

Evaluation of Factors Affecting the Delay in a Construction Project of Dr. Iskak's Hospital Pavilion of Tulungagung District

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Abstract—In its implementation, the Dr. Iskak's Hospital Pavilion of Tulungagung District, which was built in the fiscal year of 2016, experienced obstacles that had caused delays in the completion of its construction project. The delay reached 15% of the specified time. This research was conducted to find out and obtain the factors affecting the delay and to obtain the most dominant factors in influencing it, so that the right action to minimize the occurrence of delays in the completion of the work can be determined. The data analysis methods were factor analysis and multiple linear regression analysis using the SPSS program to answer the questionnaire distributed to 37 respondents consisting of the owner, contractor and supervisory consultant. The findings showed that all factors simultaneously had an effect on the delay in completing the project with a value of $F_{\text{calculate}} = 6.304 > F_{\text{table}} = 2.346$. Meanwhile, partially the factors that have a positive and significant effect on the delay in project completion are Design Changes, Work Environment, and Workers. The calculation of multiple linear regression analysis found that the most dominant factor affecting the delay in the completion of the project is the Design Change factor with a standardized coefficient of β of 0.417. The actions required to be taken to overcome this are to immediately make changes to the contract (amendment to the contract) due to changes in the scope of the work.

Keywords— Building, design changes, completion of project, delay.

I. INTRODUCTION

Construction projects always experience a number of constraints including those that have been previously predicted and those that are not expected. Usually, constraints are the cause of the delay in the work, so the work does not run smoothly. Therefore, in the implementation of the construction project, there is a possibility that the time needed to complete the project will exceed the specified time written in the contract. In other words, there is a delay in the completion of the project. [1]

Delay in the completion of the project is a problem that is very undesirable by the contractor and the owner because it will always cause adverse consequences for both parties. The impact of delays is conflict and debate about what and who is the cause plus the demands of time and additional costs [2,3] Not only for the contractor and owner, the loss is also experienced by the society around the project location due to activity disruption caused by the late completion of the project. [4]

Project delay is the main contribution to the occurrence of project cost overruns and the loss of opportunities to work on other projects. Therefore, the factors that cause delay need serious attention. Delay in project completion can be caused by several factors, including material, equipment, workers, financial problems, methods of carrying out work, design changes and work environment. [5,6]

Building project of the Dr. Iskak's Hospital Pavilion (2 floors) of Tulungagung District, which was built in 2016, was planned to be completed within 6 (six) months with a contract value of IDR 6.3 Billion. However, during its implementation, the project experienced obstacles, so that it did not meet the

target on time as the expectation. The delay in completing the project reaches almost 15% of the time agreed within the contract. It was also evidenced by a late fine from the Supreme Audit Agency at the audit time in early 2017. It was estimated that the main cause of the delay in the completion of the construction project was that the Dr. Iskak's Hospital Pavilion is a work environment factor that gives restrictions on working hours with the aim to minimize the occurrence of disruption to patients under the treatment. In addition, changes in building design, especially in the foundation structure are also suspected to contribute to the delay in the completion of the project.

Therefore, this research will explore thoroughly the factors affecting the delay in the completion of the construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District and then determine the efforts or actions to control and overcome them so that the delay in implementing the project will not be repeated.

A. Research Problems

Based on the above background of the research, the problems that will be formulated in this research are as follows:

1. What factors affect the delay in the completion of the construction project of Dr. Iskak's Hospital Pavilion of Tulungagung District?
2. What is the most dominant factor affecting the delay in the completion of the construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District?
3. What actions should the contractor take to overcome the dominant factors affecting the delay in the completion of the project?

B. Research Objectives

Based on the formulation of the above problems, the objectives of this research include:

1. Analyzing and determining the factors that affect the delay in the completion of the construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District.
2. Analyzing and obtaining the most dominant factors affecting the delay in the completion of the construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District.
3. Determining the actions that the contractor must take to overcome the dominant factors that affect the delay in the completion of the project.

II. RESEARCH METHOD

Based on the method, this research includes descriptive research aiming to determine the factors affecting the delay in the completion of construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District. The data collection was carried out by using survey method; it is by capturing respondents' opinions, experiences and attitudes about the problems experienced in the construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District. It was carried out by taking primary data through questionnaires and secondary data from related institutions. Based on the factors affecting the delay in completing the construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District, it was continued by determining the factors in the form of variables to be used as points of the questions that were going to be measured in the form of a questionnaire. [7,8,9]

A. Research Population and Sample

The research populations were people who knew the condition and who were directly involved in the construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District; as many as 41 people. The total sample were 37 respondents.

B. Research Variables

1. The independent variables (X) include:
 - a. Material (X1)
 - b. Equipment (X2)
 - c. Workers (X3)
 - d. Finance (X4)
 - e. Implementation Method (X5)
 - f. Design Changes (X6)
 - g. Work Environment (X7)
2. Meanwhile, the dependent variable (Y) is:
 - Delay in Project Completion (Y)

C. Instrument Feasibility Test

1. Multiple Linear Regression Analysis

To test the questions related to the factors affecting the delay in the completion of the construction project of the Dr. Iskak's Hospital Pavilion of Tulungagung District and to get the most dominant factors affecting it, it applied analytical

techniques in the form of multiple linear regression test. This test is applied to test or analyze the influence or correlation between independent variables with one or more variables. This analysis technique uses Anova test or F-test and t-test and searches for the coefficient of determination or adjusted R^2 . This calculation will be carried out with the help of SPSS program according to multiple linear equations:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7$$

Description:

Y = Delay in Project Completion

X1 = Material

X2 = Equipment

X3 = Workers

X4 = Finance

X5 = Implementation Method

X6 = Design Changes

X7 = Work Environment

b0 = Constant

b1, b2, b3, b4, b5, b6, b7 = Regression Coefficient

2. Hypothesis Test on Regression Model Coefficient

To prove the appropriateness of the hypothesis, the F-test is used with the following test criteria:

- a. The effect of the independent variables is simultaneously on the dependent variable.
- b. The effect of independent variables is partially on the dependent variable.

3. Assumption Test on Regression Model

To obtain estimation parameters from the dynamic model used, this research applied the OLS (Ordinary Least Square) assessment method. [10] The use of this method is accompanied by underlying assumptions. These assumptions include Normality, Multicollinearity, and Homoscedasticity. [11]

III. FINDINGS

A. Multiple Linear Regression Analysis

Regression analysis is used to obtain factors that affect the Delay in Project Completion. In processing data using multiple linear regression analysis, several steps are carried out to find the correlation between independent and dependent variables. Based on the results of data processing using SPSS 15 software, it obtains a summary as in the following Table 1.

Based on Table 1, it is found that not all independent variables have significant value. Independent variables that have significant value (significant effect on Delay in Project Completion) are Workers (X3), Design Changes (X6), and Work Environment (X7). Meanwhile, variables that do not have significant value (have no significant effect on Delay in Project Completion) are Material (X1), Equipment (X2), Finance (X4), and Implementation Method (X5).

TABLE 1. Summary of Regression Analysis Results

Variables	Coefficient β	StandardizedCoefficient β	$t_{\text{calculate}}$	p-value	Description
Constant	0.237		0.179	0.859	Not Significant
Material (X1)	-0.064	-0.034	-0.254	0.801	Not Significant
Equipment (X2)	-0.076	-0.057	-0.434	0.667	Not Significant
Workers (X3)	0.371	0.325	2.245	0.033	Significant
Finance (X4)	-0.184	-0.139	-1.065	0.296	Not Significant
Implementation Method (X5)	-0.032	-0.024	-0.171	0.866	Not Significant
Design Changes (X6)	0.413	0.417	3.221	0.003	Significant
Work Environment (X7)	0.469	0.370	2.558	0.016	Significant
$\alpha = 0.05$ $R^2 = 0.603$ $R = 0.777$ $F_{\text{calculate}} = 6.304$ $F_{\text{table}}(0.05,7,29) = 2.346$ $p\text{-value} = 0.000$ $t_{\text{table}}(0.05,29) = 2.045$					

Source: Analysis results of SPSS, 2018

Based on the above Table 1, the regression model is as follows:

$$Y = 0,237 - 0.034 X1 - 0.057 X2 + 0.325 X3 - 0.139 X4 - 0.024 X5 + 0.417 X6 + 0.370 X7 + \epsilon$$

R^2 value is the coefficient of determination which basically measures to what extent the ability of the regression model in explaining the diversity of the dependent variable (Y); that is equal to 0.603. It means that the regression model can explain 60.3% of the variability in the Delay in Project Completion (Y) variable. The R-value is a correlation that explains the closeness of the correlation between the independent variables (X) and the dependent variable (Y) of 0.777.

Moreover, to determine the independent variable (factor) that has the most dominant effect on the Delay in Project Completion, it can be carried out by comparing the value of the standardized β coefficient of each independent variable (factor) to Y. The most dominant variable affecting the Delay

in Project Completion is variable whose effect is significant and has the largest standardized β coefficient value.

Based on Table 1, Design Changes (X6) Factor is the variable (factor) that has the highest standardized value of β coefficient. It means that in this research, the most dominant factor affecting the Delay in Project Completion is Design Changes (X6). In other words, design changes affect the Delay in Project Completion. A positive standardized β coefficient value indicates that frequent design changes will result in increased delay in project completion and vice versa.

B. Hypothesis Test on Regression Coefficient Model

1. Simultaneous Regression Model Test

Simultaneous test is carried out to show whether all factors in the regression model affect the Delay in Project Completion. All of these factors are tested simultaneously using the F-test or ANOVA. The hypothesis used in testing the of the simultaneous regression coefficient model can be seen in the following Table 2:

TABLE 2. Hypothesis Test on Simultaneous Regression Model

Hypothesis	Value	Decision
$H_0: \beta_i = 0$ (there is no significant effect between X1, X2, X3, X4, X5, X6, X7 on the Delay in Project Completion) $H_a: \beta_i \neq 0$ (there is significant effect between X1, X2, X3, X4, X5, X6, X7 on the Delay in Project Completion), $\alpha = 0.05$	$F = 6.304$ $p\text{-value} = 0.000$ $F_{\text{table}} = 2.346$	Reject H_0

Source: Analysis results of SPSS, 2018

Based on Table 2, simultaneous test of the regression model is carried out using the F-test. In the F distribution table, the F_{table} value with degrees of freedom (df) $n1 = 7$ and $n2 = 29$ is 2.346. If the F-value of the calculation results in table 4.16 is compared with F_{table} , then the $F_{\text{calculate}}$ of the calculation results is greater than F_{table} ($6.304 > 2.346$). In addition, the p-value is 0.000. If the p-value is compared with $\alpha = 0.05$, the p-value is less than $\alpha = 0.05$. From these two comparisons, the decision taken is that H_0 is rejected at the level of $\alpha = 0.05$. So, it can be concluded that there is a significant effect simultaneously between X1, X2, X3, X4, X5, X6, X7 on the Delay in Project Completion.

2. Partial Regression Model Test

The partial regression model test is used to determine whether or not each independent variable forming a regression model individually has a significant effect on the Delay in Project Completion. To test the correlation, the t-test is used; that is by comparing the value of $t_{\text{calculate}}$ with t_{table} . The independent variable forming the regression model is considered to have a significant effect if $t_{\text{calculate}} > t_{\text{table}}$ or $p\text{-value} < \alpha = 0.05$. The partial regression test model is as follows:

C. Material (X1) Factor

Based on the hypothesis test on the regression coefficient of Material (X1) Factor, it can be written in the following Table 3:

TABLE 3. Hypothesis Test on the Regression Coefficient of Material (X1) Factor

Hypothesis	Value	Decision
$H_0: \beta_1 = 0$ (Material (X1) Factor has no significant effect on Delay in Project Completion) $H_a: \beta_1 \neq 0$ (Material (X1) Factor has significant effect on Delay in Project Completion) $\alpha = 0.05$	$t = -0.254$ $p\text{-value} = 0.801$ $t_{table} = 2.045$	Accept H_0

Source: Analysis results of SPSS, 2018

Material (X1) Factor has a regression coefficient of -0.064. By using the help of SPSS software, it obtains a t-test statistic of -0.254 with a p-value of 0.801. The t-test statistic value is smaller than t_{table} ($-0.254 < 2.045$) and also p-value is greater than $\alpha = 0.05$. This test shows that H_0 is accepted. Therefore, it can be concluded that the Material (X1) Factor has no significant effect on the Delay in Project Completion. In other words, the good and bad of Material (X1) Variable, will not

affect the length of delay time the in the completion of the construction project of Dr. Iskak's Hospital Building of Tulungagung District.

D. Equipment (X2) Factor

Based on hypothesis test on the regression coefficient of Equipment (X2) Factor, it can be written in the following Table 4:

TABLE 4. Hypothesis Test on Regression Coefficient of Equipment (X2) Factor

Hypothesis	Value	Decision
$H_0: \beta_1 = 0$ (Equipment (X2) Factor has no significant effect on Delay in Project Completion) $H_a: \beta_1 \neq 0$ (Equipment (X2) Factor has significant effect on Delay in Project Completion), $\alpha = 0.05$	$t = -0.434$ $p\text{-value} = 0.667$ $t_{table} = 2.045$	Accept H_0

Source: Analysis results of SPSS, 2018

Equipment (X2) Factor has a regression coefficient of -0.076. By using the help of SPSS software, it obtains a t-test statistic of -0.434 with a p-value of 0.667. The t-test statistic value is smaller than t_{table} ($-0.434 < 2.045$) and also p-value is greater than $\alpha = 0.05$. This test shows that H_0 is accepted. Therefore, it can be concluded that the Equipment (X2) Factor has no significant effect on the Delay in Project Completion. In other words, the good and bad of Material (X2) Variable,

will not affect the length of delay time the in the completion of the construction project of Dr. Iskak's Hospital Building of Tulungagung District.

E. Worker (X3) Factor

Based on hypothesis test on the regression coefficient of Worker (X3) Factor, it can be written in the following Table 5:

TABLE 5. Hypothesis Test on Regression Coefficient of Worker (X3) Factor

Hypothesis	Value	Decision
$H_0: \beta_1 = 0$ (Worker (X3) Factor has no significant effect on Delay in Project Completion) $H_a: \beta_1 \neq 0$ (Worker (X3) Factor has significant effect on Delay in Project Completion), $\alpha = 0.05$	$t = 2.245$ $p\text{-value} = 0.033$ $t_{table} = 2.045$	Reject H_0

Source: Analysis results of SPSS, 2018

Worker (X3) Factor has a regression coefficient of 0.031. By using the help of SPSS software, it obtains a t-test statistic of 2.245 with a p-value of 0.033. The t-test statistic value is bigger than t_{table} ($2.245 > 2.045$) and also p-value is smaller than $\alpha = 0.05$. This test shows that H_0 is rejected. Therefore, it can be concluded that the Worker (X3) Factor has significant effect on the Delay in Project Completion. In other words, the more expert the Workers (X3), the delay in the completion of

the construction project of the Dr. Iskak's Hospital Building of Tulungagung District will be smaller and vice versa.

F. Finance (X4) Factor

Based on hypothesis test on the regression coefficient of Finance (X4) Factor, it can be written in the following Table 6:

TABLE 6. Hypothesis Test on Regression Coefficient of Finance (X4) Factor

Hypothesis	Value	Decision
$H_0: \beta_1 = 0$ (Finance (X4) Factor has no significant effect on Delay in Project Completion) $H_a: \beta_1 \neq 0$ (Finance (X4) Factor has significant effect on Delay in Project Completion), $\alpha = 0.05$	$t = -1.065$ $p\text{-value} = 0.296$ $t_{table} = 2.045$	Accept H_0

Source: Analysis results of SPSS, 2018

Finance (X4) Factor has a regression coefficient of -0.184. By using the help of SPSS software, it obtains a t-test statistic of -1.065 with a p-value of 0.296. The t-test statistic value is smaller than t_{table} ($-1.066 < 2.045$) and also p-value is greater than $\alpha = 0.05$. This test shows that H_0 is accepted. Therefore, it can be concluded that the Finance (X4) Factor has no significant effect on the Delay in Project Completion. In other words, the good and bad of Finance (X4) Variable, will not

affect the length of delay time the in the completion of the construction project of Dr. Iskak's Hospital Building of Tulungagung District.

G. Implementation Method (X5) Factor

Based on hypothesis test on the regression coefficient of Implementation Method (X5)Factor, it can be written in the following Table 7:

TABLE 7. Hypothesis Test on Regression Coefficient of Implementation Method (X5) Factor

Hypothesis	Value	Decision
$H_0: \beta_1 = 0$ (Implementation Method (X5) Factor has no significant effect on Delay in Project Completion) $H_a: \beta_1 \neq 0$ (Implementation Method (X5) Factor has significant effect on Delay in Project Completion), $\alpha = 0.05$	$t = -0.171$ $p\text{-value} = 0.866$ $t_{table} = 2.045$	Accept H_0

Source: Analysis results of SPSS, 2018

Implementation Method (X5) Factor has a regression coefficient of -0.032. By using the help of SPSS software, it obtains a t-test statistic of -0.171 with a p-value of 0.866. The t-test statistic value is smaller than t_{table} ($-0.171 < 2.045$) and also p-value is greater than $\alpha = 0.05$. This test shows that H_0 is accepted. Therefore, it can be concluded that the Implementation Method (X5) Factor has no significant effect on the Delay in Project Completion. In other words, the good and bad of Implementation Method (X5) Variable, will not

affect the length of delay time the in the completion of the construction project of Dr. Iskak’s Hospital Building of Tulungagung District.

H. Design Change (X6) Factor

Based on hypothesis test on the regression coefficient of Design Change (X6) Factor, it can be written in the following Table 8:

TABLE 8. Hypothesis Test on Regression Coefficient of Design Change (X6) Factor

Hypothesis	Value	Decision
$H_0: \beta_1 = 0$ (Design Change (X6) Factor has no significant effect on Delay in Project Completion) $H_a: \beta_1 \neq 0$ (Design Change (X6) Factor has significant effect on Delay in Project Completion), $\alpha = 0.05$	$t = 3.221$ $p\text{-value} = 0.003$ $t_{table} = 2.045$	Reject H_0

Source: Analysis results of SPSS, 2018

Design Change (X6) Factor has a regression coefficient of 0.431. By using the help of SPSS software, it obtains a t-test statistic of 3.221 with a p-value of 0.003. The t-test statistic value is bigger than t_{table} ($3.221 > 2.045$) and also p-value is smaller than $\alpha = 0.05$. This test shows that H_0 is rejected. Therefore, it can be concluded that the Design Change (X6) Factor has significant effect on the Delay in Project Completion. In other words, the frequent Design Change (X6),

the delay in the completion of the construction project of the Dr. Iskak’s Hospital Building of Tulungagung District will be lesser and vice versa.

I. Work Environment (X7) Factor

Based on hypothesis test on the regression coefficient of Work Environment (X7) Factor, it can be written in the following Table 9:

TABLE 9. Hypothesis Test on Regression Coefficient of Work Environment (X7) Factor

Hypothesis	Value	Decision
$H_0: \beta_1 = 0$ (Work Environment (X7) Factor has no significant effect on Delay in Project Completion) $H_a: \beta_1 \neq 0$ (Work Environment (X7) Factor has significant effect on Delay in Project Completion), $\alpha = 0.05$	$t = 2.558$ $p\text{-value} = 0.016$ $t_{table} = 2.045$	Reject H_0

Source: Analysis results of SPSS, 2018

Work Environment (X7) Factor has a regression coefficient of 0.469. By using the help of SPSS software, it obtains a t-test statistic of 2.558 with a p-value of 0.016. The t-test statistic value is bigger than t_{table} ($2.558 > 2.045$) and also p-value is smaller than $\alpha = 0.05$. This test shows that H_0 is rejected. Therefore, it can be concluded that the Work Environment (X7) Factor has significant effect on the Delay in Project Completion. In other words, the better Work Environment (X7) Factor, the delay in the completion of the construction project of the Dr. Iskak’s Hospital Building of Tulungagung District will be lesser and vice versa.

(X7). Meanwhile, variables that do not have significant value (influential but not significant to Delay in Project Completion) are Material (X1), Equipment (X2), Finance (X4), and Implementation Method (X5). Furthermore, factors that significantly affect the Delay in Project Completion can be explained as follows:

1. Worker (X3) Variable is formed by manifest variables consisting of: workers who do not have good skills (X3.1), worker shortages (X3.2), inadequate foremen (X3.3) and field implementers who lack competence in their field (X3.4).
2. Design Change (X6) Variable is formed by manifest variables consisting of: inappropriate planning (X6.1), unfulfilled initial planning (X6.2) and frequent design changes by the owner (X6.3).
3. Work Environment Variables (X7) is formed by manifest variables consisting of: rainfall intensity (X7.1), construction project within the hospital area (X7.2) and the location of a crowded hospital (X7.3).

IV. DISCUSSION

A. Actions as an Attempt to Overcome Delay in Project Completion

Based on the results of regression analysis, it was found that the independent variables that have significant value (significant effect on Delay in Project Completion) are Workers (X3), Design Changes (X6), and Work Environment

Further action will be discussed to overcome factors that significantly affect the Delay in Project Completion.

B. Actions Taken for Worker (X3) Factor

Based on Table 1, Worker (X3) Factor is the third variable that has the highest standardized β coefficient value after Design Change (X6) Factor and Work Environment (X7) Factor. It means that the Delay in Project Completion is significantly affected by Worker (X3) Factor. Moreover, to find out which indicators have the most influence on the Delay

of Project Completion on Worker (X3) Factor, it can be seen in the high communality value in Table 10. Based on the table, it is found that the indicator of “workers do not have good skills (X3.1)” has the highest loading value of 0.822. So, based on these results, it can be considered that the worker indicator in the category of “do not have good skills (X3.1)” is a high-factor indicator in affecting the delay in project completion. It is displayed in the following Table 10:

TABLE 10. Loading Factor Values of Worker (X3) Factor

Manifest Variables	Description	Loading Values
X3.1	The workers do not have good skills	0.822
X3.2	Worker shortages	0.744
X3.3	Inadequate foremen	0.672
X3.4	Field implementers who lack competence in their field	0.651

Source: Analysis results of SPSS, 2018

Based on the above Table 10, it can be seen that the indicator of “the workers do not have good skills” (X3.1), with a loading value of 0.822, is an indicator that most affects the delay in project completion, then the action taken to overcome it is to replace the workers who are less productive with more productive ones and provide training and direction to the workers on a regular basis so that their skills/expertise increase.

C. Actions Taken for Design Changes (X6) Factor

Design Changes (X6) Factor is the variable that has the highest standardized β coefficient. It means that in this research, the most dominant factor affecting delay in project completion is the Design Changes (X6) Factor. In other words, delay in project completion is strongly affected by Design Changes (X6). The sequences of indicators that most influence the delay in project completion in the Design Change (X6) Factor can be seen in the following Table 11:

TABLE 11. Loading Factor Values in Design Changes (X6) Factor

Manifest Variables	Description	Loading Values
X6.1	Inappropriate planning	0.848
X6.3	Frequent design changes by the owner	0.835
X6.2	Unfulfilled initial planning	0.774

Source: Analysis results of SPSS, 2018

Based on the above Table 11, it is found that the indicator of the Design Change (X6) Factor which most affects the delay in project completion is “inappropriate planning (X6.1)” with a loading value of 0.848. It was caused by errors in the planning of building foundation structures that were less accurate in calculating the condition of the carrying capacity of the land at the project site. This planning error was found during the implementation of the foundation work, especially when soil excavation works which experience many obstacles. After a re-evaluation and land testing was conducted again for the work location (soil test), finally, the owner along with planner consultant, supervisory consultant, and contractor decided to have design changes. Design changes that occurred in foundation work were the construction of local plates which were converted into Strauss pile (manual) construction. It relates to soil conditions at the project site which is a type of sandy soil and it is not considered during initial planning. Another consideration about why choosing Strauss pile

foundation is because this method is not noisy in its implementation. So, it is very suitable for use in project locations that may not cause noise in the work implementation. In addition, this type of foundation can still be used for 2 to 4 floors high-rise buildings. Thus, the action that must be taken to overcome this is to immediately make a contract change (contract amendment) due to changes in the scope of work.

D. Actions Taken for Work Environment (X7) Factor

The Work Environment (X7) Factor is the variable that has the second highest value of standardized β coefficient after the Design Change (X6) Factor. In other words, delay in project completion is also affected by Work Environment (X7) Factor. The sequences of indicators that most affect the delay in project completion on Work Environment (X7) can be seen in the following Table 12:

TABLE 12. Loading Factor Values in Work Environment (X7) Factor

Manifest Variables	Description	Loading Values
X7.2	Construction project within the hospital area	0.793
X7.3	The location of a crowded hospital	0.770
X7.1	Rainfall intensity	0.768

Source: Analysis results of SPSS, 2018

Based on the above Table 12, it is found that the indicator of the Work Environment (X3) Factor which most affects the delay in the project completion is “the construction project within the hospital area” (X7.2) with a loading value of 0.793. That was caused by the limitation of working hours by Dr. Iskak Hospital since the project activities are about to disturb patients who are being treated there. Thus, the actions taken to overcome them are that the contractor must employ and increase the number of skilled and productive workers in accordance with the requirement of the work and to do the possible work items that can be done outside the project site.

V. CONCLUSIONS

From the research findings and discussion described in the previous chapter, it can be concluded as the following:

1. Based on the F-Test, it is found that all factors X1, X2, X3, X4, X5, X6 and X7 simultaneously affect Project Delay (Y) of Dr. Iskak’s Hospital Pavilion of Tulungagung District with F-value of $= 6.304 > F_{table} = 2.346$. Meanwhile, based on the t-test, the factors that have a positive and partially significant effect on the delay are factor X6 with $t_{calculate} = 3.221 > \text{from } t_{table} = 2.045$, factor X7 with $t_{calculate} = 2.558 > \text{from } t_{table} = 2.045$ and factor X3 with $t_{calculate} = 2.245 > \text{from } t_{table} = 2.045$.
2. Based on multiple linear regression analysis, the most dominant factor affecting the delay in the project completion is the Design Change (X6) Factor with the standardize coefficient β of 0.417.
3. Actions need to be taken to overcome delays in project completion due to design change factor are:
 - a. Mak contract changes (contract amendments) immediately due to changes in the scope of work.
 - b. The should be a commitment between the owner and the contractor to fulfill the agreement that has been stated in the contract so that there will not be many changes in the scope of work.
 - c. It needs good supervision and control to the project so that the construction implementation process does not deviate from the plans that have been made previously.

VI. SUGGESTIONS

The suggestions that can be provided to anticipate the delay in completing construction projects based on the research findings are:

1. It needs design and planning specifications that are good, clear, careful and complete before the project is implemented in order to minimize changes in work items (scope of work) during the project implementation phase.
2. The contractor should carry out a design review in anticipation of reducing the risks that must be borne by the

contractor in the design error occurs that could hamper the implementation of construction.

3. The owner must choose a planner consultant who is qualified, experienced and has competence in their field and is fully responsible for the results of the planning that has been made.
4. During the construction planning, the sondir test must be carried out at each point of the building foundation plan to be established for accuracy in the design process.

VII. RECOMMENDATIONS

From the research findings that has been described and the suggestions that have been mentioned, there are several recommendations that can be used as input for further research, among others:

1. To add other variables such as age of worker and relations with the government in order to obtain more applicable research findings.
2. To obtain a better analysis of the causes of delay, further research should be conducted by combining the results of the analysis in this research with the results of data processing from the construction project report which is the work implementation report. From the report, the productivity performance of contractors in the field will be analyzed.

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