ASTONJADRO

pISSN 2302-4240
eISSN 2655-2086

Volume 13, Issue 3, October 2024, pp.821-829
DOI: http://dx.doi.org/10.32832/astonjadro.v13i3 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

Analysis of Factors Affecting Labor Productivity in Fixing and Formwork Work on the Joglo Fly-Over Rail Project

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| Submitted: January 11, 2024 | Revised: April 03, 2024 | Accepted: May 24, 2024 |

| Published: September 21, 2024 |

ABSTRACT

The study investigates factors influencing worker productivity in construction projects, recognizing the challenge of balancing a sufficient workforce without compromising efficiency. Employing work sampling and regression analysis, eight variables are identified: experience, education, health, family dependents, wages, field conditions, weather, and K3. The results reveal that, collectively, these variables fall below established standards, indicating a lack of significant impact on labor productivity. Notably, experience emerges as the most influential factor, although its significance level remains below the threshold. Despite this, the variable's calculated t value of 1.772 suggests its relative importance compared to others. The study underscores the need for meticulous labor selection, emphasizing experienced individuals to enhance overall productivity. While no single variable surpasses the significance threshold, the findings provide valuable insights for construction project management, urging a focus on experienced workers to improve productivity levels. Ultimately, the study contributes to understanding the nuanced dynamics of worker productivity in construction, urging practitioners to consider experience as a pivotal factor in their labor selection process.

Keywords: labor productivity, influential factors, productivity

INTRODUCTION

Surakarta City is one of the cities in Indonesia that is growing rapidly, along with its development, the traffic is also getting busier which results in congestion at the joglo intersection point. According to (Budi, 2022) The Solo Balapan - Kadipiro elevated railway line construction project is a large project undertaken by several companies. The elevated railway line aims to connect Solo with other areas in Central Java and even to East Java..

In this Rail Fly Over Joglo project, research was carried out on factors affecting worker productivity in the work of forming and formwork installation. The work definitely requires human resources that must be controlled so that the project is completed on schedule. The success of a construction project hinges on resources, and even the smallest task, without the backing of high-quality and productive human resources, will fail to yield optimal and satisfactory outcomes in the project. Resources that influence the project consist of man, material, machine, money and method. (Rauzana, 2016) Therefore, it is important for companies to know what factors affect productivity on the project. Assessment of worker productivity needs to be done as an effort to evaluate the efficiency and effectiveness of workers in carrying out work. A number of factors that can affect productivity are wages, education, work ability, operational standards that must be carried out, special training, and maintained work discipline.

Research on worker productivity also has positive benefits in the long run. Especially for the forming and formwork section, due to the function of formwork iron as a mold for both columns and beams and iron as a barrier to the tensile strength of a building. In addition to improving the efficiency and effectiveness of workers involved in the project, the results of the research can be used as a reference and material to improve production management on other large projects in the future.

In this case, it is important for the company to obtain accurate data and information by conceptualizing a research framework for a complete and systematic analysis of worker productivity, because by knowing the level of productivity, the company can determine the amount

of profit or loss in the project. Thus, the company will be able to observe factors related to worker productivity that can improve work efficiency and increase work productivity so as not to experience losses in the next project.

RESEARCH METHODS

Equipment and Material

In this study using a tool in the form of a questionnaire form and processed using the SPSS software application.

Method

This type of research is semi-quantitative. Semi-quantitative research is weighting or giving value to a qualitative scale on a qualitative method (Maria Sintorini & Putra, 2016). This study aims to determine what factors influence the productivity of workers on the work of fixings and formwork on the Rail Fly Over Joglo Surakarta project. For the calculation method used is multiple linear regression analysis where the data collection techniques in this study are by distributing questionnaires containing a list of questions with several relevant variables and distributed to respondents, namely workers in the Joglo Fly Over Rail project. The research flowchart is introduced in **Figure 1** below.

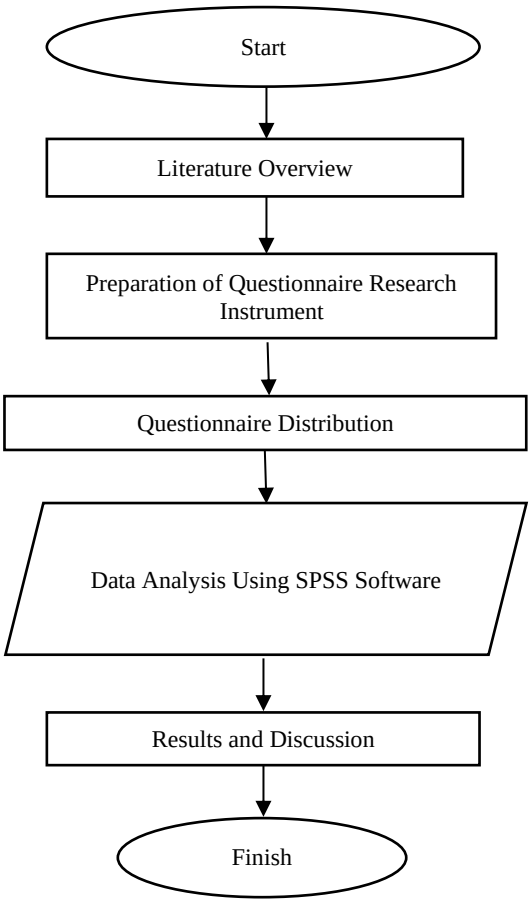

Figure 1. Research Flow Diagram

RESULT AND DISCUSSION

Instrument Test

Validity Test

pISSN 2302-4240
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In the process of determining the number of samples using the Slovin formula, which resulted in a total of 20 people who could already represent a number of people in the project. In the validity test, several changes in the order of the questions were made so that the questions were easily understood by the respondents when filling out, and finally the questionnaire as a whole would be obtained. According to (Didik, 2018) validity is a measurement or test to determine the accuracy and accuracy of a measuring instrument or a measurement. In this study, the validity test was carried out using Pearson's product moment correlation technique. An item is declared valid if it has a product moment correlation index above r table, while for the value of r table is obtained through determining the number of samples. In this study the dependent variable (Y) is productivity while the independent variable (X) there are 8 variables that have been determined, namely experience, education, health, number of dependents in the family, wages, field conditions, weather, K3. Based on the results of the Validity Test, it is found that all variables can be declared valid because they exceed the value of r table which is based on the number of samples obtained r table value of 0.444 while for r counts obtained values from the range 0.587 - 0.897. Therefore the sample can proceed to the Reliability Test to find the Cronbach's Alpha value.

Reliability Test

Reliability test is a test to determine the extent to which a measuring instrument can be trusted in measuring and also aims to determine whether the questionnaire made is reliable, an object is reliable if the object tool has been used many times and the average results obtained are still relatively the same or not too far different.(Dewi & Sudaryanto, 2020). In reliability testing using the Cronbach's Alpha method with the SPSS version 23 application. Therefore, the acceptable Cronbach's Alpha value that is accepted and declared reliable is> 0.6, otherwise it is declared unreliable if the Cronbach alpha value <0.6. (Abdillah, Novia Nur; Lestariningsih, 2023). From the test results, it is found that the Cronbach's Alpha value has a range of 0.871 - 0.998. Therefore it can be said that all variables in the questionnaire have passed the reliability test and are consistent, so they can be used in further research.

Calculation and Result

Normality Test

Aims to determine whether the data obtained from a study is normally distributed or not. (Haniah, 2013). To find out whether the sample data is normally distributed and can be determined using the Kolmogrov-Smirnov test. Decision making that the data is normally distributed if the value of sig. Kolmogorov-Smirnov Test > 0,5 To find out whether the sample data is normally distributed and can be determined using the Kolmogrov-Smirnov test. The test results can be presented in **Table 1** and **Graph 2** below.

Table 1. Normality Test Results

No	Variabel	Asymp.Sig (2-tailed)	α	Keterangan
1	Experience (X1)	0.167	0.05	Normally Distributed
2	Education (X2)	0.2	0.05	Normally Distributed
3	Healthcare (X3)	0.2	0.05	Normally Distributed
4	Number of Dependents in Family (X4)	0.2	0.05	Normally Distributed
5	Salary (X5)	0.2	0.05	Normally Distributed
6	Field Conditions (X6)	0.11	0.05	Normally Distributed
7	Weather (X7)	0.2	0.05	Normally Distributed
8	Occupational Health and Safety (X8)	0.157	0.05	Normally Distributed

Source: Data processing SPSS 23

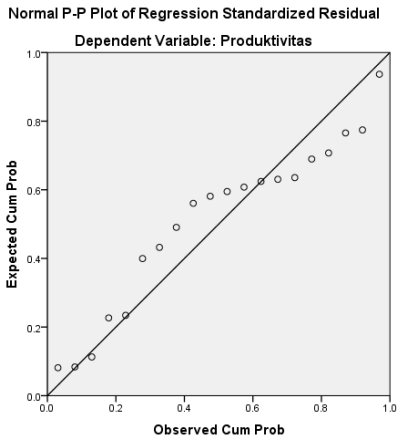

Figure 2. Normal P-Plot Chart Source: Data processing SPSS 23

Based on the normality test table and chart Kolmogrov-Smirnov It is known that the data is normally distributed because all the *Asymp.* Sig. (2-tailed) > 0.05 and also the distribution of points on the graph has followed the diagonal line, which means that the data is normally distributed.

Multicollinearity Test

The multicollinearity test serves to see whether or not there is a correlation between the variables in a model. (Christy et al., 2018). Multicollinearity testing in this study will use the value of *Varian Inflation Factor* (VIF) obtained from hypothesis testing. If the VIF value > 10 then there is a big problem associated with the Multicollinearity Test, otherwise if the VIF value < 10 then the regression model does not contain Multicollinearity. The results of this multicollinearity test are presented in **Table 2**.

Table 2. Multicollinearity Test Results

No	Factor	Collinearity Statistics		Description (VIF<10,Tolerance>0.1)
		Tolerance	VIF	
1	Experience (X1)	0.624	1.603	Non-Multicollinearity
2	Education (X2)	0.605	1.654	Non-Multicollinearity
3	Healthcare (X3)	0.728	1.373	Non-Multicollinearity
4	Number of Dependents in Family (X4)	0.918	1.090	Non-Multicollinearity
5	Salary (X5)	0.618	1.618	Non-Multicollinearity
6	Field Conditions (X6)	0.562	1.780	Non-Multicollinearity
7	Weather (X7)	0.649	1.542	Non-Multicollinearity
8	Occupational Health and Safety (X8)	0.553	1.810	Non-Multicollinearity

Source: Data processing SPSS 23

Based on **Table 2**, it can be concluded that the regression model in this study does not contain symptoms (problems) of multicollinearity, because the value of the Variant Inflation Factor (VIF) is below the criteria limit on the existence of multicollinearity problems, namely 10..

Heteroscedasticity Test

The heteroscedasticity test is a statistical procedure used to determine whether the residual variance of a regression model is constant. (Firdausya & Indawati, 2023). (Zahari et al., 2019) Also Acording to Zahari et al, 2019 Heteroscedasticity test aims to test whether in the regression model there is an

pISSN 2302-4240
eISSN 2655-2086

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inequality of variance from the residuals of one observation to another. Heteroscedasticity is tested by using the Rank Spearman correlation coefficient test, which correlates the absolute residuals of the regression results with all independent variables. If the significance of the correlation result is <0.05 (5%) then the regression equation contains heteroscedasticity and vice versa non-heteroscedasticity or homoscedasticity. The following can be seen the results of the Heteroscedasticity test using the Rank Spearman method in **Tabel 3**.

Tabel 3. Heteroscedasticity Test Results

No	Factor	Sig.	Description
1	Experience (X1)	0.378	Non Heteroscedasticity
2	Education (X2)	0.068	Non Heteroscedasticity
3	Healthcare (X3)	0.289	Non Heteroscedasticity
4	Number of Dependents in Family (X4)	0.897	Non Heteroscedasticity
5	Salary (X5)	0.210	Non Heteroscedasticity
6	Field Conditions (X6)	0.541	Non Heteroscedasticity
7	Weather (X7)	0.090	Non Heteroscedasticity
8	Occupational Health and Safety (X8)	0.666	Non Heteroscedasticity

Source: Data processing SPSS 23

The test results above show that all factors tested are greater than 0.05 (5%) or do not contain heteroscedasticity. This means that there is no correlation between the magnitude of the residual data so that the enlarged data does not cause the residual (error) to get bigger.

Multiple Linear Regression Analysis Test

It is a statistical technique that can be used to analyze the relationship between dependent and independent variables. The main purpose of this analysis is to determine the significance of the influence of the independent variable on the dependent variable so that it can contain appropriate predictions.. (Wisudaningsi et al., 2019) In this study, analysis was used to determine the effect of experience, education, health, number of dependents in the family, wages, field conditions, weather and K3 on age. The following table is the result of the calculation of the Multiple Linear Regression Test with the help of *Statistical Package for Social Science (SPSS)* 15.0 for *windows* which are presented in **Table 4** below.

Table 4. Multiple Linear Regression Analysis Test Results

No	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	-0.385	2.832		-0.136	0.894
1	Experience (X1)	0.786	0.443	0.438	1.772	0.104
2	Education (X2)	-0.053	0.487	-0.027	-0.108	0.916
3	Healthcare (X3)	-0.636	0.361	-0.394	-1.761	0.106
4	Number of Dependents in Family (X4)	0.059	0.303	0.058	0.195	0.849
5	Salary (X5)	-0.104	0.232	-0.11	-0.447	0.664
6	Field Conditions (X6)	0.121	0.195	0.156	0.621	0.547
7	Weather (X7)	0.465	0.301	0.452	1.543	0.151

8	Occupational Health and Safety (X8)	0.596	0.391	0.446	1.524	0.156

Source: Data processing SPSS 23

In **Table 4**. above can be explained about the multiple regression equation in this study. The regression equation formula in this study is as follows :

$X = -B0 + B_1X_1 - B_2X_2 - B_3X_3 + B_4X_4 - B_5X_5 + B_6X_6 + B_7X_7 - B_8X_8$

$Y = -0{,}385 + 0{,}796X_1 - 0{,}053X_2 - 0{,}636X_3 + 0{,}059X_4 - 0{,}104\ X_5 + 0{,}121X_6 + 0{,}465X_7 - 0{,}596X_8$

Hypothesis Test

It is a method to statistically test the truth of a statement and draw conclusions on the acceptance or rejection of the decision.. (Muhfiyanti et al., 2021) In the hypothesis test there are two tests, namely the F test and the T test.

F Test

Used to determine the level of influence of all independent variables on the dependent variable. (Suriyanti et al., 2021) The F-test results are shown in **Table 5.**

Table 5. F Hypothesis Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.661	8	0.458	1.678	0.209
Residual	3	11	0.273		
Total	6.661	19			

Source: Data processing SPSS 23

Based on the table, it can be seen that the calculated F value = 1.678 and the Sig value = 0.209 while the F table value = 3.02 and the α set is 0.05. Because the F value is 1.678 < 3.02 and the Sig value is 0.209 > 0.05, from these results it can be concluded that HO is accepted and HI is rejected. This means that the independent variables have a simultaneous influence on the magnitude of the productivity variable.

T Test

According to (Sabena et al., 2016) aims to determine whether or not the independent variable (X) partially affects the dependent variable (Y) and whether the hypothesis can be accepted or rejected. The results of Hypothesis T testing are presented in **Table 6**.

Table 6. Hypothesis Test T Results

No	Model	t	Sig.	Results
	(Constant)	-0.136	0.894	
1	Experience (X1)	1.772	0.104	Not Affected
2	Education (X2)	-0.108	0.916	Not Affected
3	Healthcare (X3)	-1.761	0.106	Not Affected
4	Number of Dependents in Family (X4)	0.195	0.849	Not Affected
5	Salary (X5)	-0.447	0.664	Not Affected
6	Field Conditions (X6)	0.621	0.547	Not Affected
7	Weather (X7)	1.543	0.151	Not Affected

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eISSN 2655-2086

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8	Occupational Health and Safety (X8)	1.524	0.156	Not Affected

Source: Data processing SPSS 23

T Test X1 (Experience)

The analysis results of the SPSS program can be seen in table 8 which shows the value of t = 1.772 < 2.20. Meanwhile, the probability value of the experience variable is 0.104> 0.05, so HO is accepted HI is rejected. This means that the variable partially does not have a significant effect on the dependent variable productivity.

T Test X1 (Education)

The results of the analysis of the SPSS program can be seen in table 8 showing the value of t = -0.108 < 2.20. Meanwhile, the probability value of the education variable is 0.916> 0.05, so HO is accepted HI is rejected. This means that the variable partially does not have a significant effect on the dependent variable productivity.

T Test X1 (Healthcare)

The results of the analysis of the SPSS program can be seen in table 8 showing the value of t = -1.761 < 2.20. Meanwhile, the probability value of the health variable is 0.106> 0.05, so HO is accepted HI is rejected. This means that the variable partially does not have a significant effect on the dependent variable productivity.

T Test X1 (Number of Dependents in Family)

The results of the analysis of the SPSS program can be seen in table 8 showing the value of t = 0.195 < 2.20. Meanwhile, the probability value of the variable number of dependents in the family is 0.849> 0.05, so HO is accepted HI is rejected. This means that the variable partially does not have a significant effect on the dependent variable productivity.

T Test X1 (Salary)

The analysis results of the SPSS program can be seen in table 8 showing the value of t = -0.447 < 2.20. Meanwhile, the probability value of the wage variable is 0.664> 0.05, so HO is accepted HI is rejected. This means that the variable partially does not have a significant effect on the dependent variable productivity.

T Test X1 (Field Conditions)

The analysis results of the SPSS program can be seen in table 8 showing the value of t = 0.621 < 2.20. Meanwhile, the probability value of the field condition variable is 0.547> 0.05, so HO is accepted HI is rejected. This means that the variable partially does not have a significant effect on the dependent variable productivity.

T Test X1 (Weather)

The analysis results of the SPSS program can be seen in table 8 showing the value of t = 1.543 < 2.20. Meanwhile, the probability value of the weather variable is 0.151> 0.05, so HO is accepted HI is rejected. This means that the variable partially does not have a significant effect on the dependent variable productivity.

T Test X1 (Occupational Health and Safety)

The analysis results of the SPSS program can be seen in table 8 which shows the value of t = 1.524 < 2.20. Meanwhile, the probability value of the K3 variable is 0.156> 0.05, so HO is accepted HI is rejected. This means that the variable partially does not have a significant effect on the dependent variable productivity.

From the results of the above analysis, it is known that the most dominant factor on the dependent variable (Age) is in the independent variable (Experience) with a value of t = 1.772, which is also supported by the Sig. value of 0.104.

CONCLUSION

Based on the results of the study, it can be concluded that there are 8 variables that can be seen as affecting productivity, namely experience, education, health, number of dependents in the family, wages, field conditions, weather and K3. From the research conducted, the value is still below the standard that has been determined from the provisions of the value of f table and t table which if the value of t count is smaller than t table (2.23) and its significance> 0.05 means that it does not have a too significant influence on labor productivity. Among the 8 variables there are 3 variables that are insignificant and there are 5 variables that have a significant influence. For variables that have an insignificant effect are the variables of Education, Health and Wages, while for variables that have a significant effect are Experience, Number of Dependents in the Family, Field Conditions, Weather and K3. Then for the dominant variable, the experience variable with a value of t = 1.772 and a value of Sig = 0.104. Even though it is still below the standard, it has the highest points in the calculation.

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