12.094 | 0.000[b] |
| | Residual | 258.195 | 73 | 3.537 | | |
| | Total | 386.519 | 76 | | | |

Source: Data Analyzed, 2024

Based on the Table 9, it can be described that the significance level is 0.000 < 0.05 and the calculated F value is 12.094 > F table (2.728) using the formula (k; n-k) = (3 ; 74), where "k" is the number of independent variables and "n" is the number of samples . This shows that Ha is accepted, meaning that raw material supplies, production processes and maintenance have a significant influence on product quality together.

## Coefficient of Determination

According to Nuryanti & Satpatmantya (2021) The coefficient of determination in the multiple linear test is used to calculate the magnitude of the contribution of each independent variable to the dependent variable. These results are represented in the following model summary in Table 10.

**Table 10**
**Coefficient of Determination**

***Model Summary***

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | 0.576[a] | 0.332 | 0.305 | 1.881 |

Source: Data Analyzed, 2024

The correlation coefficient (R) value is 0,576 and then squared, this squaring produces an R Squared value of 0,332. The coefficient of determination is 33.2%, indicating that the variables raw material inventory (X1), production process (X2), and equipment maintenance (X3) together have an effect on product quality (Y) by 33.2%. Meanwhile (100% - 33.2% = 66.8%) is influenced by additional variables not studied which are not part of this regression equation.

## CONCLUSION AND SUGGESTIONS

The conclusion of this study is raw material supplies significant impact on product. Production process does not significant impact on product quality. Equipment maintenance significant impact on Product Quality. Raw material supplies, production processes, and equipment maintenance significant impact on product quality. The coefficient of determination is 33.2%, indicating that product quality is influenced jointly by the variables raw material inventory, production process, and equipment maintenance by 33.2%.

Suggestions for this study, industry must pay close attention to raw material supplies, including the amount of production output so that it can meet demand, as well as safety raw material supplies to anticipate shortages of raw materials during the production process. Pay attention to the number of workers involved in the production process, and the production schedule should be regular or according to what has been previously determined. To pay more attention to the regular replacement of spare parts on production machines, cleaning of equipment must be carried out regularly and adjustments to production machines before starting the production process should be carried out to run the production machines smoothly. Consider variables by reducing the research variables or replacing them with other variables and using appropriate measurement instruments, as well as using different research objects to produce research that can be generalized with a wider scope. Examples of variables that need to be discussed in further research include changing variables to raw material quality, or eliminating production process variables.

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