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Analysis of Worker's Age and Working Time on the Influence of Productivity with Multiple Linear Regression Methods (Case Study of Automotive Spare Parts Manufacturing Company)

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A B S T R A C T

Improving the quality of products produced by industry is largely determined by labor productivity. Age and years of service are factors that can reduce or increase employee productivity. So labor productivity is very influential on company profits. This research was conducted at companies that produce automotive parts, aiming to determine the effect of age and years of service of employees on the level of productivity in the pruning process. In this study, we took a sample of 44 employees using the multiple linear regression method using Minitab software. In this study the independent or independent variables are age (X1) and years of service (X2), while to determine the variable is the level of employee productivity (Y). The results of the study, through data analysis, showed that the variables X1 (age) and X2 (years of service) did not affect Y (work productivity). The results of the classical assumption test obtained that the normality test results obtained a P-Value value of 0.010 < 0.05, the multicollinearity test obtained a VIF value of 23.38 > 10, and for the heteroscedasticity test it was found that the graph versus fit occurred in an orderly distribution. As for the results of the hypothesis test with the summary of the model that the factors X1 (age) and X2 (years of service) have little effect on Y (work productivity), which is only 4.3% and the remaining 95.7% is influenced by other factors that are not research variables.

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1. INTRODUCTION

Delays in the production process are often a factor in problems that are difficult to solve. Poor production management can also have an impact on low employee productivity. The cause of low productivity is influenced by many factors including low employee attendance, the influence of age, years of service, wages, motivation, technology used and work environment factors. An automotive spare part company is a manufacturing company that produces automotive spare parts that function to prevent oil leaks from inside the engine. With a high production target, it is necessary to increase productivity optimally, one of which is the trimming process. In the trimming process,

the output is not proportional to the capacity of the trimming machine itself. The trimming machine capacity is 4,800 pcs/day or 2,400 pcs/shift, while the average achievement based on the data obtained only reaches 2,956 pcs/day or 1,478 pcs/shift. The unbalanced achievement of production results in the trimming process which only reached 62% causing a WIP of 38%, so it is necessary to analyze what influences work productivity in the trimming process for improvement.

From previous research conducted by Sarjono and Supratman (2021), Sarjono et al. (2023), Azizah and Rinaldi (2022), Prabowo and Aisyah (2020), Aprilyanti (2017), Arifin and Parmariza (2021), Sunarto (2020), Rista et al. (2022), Gutara et al. (without year), Hadi and Djamil (without year), Walid and Kasmir (without year) indicate that there are factors that affect work productivity, such as waste in the production process, less effective machine performance, error prevention, workload, compensation, work environment, and work motivation. By taking into account previous research, this research can dig deeper into the relevant factors and broaden our understanding of their effects on work productivity.

Thus, this research is important to provide a better understanding of the factors that affect work productivity in the trimming process in the context of manufacturing companies that produce automotive spare parts. Low work productivity can cause obstacles in the production process and reduce company efficiency. In this case, the low productivity of the trimming process results in an output that is not proportional to the capacity of the trimming machine, causing high WIP. By analyzing the factors that affect productivity in the trimming process, the company can identify existing problems and take appropriate corrective steps. Previous research In the context of manufacturing companies that produce automotive spare parts, increasing work productivity in the trimming process is very important to meet high production targets. By increasing productivity, companies can reduce time wastage, improve machine efficiency, and optimize production capacity. This will have a positive impact on improving product quality, increasing customer satisfaction, and increasing company competitiveness. This research can provide practical insights and recommendations for manufacturing companies in identifying factors that affect work productivity in the trimming process. By understanding the factors that play a role, companies can implement appropriate strategies and improvements, such as improving machine layouts, improving machine performance, improving work processes, or increasing employee motivation. This can help companies increase work productivity effectively and efficiently.

2. LITERATURE REVIEW

Productivity is the ratio of output in the form of goods and services to input that is in the form of resources used such as labor and capital (Assauri, 2014). Productivity can be interpreted as the output obtained from production using either 1 or more factors of production. the meaning of productivity is shown as the ratio of input to output (Fahmi, 2014).

Productivity is defined as the comparison of output with the total input used in one production cycle. Productivity measurement is carried out using methods to measure work attitudes, mentality and outlook on life to constantly improve the quality of life. Simply put, productivity can be interpreted as an increase in quantity and quality (Ukkas, 2017).

Low productivity is affected by waste that occurs in the production line, namely waste waiting time, waste inventory, waste defects, and cramped machine layout (Sarjono & Supratman, 2021), (Sarjono et al., 2023). Productivity is also affected by less effective engine performance and old engine conditions (Azizah & Rinaldi, 2022). Error prevention and error detection can affect productivity levels (Prabowo & Aisyah, 2020).

The age of the workforce can affect labor productivity (Aprilyanti, 2017). Age greatly affects the physical ability of the workforce. Young age reflects a strong physique so that the resulting product is greater and in old age productivity tends to decrease (Kumbadewi et al., 2021). Age factors that affect work activities are as follows:

a. Age 25-45 is a pioneering group that has the characteristics of advanced thinking, broad knowledge and intelligence, advanced entrepreneurs, high income and wealth as

well as high productivity.

b. The age of 45-60 years and above is called the static group with the characteristics of being less capable, and having the ability to lack enthusiasm to accept new things.

The definition of tenure is the extent to which a person has been employed and experienced in a particular field of work. In other words, tenure is the length of time an employee has been performing their duties in the company. The longer the employee has been working for the company, the more experience the employee has gained. With a lot of experience and a long working period, the level of employee productivity is higher.

Regression analysis is a method of mathematically defining the relationship between one or more (Syukron & Kholil, 2012). In this study, data processing uses the multiple linear regression method with the help of Minitab software. Some of the tests that can be done include classical assumption testing and hypothesis testing. Classical tests are conducted to detect the partial (independent) effects of the independent variables (X1 and X2) on the dependent variable (Y) individually. Then to detect the simultaneous influence of the independent variable (X1 and X2) on the dependent variable (Y) a hypothesis test is conducted. The types of Classical assumption tests are as follows:

1. Residual normality test
   Used to detect whether the value obtained from the residual value is normally distributed or not. If it has a normal distribution residual value, this regression test is good. The distribution of data on the diagonal source on the P-P Plot Normal regression is standardized as a means of detection and as a basis for decision-making. The regression test is said to be normal and can be used if the distribution is around the line and follows the diagonal line (Mardiatmoko, 2020). Another test can be used using One-Sample Kolmogorov Smirnov with the following criteria:
   • If the Significant value (Asym Sig 2 tailed or P-Value) > 0.05, then the data is normally distributed.
   • If the Significant value (Asym Sig 2 tailed or P-Value) < 0.05, then the data is not normally distributed.
2. Multicollinearity Test
   The multicollinearity test aims to test whether the regression model found a correlation between independent variables (Ghozali, 2018). A multicollinearity test is a condition when there is a perfect or close linear relationship between the independent variables in a regression model. A regression model is said to suffer from multicollinearity if there is a perfect linear function on some or all of the independent variables in the linear function. Symptoms of multicollinearity include looking at the Variance Inflation Factor (VIF) and its Tolerance value.
   If the VIF value < 10 and Tolerance > 0.1 then it is stated that there is no multicollinearity.
3. Heteroskedasticity Test
   Heteroskedasticity is the condition when there is inequality between the residual variances in all observations of a regression model. Testing is performed by regressing all independent variables to the absolute values of the residuals. The residual is the comparison between the value of the variable Y and the predicted value of the variable Y. While the absolute is the absolute value (all positive values). If the significant value between the independent variable and the absolute balance is > 0.05, then there is no heteroscedasticity.

The research uses multiple linear regression analysis, revealing that simultaneously or simultaneously the three variables influence organizational commitment. The variable results of the workload partial test, the compensation variable and the work environment have a positive and significant effect on organizational commitment(Arifin & Parmariza, 2021).

The results of multiple linear regression analysis using SPSS version 23 statistical software showed that attitude variables, subjective norm variables and perceived behavioral control had a positive and significant impact on BreadTalk customer purchase intentions. However, partially the attitude variable has a more positive and significant effect on the purchase intention of BreadTalk customers, then followed by the subjective norm variable. Unlike the perceived behavioral

control, partially this variable has not had a positive and significant effect on the purchase intention of BreadTalk customers (Sunarto, 2020).

Testing Multiple linear regression analysis was carried out to determine the effect of the independent variables on the dependent variable, namely profitability and Investment Opportunity Set (IOS) on dividend policy. This regression analysis was assisted by using SPSS version 22 (Desmizar, 2021). Data analysis using Multiple Linear Regression showed that Tax Knowledge has a positive effect on the intention to avoid tax while E-Commerce, Self Assessment Systems, and Automatic Exchange of Information (AEoI) do not effect on the intention to avoid tax (Rista et al., 2022).

3. RESEARCH METHOD

This study has 3 variables namely: age of the employee (X1), years of service (X2) and, productivity (Y). The reason is because the three of them have a strong relationship. For example, in old age, the physical condition of workers will decrease. Meanwhile, a long working period will affect work motivation caused by boredom. This will certainly affect the decline in productivity.

Independent variable or independent variable (X), and dependent or dependent variable (Y) using quantitative research design, while for data analysis using multiple linear regression using Minitab software.

Fig. 1 describes the effect of age (X1) and years of service (X2) on productivity (Y). From the research variables, hypotheses can be drawn as follows:

1. H0-1 = There is no effect of age on productivity
   Ha-1 = Age affects productivity
2. H0-2 = Working duration does not affect productivity
   Ha-2 = Working duration affects productivity
3. H0- 3 = Age and years of service do not affect productivity
   Ha-3 = There is an effect of age and years of service on productivity

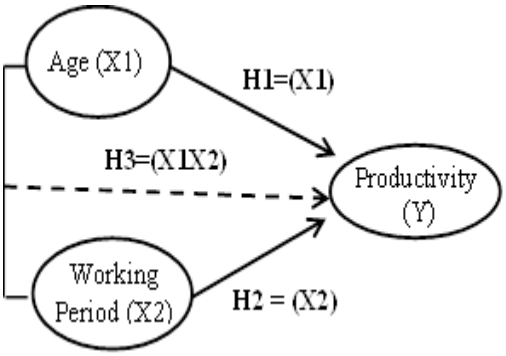

Fig. 1. Research variables

The research population is the employees of the trimming process division in a company that produces automotive spare parts. Sampling observations in the study were workers who had worked for over 3 years to 25 years with ages 21 to 45 years. In this study, the data on the achievement of production results of employees in the production line, especially in the trimming process, were taken. research data are listed in Table 1 below:

Table 1. Population data of labor productivity sample

Productivity (Pcs)			
2661	1357	1267	1845
1287	1238	1259	1256
1788	1304	1741	1727
1446	1404	1865	1317
1400	1220	1285	1920
1617	1451	1404	1310
1514	1269	1191	1330
1141	1717	1400	1426
1705	1440	1526	1273
1424	1618	1348	1397
1273	1932	1568	1185

4. RESULT AND DISCUSSION

4.1. Classical hypothesis testing

a. Normality test
   From the normality test, the P-Value is 0.010 < 0.05, so the test result is not normal, and if the P-Value is > 0.05, the test result is normal.

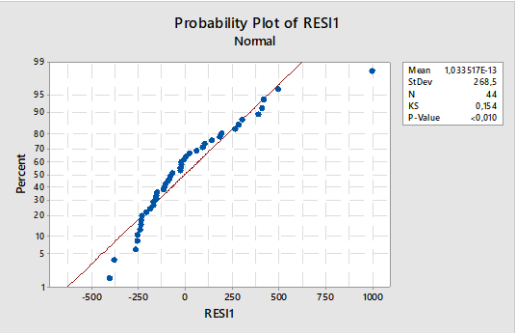

Fig. 2. Normality test

b. Multicollinearity test
The multicollinearity test can be seen in Table 2, with the results obtained VIF 23.38 > 10 so multicollinearity occurs.
Multicollinearity occurs if the VIF value is >10 and if there is no multicollinearity the VIF value is <10.

Table 2. Multicollinearity test

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	649	493	1,32	0,196	
X1 Age	41,8	26,6	1,57	0,123	23,38
X2 Work Period	-34,6	26,8	-1,29	0,205	23,38

c. Heteroskedasticity Test
From Fig. 3, it can be seen that the matching versus graph occurs in a regular distribution so it can be concluded that this test has heteroscedasticity.

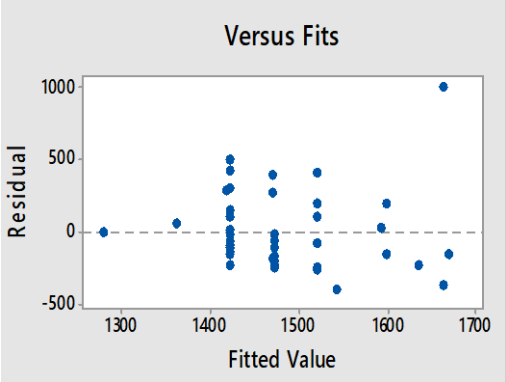

Fig. 3. Heteroscedasticity test

The three classical hypothesis tests concluded that they do not meet the requirement.

4.2. Hypothesis Testing or Multiple Regression Testing

To perform a multiple regression test, the first step is to test the hypothesis, which is shown in the Table (3, 4, and 5).

1. H0-2 = Working duration does not affect productivity
Ha-2 = Working duration affects productivity

Table 3. Hypothesis test H0-1 and H0-2

Coefficients					
Term	Coef	SE Coef	T-Value	P-Value	VIF
Constant	649	493	1,32	0,196	
X1 Age	41,8	26,6	1,57	0,123	23,38
X2 Work Period	-34,6	26,8	-1,29	0,205	23,38

Alternative H is accepted if T-Value > T table because it shows influence, otherwise if T-value < T table means no effect. If P-Value < 0.05 indicates influence and if P-Value > 0.05 then it has no effect.

So from Table 3, it can be concluded that for variable X1 (Age) P-Value is 0.123 > 0.05 there is no effect on work productivity. So that the hypothesis result for H0-1 is accepted because there is no effect and Ha-1 is rejected because there is no effect on productivity.

While for variable X2 (years of service) P-Value is 0.205 > 0.05 then there is no effect on work productivity. Until the hypothesis result for H0-2 is accepted because there is no effect and Ha-2 is rejected because there is no effect on work productivity.

2. H0- 3 = Age and years of service do not affect productivity
Ha-3 = There is an effect of age and years of service on productivity

In Table 4 it can be seen that Age (variable X1) and years of service (X2) have a P-Value of 0.153 > 0.05 so there is no effect on work productivity. So that the hypothesis result for H0-3 is accepted because there is no effect and Ha-3 is rejected because there is no effect on work productivity. So simultaneously when combined all the results of the hypothesis test do not effect on work productivity.

Table 4. Hypothesis test H0-3

Analysis of Variance					
Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	2	297304	148652	1,97	0,153
X1 Age	1	187078	187078	2,47	0,123
X2 Work period	1	125672	125672	1,66	0,205
Error	41	3100201	75615		
Lack-of-Fit	10	764798	76480	1,02	0,453
Pure Error	31	2335403	75336		
Total	43	3397506			

4.3. Summary models

Table 5 can be seen in the Summary Model, which is used to predict how much the independent variable contributes to the dependent variable.

Table 5. Summary model

Model Summary			
S	R-sq	R-sq(adj)	R-sq(pred)
274,981	8,75%	4,30%	0,00%

So the effect of age (X1) and years of service (X2) on productivity is 4.3% while other factors that we did not examine affect the rest. So we get the multiple linear regression equation in Table.6.

Table 6. Multiple linear equations

Regression Equation
Y Work Productivity
= 649 + 41,8 X1 Age - 34,6 X2 Work Periode

From the above equation, it can be concluded that the dependent variable (Y) is work productivity. This is the variable that will be predicted or explained using other independent variables. The first independent variable (X1) is age. In this context, every one year increase in age will result in a 41.8 increase in work productivity, which is assumed to be a positive linear relationship. This means that the older a person is, the higher the expected work productivity. The second independent variable (X2) is the working period. In this context, every one-unit increase in working period will lead to a 34.6 reduction in labor productivity. This is assumed to be a negative linear relationship. In other words, the longer a person works at a job, the lower the expected work productivity.

5. CONCLUSION

After conducting research at Automotive Spare Part Companies on the trimming process, it can be concluded that age and years of service have only a small effect on productivity levels. From several tests, the following results from the normality test, abnormal results are obtained, from the Multicollinearity test there is Multicollinearity and Heteroscedasticity test can mean that this test has Heteroscedasticity. So that from the third test, the calcic assumptions do not meet the requirements.

As for the testing hypothesis and multiple regression tests, it was found that age (X1) and years of service (X2) had little effect on productivity (Y), namely only 4.3% while 95.7% were determined by factors that we did not examine.

The benefits of implementing multiple linear regression testing are that it can add to scientific studies of industrial techniques in forecasting production processes, able to perform calculations in parallel so that the process is shorter and able to acquire knowledge even though there is no certainty.

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