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The Most Influential Factor as The Cause of Delays in Aluminum Form Work in The Sakura Project, East Jakarta

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Abstract - Project development in Indonesia, especially DKI Jakarta continues to grow, especially in the construction of a multi-storey building concept. These high-rise buildings, including apartments, offices, and flats, have different construction methods. The construction method used in the construction of buildings with multilevel concepts is now more advanced, using a method called aluminum formwork. Aluminum formwork work in several projects in multi-storey buildings sometimes has problems in its work which can cause delays, one of which is in the Sakura Project, East Jakarta. For example, delays that occur in aluminum formwork work, namely in the delivery of materials and the lack of skilled workers on the job. This can also be caused by executors who are used to taking project work for granted and not learning from it. Therefore, with delays in aluminum formwork work, the purpose of this study was to determine the most influential factors causing delays in aluminum formwork work. The research method used is descriptive quantitative with a survey approach where the data collection technique uses questionnaires, interviews and documentation, and is analyzed into factor analysis with the help of SPSS software. The results of this study indicate that the factors that cause delays in aluminum formwork work are labor factors with a value of 65%, material factors with a value of 71%, equipment factors with a value of 62%, place characteristic factors with a value of 69%, managerial factors with a value of value of 58%, financial factors with a value of 72%, and external factors with a value of 68%. Thus, it can be concluded that the factor causing the delay that occurred in the aluminum formwork work at the Sakura Project, East Jakarta, which is the most influential or dominant factor, is the financial factor, while the factor that has the least influence is managerial factor.
Keywords **:** Aluminum Formwork, Work Delays, Delay Factors.

I INTRODUCTION

As project development increases, especially in DKI Jakarta, it can be in the form of multi-storey building construction with various innovations in construction methods. The construction methods used in the construction of high-rise buildings are now more advanced and modern, for example, the aluminum formwork method (1). Project executors usually require the roles and services of suppliers and sub-implementers, especially as a provider of aluminum formwork work, both for purchasing materials and equipment for the work as well as for skilled workers (2).

However, the work of aluminum formwork in several high-rise building projects sometimes has several obstacles that can cause delays (3). This work should be done quickly because it looks like a one-piece system from plates, beams, columns, to stairs, but it can take longer due to certain reasons such as the lack of completeness of the formwork material, the absence of experts, and other factors. -other factors (4). Regardless of the method used, some projects often experience delays in work that has problems in its implementation (5).

Delay in project work is the execution time on work that has exceeded the completion date or deadline specified by the contract (Messah et al, 2013). Various ways are done to avoid several problems that can be a factor causing delays and the impacts that can be caused (7). However, these repeated delays are also caused by executors or owners who are trivial and are not used as lessons in project implementation (5).

The Sakura project located in Cipayung, East Jakarta is a project with late aluminum formwork work. This is known from observations that were previously carried out in November 2020 in the form of interviews with the Construction Manager and were seen based on the S-Curve of scheduling for each job in the project. However, it is not yet known which factors have the most influence as a cause of delays in the work.

Therefore, with the delays in the aluminum formwork work at the Sakura Project, the purpose of this research is to find out the most influential factors as a cause of delays in the aluminum formwork work, so that it can be overcome so that there are no delays in other work on the project or in other projects.

II. LITERATURE REVIEW

A. Aluminum Forms

Basically, formwork is a concrete molding construction of various sizes and shapes that is temporary until the concrete is able to withstand its own loads and live loads (Perwitasari et al, 2016). Formwork has several types, one of which is aluminum formwork. Aluminum formwork is a brand originating from South Korea. In this case what is meant is that

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the main material referred to as aluminum has a shape in the form of an arrangement, for example like a puzzle that forms a single component (8). Formwork is the most recent formwork innovation and has also been applied by a company called PT PP (Tbk) in a Darmo Hill Apartement project (The AYOMA Apartement, 2018).

Fig. 1 Aluminum Formwork

Source: personal documents

B. Project Work Delays

One or several jobs in the project field with a certain implementation time that cannot be utilized or completed based on an activity plan, so this causes work to be late and can have a detrimental effect in terms of cost and time (9).

C. Project Work Delay Factors

Every work that experiences delays cannot be separated from the factors that influence it. The following is an identification of factors that influence the cause of a delay in a project work:

D. Labor (labors / man), are factors related to human resources in completing a job, including (10) and (11):

a). Expertise, namely a workforce with skills and experience in helping problems beyond the control of the executor and can minimize work that requires improvement (10).
b). Discipline, namely a workforce that can be disciplined when arriving and disciplined in attitude at work and not joking in completing work (10).
c). Work motivation, namely something that is given to workers in the form of good wages or salaries according to the contract (10). The number of attendance, namely the presence of workers who are present when needed at work (10).
d). Availability of skilled labor, namely the presence of workers who have been trained in certain fields to complete a job (10).
e). Change of new workforce, the large number of new workforce changes that can hinder the progress of work if you have to carry out retraining on the job (10).
f). A communication between the workers and the chief craftsman or foreman, so that the result is no misunderstanding of information and coordination in the work environment (11).

E. Materials, are factors needed in forming a job, which include (Astina et al, 2012):

a) Availability and calculation of work material requirements, namely availability that must be adjusted by calculating material requirements to be used in work (Astina et al, 2012).
b) Delivery of work materials, namely executors must involve suppliers in the delivery of materials when needed (Astina et al, 2012).
c) The quality of the work material, which must be re-checked and tested on the material according to the standards required by the work (Astina et al, 2012).

I. Equipment (equipment / machines), is a factor in the form of supporting tools used in assisting the material until the work is formed, including (Astina et al, 2012):

a) Availability of work equipment, namely all work equipment must be prepared from planning, operation, maintenance, until the equipment is not reused (Astina et al, 2012).
b) The quality of work equipment, which must be re-checked and must be in accordance with the standards required by the work (Astina et al, 2012).

J. Site characteristics, are factors related to the conditions or circumstances surrounding the work location, including (10) and (Ramli et al, 2018):

a). The vision or response of the surrounding environment to work, namely the state of the environment in influencing the operation of carrying out work (10).
b). A place for storing work materials, namely a location for storing materials that is strategic and not far from the work location (Ramli et al, 2018).
c). Access to project work locations, namely access to work locations that are capable of being passed by material and equipment transportation (Ramli et al, 2018).
d). The need for work space for work, namely space for movement that can facilitate equipment and materials, as well as labor in completing work

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(Ramli et al, 2018).

K. *Managerial (managerial), is a factor that includes the scope of organization in each job, including (11) and (Astina et al, 2012):*
   a). Supervision and quality control, namely supervision carried out by supervisors/inspectors (field supervisors) in the form of corrective actions for implementers when they have deviated from work and are able to provide recommendations for owners and implementers (11).
   b). The experience of field supervisors, namely the experience possessed by field supervisors can be used in carrying out evaluations of work constraints (11).
   c). Changes in work design, namely errors, deficiencies, and impracticality found in design documents, or changes at the request of the owner (11).
   d). Communication between consultants and executors as well as executors and owners regarding project work, namely an important role in exchanging information so that coordination can be formed in solving work problems (11).
   e). The schedule for the supply of work materials and equipment, as well as the schedule for the work parts that must be completed, is a means of monitoring progress during the work process (11).
   f). Preparation or determination of the design of the work location, namely preparations that must be made by the surveyor before the work takes place (11).
   g). Work sequence plan, namely the steps in the work that must be arranged in accordance with the construction method guidelines for each work (Astina et al, 2012).

K. *Finance (financial / money), is an important factor to support the cost of capital in carrying out a job, which includes (10):*
   a. Payment system by the owner, namely the system carried out by the owner to executors and consultants to mutually agree on payment contracts in work (10).
   b. Material costs, namely the price of materials that have been issued and have been adjusted to material providers (10).

L. *Other external factors (other factors), are factors outside of work that can affect the work process, including (Ramli et al, 2018) and (Astina et al, 2012):*
   a). Weather intensity, namely the influence of weather such as increased rainfall (Ramli et al, 2018).
   b). Work accident risks, namely risks resulting from the negligence of workers, executors, supervisors and owners which can cause work accidents (Astina et al, 2012).

M. *Impact of Project Work Delays Delays can have an impact that causes losses for owners, implementers, and consultants, including (11):*
   a). For the owner, in the case of a delay it could result in a loss of income or a loss of profit from the building which should have been rented out.
   b). For executors, delays can lead to increased overhead costs.
   c). For consultants, delays can cause loss of time and experience in scheduling work for other projects.

III METHOD

A. *Research Design*

The research design uses a quantitative descriptive research method using a survey approach. Quantitative research emphasizes data in the form of numeric (numbers) and is analyzed with appropriate statistical methods and is able to describe the results of real phenomena (14). Techniques and procedures for collecting data in this quantitative study used various techniques, namely questionnaires, interviews, and documentation.

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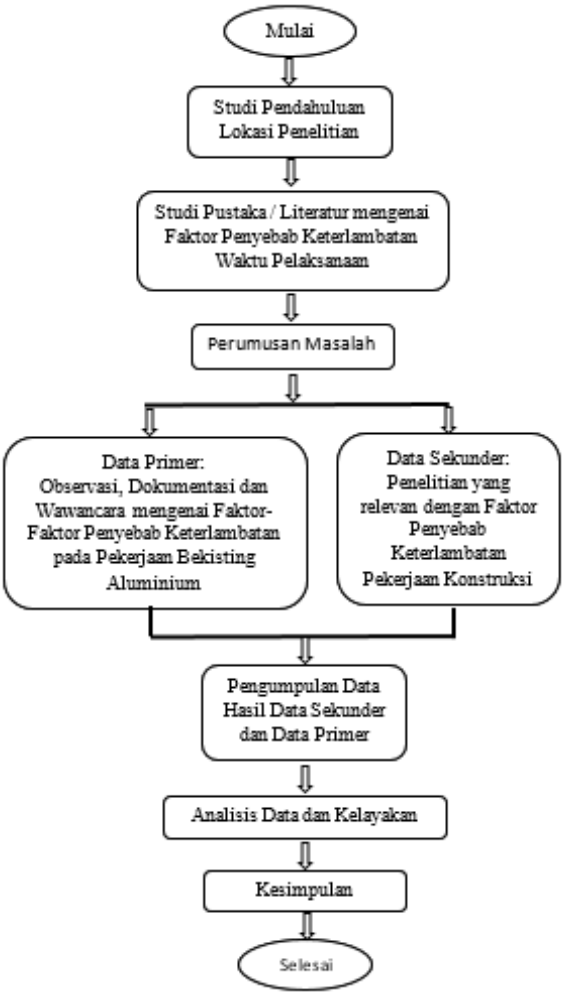

Fig. 2 Research Flow Diagram

Source: personal documents

B. Data Sources

This research has data sources which include 2 things including:

a). A primary data obtained directly from distributing questionnaires, documentation in the field and interviews with various parties as informants regarding the factors causing delays in aluminum formwork work.

b). A secondary data that is indirectly obtained, namely from important project data related to the scheduling of aluminum formwork work and the results of previous research, namely books and journals that are relevant to the research.

C. Data Analysis Techniques

The descriptive data analysis technique in this research uses SPSS with the results of the analysis in the form of quantitative data (numbers). The data is carried out with a test called the validity test and also the reliability test first to find out whether the variables used as factors are valid or not and have consistency (reliability) (7).

In addition, using factor analysis which is also processed with SPSS to analyze variables can be used as factor values (15). There is a condition in a factor analysis that is fulfilled, namely the Kaiser Mayer Olkin (KMO) score is > 0.59 and the significant value is < 0.05. Also do an Anti-Image Correlation test with a Measure of Sampling Adequacy (MSA) value that must exceed 0.5 (> 0.5). If you have a variable that has an MSA value of <0.5, then that variable is excluded and cannot be tested further. Then, look at the value of Communalities or the role of variables, which can be seen in how much a factor or variable influences delays in aluminum formwork work.

IV RESULTS

A. Validity Test

The validity test in question is a test carried out to find out that the data used is valid or feasible if the results are rcount > rtable (Ghozali, 2013). Testing this validity using the help of SPSS software. This study uses 40 samples to test the validity of the data, so that the rtable for 40 samples with an error of 5% is 0.312. So, if rcount > 0.312 then the variable can be said to be valid or feasible. The following is a table of validity test tables in Figure 3 and the results of calculating the validity in Table 1.

N	TarafSignifikan 0,05	0,01
35	0.334	0.430
36	0.329	0.424
37	0.325	0.418
38	0.320	0.413
39	0.316	0.408
40	0.312	0.403

Fig. 3 Table of validity test rcount

Source: Teknikelektronika.com

Table 1 Data Validity Test Results

No	Variable	Question	Information
1	Labor Factors	10 question	Valid (1-10 question)
2	Material Factors	5 question	Valid (11-15 question)
3	Equipment Factors	2 question	Valid (16-17 question)
4	Place Characteristic Factors	5 question	Valid (18-22 question)
5	Managerial Factors	13 question	Valid (23-35 question)
6	Financial Factors	3 question	Valid (36-38 question)

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No	Variable	Question	Information
7	Eksternal	2 question	Valid (39-40 question)

Source: processed research results

D. Reliability Test

The reliability test is a test which is carried out to determine the consistency of a data and obtain relative results (Matondang, 2009). This test is determined by Cronbach's Alpha value, which consists of:

a). Cronbach's Alpha value of 0 – 0.2 indicates very low reliability.
b). Cronbach's Alpha value of 0.21 to.d. 0.4 indicates low reliability.
c). Cronbach's Alpha value of 0.41 – 0.6 indicates moderate reliability.
d). Cronbach's Alpha value of 0.61 – 0.8 indicates high reliability.
e). Cronbach's Alpha value of 0.81 – 1.00 indicates very high reliability.

The following are Cronbach's Alpha values and the results of a data reliability test in Table 2.

Table 2. Data Reliability Test Results

No	Variable	Reliabel score	Information
1	Labor Factors	0,861	Very high reliability
2	Material Factors	0,700	High reliability
3	Equipment Factors	0,462	Moderate reliability
4	Place Characteristics	0,666	High reliability
5	Managerial Factors	0,781	High reliability
6	Financial Factors	0,589	Moderate reliability
7	External Factors	0,561	Moderate reliability

Source: processed research results

From the data described above, it can be seen that the variable that has very high reliability is the labor variable.

E. Factor Analysis Test

a. KMO and Bartlett's Test

Variables are declared included in the factor category if the Kaiser Mayer Olkin (KMO) value must exceed 0.59 (> 0.59) and the significant value must not exceed 0.05 (<0.05). This test has a result obtained in this research, has a KMO value of 0.610 > 0.59 and a sig is also obtained, namely 0.000 <0.05 so that all the variables contained in this study are included in the factors. The following are the results of a KMO and Bartlett's Test in Figure 4.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.610
Bartlett's Test of Sphericity	Approx. Chi-Square	80.075
	df	21
	Sig.	.000

Fig. 4 KMO and Bartlett's Test

Source: processed research results

b. Anti-Image Correlation Test

An Anti-Image Correlation test is carried out with a Measure of Sampling Adequacy (MSA) value which must exceed 0.5 (> 0.5) to find out which variables can be further tested, namely ranking variables or factors. The following are the results of the decision and the MSA value in a Table 3.

Table 3. MSA Value Results

No	Variable	MSA score	Decision
1	Labor Factors	0,665	Can be continued
2	Material Factors	0,636	Can be continued
3	Equipment Factors	0,535	Can be continued
4	Place Characteristic Factors	0,552	Can be continued
5	Managerial Factors	0,702	Can be continued
6	Financial Factors	0,629	Can be continued
7	External Factors	0,540	Can be continued

Source: processed research results

c. Communalities

The value of Communalities or the role of variables is used to see the ranking of the variables that have the most influence on delays in aluminum formwork work. Here are the results of the factor rankings.

Table 4. Frequency of Delay Factors

Order	Variable / Factor	Frequency
1	Financial Factors	72%
2	Material Factors	71%
3	Place Characteristic Factors	69%
4	External Factors	68%
5	Labor Factors	65%
6	Equipment Factors	62%
7	Managerial Factors	58%

Source: processed research results

V. DISCUSSION

In the Delays section where this took place in the aluminum formwork work influenced by factors causing delays in the

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Sakura Project, East Jakarta can be described as follows:

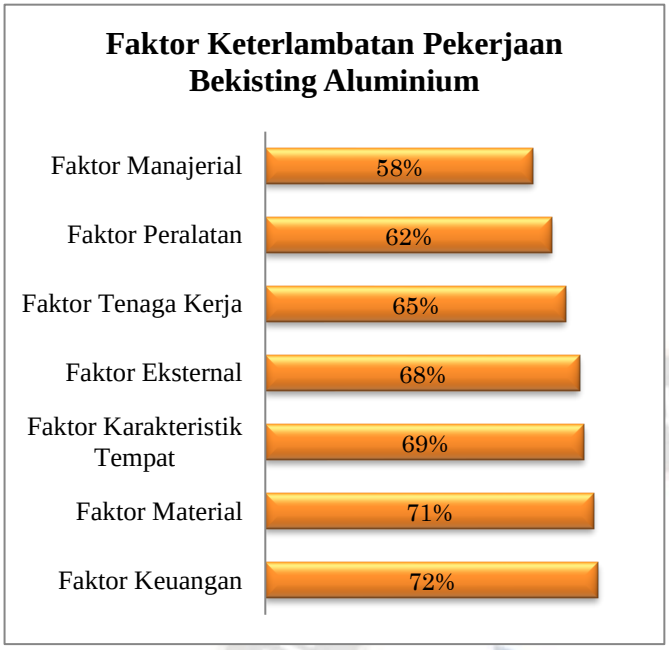

Fig. 5 Results of Aluminum Formwork Work Delay Factors

a) Financial factors which include payment systems and material costs with a frequency of 72%. This is one of the highest or most influential factors for delays due to the payment system at the Sakura Project which is not structured neatly from the executor to the foreman, thus hampering payments to workers.

b) Material factors which include material availability, material delivery and material quality with a frequency of 71%. This includes factors that affect delays due to insufficient material and are not taken into account in advance by the executors so they have to wait for material delivery from suppliers and delivery schedules that are delayed due to waiting for the completion of aluminum formwork work in other projects with the same supplier.

c) Place Characteristic Factors which include environmental responses, then a place to store some materials, access to work places, and work space needs with a frequency of 69%. This includes the factors that affect the delay due to the location of the aluminum formwork work material storage which is uncertain and shifts, not strategic to the work location, as well as limited space for workers at the work site.

d) External factors which include weather intensity and accident risk with a frequency of 68%. This includes factors that affect delays due to high rainfall which greatly affects work so that it does not work carried out during rain and if an accident occurs around the work site will greatly hinder the work from being completed.

e) Manpower factors which include expertise, discipline, motivation, number of attendance, availability factor, skilled labor factor, workforce turnover factor, and also communication factor between the foreman and the workforce with a frequency of 65%. This includes a factor which has an effect on delays due to a lack of skilled workers who really understand the work of aluminum formwork, so it takes time to learn about aluminum formwork in advance.

f) Equipment factor which includes the availability of tools and the quality of tools with a frequency of 62%. This includes factors that affect delays due to aluminum formwork work equipment that must be checked and recalculated when used until finished use.

g) Managerial factors which include the quality of supervision, experience of field supervisors, design changes, communication between contractors and owners and consultants, material and equipment inventory schedules and work schedule, location determination, and work sequence plans with a frequency of 58%. This includes the factors that affect the delay but the lowest because the role of supervisors and scheduling is very important to control the progress of aluminum formwork work.

IV CONCLUSION

In this research, an analysis was finally obtained in the form of results from data processing and included in the previous discussion, that in terms of delays in aluminum formwork work at the Sakura Project, East Jakarta there were 7 variables or causal factors. The 7 variables include labor, materials, equipment, site characteristics, managerial, and external factors. Then besides that, there are factors that cause delays in aluminum formwork work at the Sakura Project, East Jakarta, which are the most influential, which are shown in a financial factor, while the factor that has the least influence is

in terms of managerial factors..

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