

Analysis of the Causes of Project Delays Ceramic Finishing Work With Importance Index Method to Improve Time Performance

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Abstract

UrbanTown Serpong is an integrated vertical residential area developed in the buffer zone of the capital city, business and industrial center, and connected to mass transportation facilities. Which carries the concept of integrated entrepreneurship with many supporting facilities. However, not all construction projects can be completed on schedule. There are several delay factors that can occur, such as caused by time estimation; improper management; material problems; labor; equipment; finance; and an unsupportive environment. This study aims to determine the dominant factors that cause delays during construction and solutions to prevent delays in the development of the UrbanTown - Serpong Project. The factor analysis uses the Importance Index (IMPI) method to assess which factors are classified as high in the project. The results of the study indicate that there are 4 out of 31 indicators that have a significant effect on the factors causing work delays, including: constrained by labor shortages; the work is not carried out with the correct method; lack of material; and owner delays in making decisions.

Keywords

Finishing Ceramic Installation, Importance Index, PMBOK, Project Delay, Statistics.

1. Introduction

Building is a physical form resulting from construction work that is integrated with its domicile, partially or wholly located above and/or in the land and/or water, which functions as a place for humans to carry out their activities, either for housing or residence, religious activities, religious activities, business, social, cultural and special activities.

Construction project delays can be caused by incorrect estimation of the time needed to complete the project in the planning stage, or various possibilities, for example due to improper management, problems with materials, labor, equipment, finances, and an unsupportive environment that hampers project implementation. And inevitably lead to project delays.

The volume of work is very large and has internal and external aspects or technical and non-technical aspects that affect the implementation of the construction. Basically, construction projects cannot be separated from existing obstacles that can cause delays in the project. Project delays for contractors will experience a loss of time and cost because of that the profits expected by the contractor will be reduced or even no profits will be made at all. For the project owner (owner) the delay in completing the work of a project will cause a loss to the operating time of the project results, so that the use of the results of project development becomes delayed or late. Therefore, in this study, researchers will conduct research on the causes of project delays using the Importance Index (IMPI) method to assess what factors are classified as high in the project. IMPI is a method that refers to the impact index and the frequency index of occurrence.

Based on the description above, it can be formulated research problems as follows:

1. What are the dominant factors that cause delays in the implementation of Project development?
2. What are the efforts to prevent delays that occur in the implementation of Project development?

2. Literatur Review

In the implementation of construction projects, various things can happen which can cause increased implementation time and project completion to be delayed. The causes of delays that often occur are due to differences in location conditions, design changes, weather influences, lack of fulfillment of worker, material or equipment needs, planning or specification errors, and the influence of project owner involvement (Sianipar, 2012). Delays in project implementation generally always cause adverse consequences for both the owner and contractor, because the impact is conflict and debate about what and who is the cause, as well as time demands and added costs (Pelabuhan & Calang, 2016). Project delays are often a source of disputes and demands

between project owners and contractors, so that the value will be very expensive both from the owner's perspective and from the contractor's perspective. From the owner's perspective, project delays will have the effect of reducing income due to delays in the operation of the facility. Meanwhile, in terms of the contractor, the contractor will be subject to a penalty in accordance with the contract, besides that the contractor will also experience additional overhead costs during the project (Hassan et al., 2016).

Delay in construction projects means an increase in the implementation time for the completion of the project that has been planned and stated in the contract document (Wirabakti et al., 2014).

(Wirabakti et al., 2014), delays in project implementation generally always cause adverse consequences for owners and contractors because the impact of delays is conflict and debate about what and who is the cause, as well as time demands and added costs.

3. Research Methodology

3.1. Types of Research

This type of research is quantitative research. Meanwhile, according to Sugiyono (2017) quantitative research is a research method based on the philosophy of positivism, used to examine certain populations or samples, data collection using research instruments, data analysis is quantitative or statistical, with the aim of testing predetermined hypotheses.

3.2. Research Sampel

The sample is part of the number and characteristics possessed by the population. If the population is large, and it is not possible for the researcher to study everything in the population, for example due to limited funds, manpower and time, the researcher can use a sampling technique from the population. This means that the sample taken can be representative or representative for the population. (Sugiyono 2017)

There are two sampling methods, namely large samples and small samples. The large sample is the sample with the number of respondents as many as 31 people or more, while the small sample is the sample with the number of respondents less than 31 people. To determine the sampling (if the population is known) used by using the Slovin formula with the following equation:

$$n = \frac{N}{1 + N d^2}$$

Where :

n : Number of samples

N : Total population

d2 : Set precision (5%, 10%, 15%)

$$n = \frac{31}{1 + 31 (0.1)^2} = 23,66$$

So based on the Slovin formula there is a minimum number of samples of 24 people.

Table 1. Research Variable

Category	Variable	Factors Caused For Delay
Engineering Stage	X.1	Company management where for one human resource intended for various projects handled by the company.
	X.2	Changes desired by project owner & delays changes provided by the project owner
	X.3	In short the time allotted at the design stage
	X.4	Inadequate company resources such as software, hardware, and human resources
	X.5	The engineering team's products are demanded to be economical
	X.6	Lack of experience of the engineering team in compiling Budget Plan
	X.7	Involving engineering experts from external parties
	X.8	Work complexity
	X.9	Lack of availability of experts for technical

Category	Variable	Factors Caused For Delay
		problems
	X.10	The logic of the design decisions taken is not communicated effectively
	X.11	The workforce is not competent in the team shop drawing
	X.12	Late approval of shop drawings
	X.13	There are difficulties with job approval
	X.14.	Negotiation and Licensing
	X.15	Late payments to workers
	X.16	Lack of manpower
	X.17	Lack of material
	X.18	The work is not done with the right method
	X.19	Layout and material processing in the field
	X.20	Lack of communication or coordination
	X.21	Limited means of communication
	X.22	Lots of repair work
	X.23	Owner's payment system to contractors that are not in accordance with the contract for some reason
	X.24	Owner's delay in making decisions
	X.25	Quality control work
	X.26	Poor site management
	X.27	Unclear work policies and procedures
	X.28	Improper construction methods resulting in error during construction
	X.29	The application of new/special technologies that are not yet known as good.
	X.30	Produced goods are not in accordance with the conditions, so field adjustments required
	X.31	Inadequate equipment
	X.32	Slow decision making
	X.33	Unstable weather conditions
Installation Stage	X.34	Access to work is limited, because it is related to another job
	X.35	Lack of expertise and experience
	X.36	Low productivity
	X.37	Request for change from the owner in the middle of construction.
	X.38	The owner is having financial problems.
	X.39	Unforeseen floods or natural disasters

3.3. Measurement Scale

The measurement scale is used to measure how often a variable appears using a probability scale. The frequency level is measured using the terms very rarely, rarely, moderately, often, and very often. According to (Astuti, 2017) the frequency weight assessment given by the respondent uses a Likert scale 1-5 with the information in Table 2:

Table 2. Frequency Assessment

Scale	Category	Criteria
1	Very Rarely	Happened <2 times
2	Seldom	Happened 2-3 times
3	Currently	Happened 3-4 times
4	Often	Happens 4-5 times
5	Very Often	Happened >5 times

The project risk rating value is useful for classifying the factors causing delays based on the assessment that has been carried out so that they can be categorized to facilitate mitigation priorities. According to Baccarini, the frequencies that need to be mitigated are those belonging to the high category. The classification of the assessment can be seen in the table:

Table 3. Classification of Value Range

No.	Scale	Information
1	Index 0% - 20%	Low
2	Index 21% - 40%	Moderate
3	Index 41% - 60%	Significant
4	Index 61% - 100%	High

4. Results And Analysis

4.1. Data Analysis Phase I (Expert)

In the expert questionnaire, there are 39 variables that are given to the expert for review before becoming a respondent's questionnaire. Of the 39 variables, 9 were eliminated by experts, and there were 3 additional variables, including:

Table 4. Expert Suggestion Variables

No.	Variable Code	Information
Installation		
2	X2.26	The planning stage of project implementation is less concerned with interfaces between work in the field such as Civil, Melanical, Electrical, and plumbing
	X2.27	Lack of monitoring and records of work implementation related to the plans that have been prepared in advance
	X2.28	Not explained/communicated work productivity targets to be achieved per day, week or month

This variable was eliminated by the expert because it did not dominate the delay factor. Furthermore, from 33 variables that have been reviewed by experts, they are used as a response questionnaire and distributed to 31 respondents.

4.1.1. Validity Test

Validity test in this study using the Software Statistical Package for Social Sciences (SPSS 26.0 for Window).

With the help of SPSS version 26 program, the tabulated instruments were tested for validity. The output of the test is declared valid if $r_{count} > r_{table}$. On the other hand, if $r_{count} < r_{table}$, then the data is invalid. So with the number of respondents as many as 31 (thirty one) taking a significance level of 5%, the R product moment table is 0.355.

The value of r table for n = 31 is 0.355, while the value of r for X2.1 and X2.5 is still below the r table. Therefore, X2.1 (Lack of manpower) and X2.5 (Layout and material processing in the field) are declared invalid and should be eliminated in the data analysis process. The remainder is considered valid because r Count is greater than r Table.

4.1.2. Reliability Test

This study conducted a reliability test using the Statistical Package for Social Sciences (SPSS 26.0 for Windows) software program with the basis for making decisions in reliability testing which was interpreted as follows:

3. If the Cronbach Alpha value > 0.60 then the questionnaire or questionnaire is declared reliable or consistent.
4. If the Cronbach Alpha value < 0.60 then the questionnaire or questionnaire is declared unreliable or inconsistent.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.925	31

4.1.3. Frequency Index Analysis (FI%)

Frequency index (FI%) analysis is carried out with the formula:

$$FI(\%) = \frac{\sum_1^5 a_i n_i}{5N} \times 100$$

Where :

FI : Frequency index

ai : The weight given by the respondent with a value of i; ai = 1,2,3,4, and 5

ni : The number of respondents who answered with a value of i

N : Total number of respondents

4.1.4. Severity Index Analysis (SI%)

Severity index (SI%) analysis is carried out with the formula:

$$SI(\%) = \frac{\sum_1^5 a_i n_i}{5N} \times 100$$

Where :

SI : Severity Index

ai : The weight given by the respondent with a value of i; ai = 1,2,3,4, and 5

ni : The number of respondents who answered with a value of i

N : Total number of respondents

4.1.5. Importance Index Analysis (IMPI%)

The importance index or the interest index is multiplied between frequency and impact. The importance index is obtained by the formula:

$$IMPI(\%) = \frac{FI(\%) \times SI(\%)}{100}$$

Where :

FI : Frequency index

SI : Severity index

IMPI : Importance Index.

Table 6. Importance Index Value (IMPI%)

No.	Variable	Kode	FI%	SI%	IMPI%	Ket.
1	Engineering	X1.1	63.23	67.74	42.83	Signific ant
		X1.2	75.48	80.65	60.87	Signific ant
		X1.3	67.10	69.68	46.75	Signific ant
		X1.4	72.26	76.13	55.01	Signific ant
		X1.5	67.10	65.16	43.72	Signific ant
		X1.6	63.23	67.74	42.83	Signific ant
		X1.7	68.39	70.32	48.09	Signific ant
		X1.8	69.03	71.61	49.44	Signific ant
		X1.9	72.90	72.90	53.15	Signific ant
		X1.10	63.87	67.74	43.27	Signific ant
		X1.11	71.61	75.48	54.06	Signific ant
		X1.12	63.87	68.39	43.68	Signific ant

Table 7. Advanced Importance Index (IMPI%) Value

No.	Variable	Code	FI %	SI %	IMPI %	Information
	Installation	X2.2	76.77	83.87	64.39	High
		X2.3	54.84	121.29	66.51	High
		X2.4	76.13	77.42	58.94	Significant
		X2.6	72.26	76.13	55.01	Significant
		X2.7	49.03	58.06	28.47	Moderate
		X2.8	76.77	80.65	61.91	High
		X2.9	63.87	68.39	43.68	Significant
		X2.10	66.45	67.74	45.02	Significant
		X2.11	50.32	54.19	27.27	Moderate
		X2.12	76.77	77.42	59.44	Significant
		X2.13	76.77	77.42	59.44	Significant
		X2.14	65.16	70.32	45.82	Significant
		X2.15	67.10	69.03	46.32	Significant
		X2.16	74.84	80.00	59.87	Significant
		X2.17	61.29	68.39	41.91	Significant
		X2.18	72.90	81.29	59.26	Significant
		X2.19	52.90	70.97	37.54	Moderate
		X2.20	52.26	70.32	36.75	Moderate
		X2.21	50.97	68.39	34.86	Moderate

Based on Table 7, it can be seen that the factors that can affect the delay in installing ceramics in the construction of the Serpong Urbantown Apartment are:

Table 8 Interpretation of Importance Index Value (IMPI%)

No.	FI %	SI %	IMPI %	Variable	Code	Factors Causing Delay	Information
1	76.77	83.87	64.39	Installation	X2.2	Lack of material	High
2	54.84	121.29	66.51		X2.3	The work is not done with the right method	High
3	76.77	80.65	61.91		X2.8	Owner's delay in making decisions	High

Based on the interpretation of the Importance Index (IMPI), there are 3 (three) factors causing Project delays in the High category which can be explained as follows:

1. Variable X2.3 (Work is not done with the correct method) is ranked 2nd (two) causes of work delays with a percentage of 66.51%.
2. Variable X2.2 (lack of material) is ranked 3rd (three) causes of work delays with a percentage of 64.39%.
3. The X2.8 variable (the owner's delay in making decisions) is ranked the 4th (fourth) cause of delays with a percentage of 61.91%.

4.2. Data Collection Stage IV (Final Stage Expert Validation)

At this stage the researcher redistributes data from the results of phase III data analysis to experts to ask for validation.

Table 9 Results of Data Collection Phase IV

Code Variable	Factors Causing Delay	Expert1		Expert2		Expert3		Expert4		Expert5	
		Agree	No	Agree	No	Agree	No	Agree	No	Agree	No
Installation Stage											
X2.2	Lack of material	√		√		√		√		√	
X2.3	The work is not done with the right method	√		√		√		√		√	
X2.8	Owner's delay in making decisions	√		√		√		√			√

In table 9 it can be seen that the expert believes that 4 experts agree with the 3 (three) factors causing the delay and there is one expert who does not agree with one of the factors causing the delay, which is related to the owner's delay in making decisions.

Table 10 Efforts to Prevent Delays

Code Variable	Factors Causing Delay	Prevention	P1	P2	P3	P4	P5
			Installation Stage				
X2.2	Lack of material	Changed the design with standard type material specifications that are widely available in the market.	√	√	√	√	X
		Adding several material vendors so that if a vendor runs out of stock, they can still bring in materials from other vendors.	√	√	√	√	√
X2.3	The work is not done with the right method	The supervisor should always direct the work before the production process begins.	√	√	√	√	√
		Workers must be given training on the work to be carried out.	√	√	√	√	√
X2.8	Owner's delay in making decisions	Supervisors and main contractors must always remind the owner to immediately take a decision if there is work that is still unclear in the contract.	√	√	√	√	X

5. Conclusion and Suggestion

5.1. Conclusion

Based on the research analysis, the authors can conclude that the factors causing work delays are as follows:

- The work is not done with the right method
 This factor is ranked 1 (first) with a percentage of IMPI value reaching 66.51%. In this study, apart from being constrained by a shortage of labor, there were several work methods that were not carried out properly, resulting in repetitive work.
- Lack of materials
 This factor is ranked 2nd (second) with a percentage of IMPI value reaching 64.39%. Running out of stock of materials and delays in payments to material vendors resulting in late delivery of materials.
- Owner's delay in making decisions
 This factor is ranked 3rd (three) with a percentage of IMPI value reaching 61.91%. The owner's delay in making decisions regarding material changes resulted in some work being unable to be carried out according to the agreed schedule.

5.2. Suggestion

Based on the results of the research analysis and all the limitations of existing research, the authors suggest:

1. The implementing contractor must pay close attention to the project management system to avoid delays.
2. Contractors to better understand the sequence in pursuing the target master schedule so that there are no delays in a project.
3. The contractor must always coordinate with the supervisor regarding the obstacles in the project.

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