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The Analysis Performance of Project Delays in Pile Foundation Work: A Case Study Batam Island

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ABSTRACT

Purpose: Delays are common in construction projects. The term "project delay" refers to a project's completion date later than anticipated. Lack of performance by contractors or project managers in resolving issues can result in project delays. The factors that cause project delays must be considered to reduce delays. This study aims to examine the elements contributing to Batam island's pile foundation construction delays.

Findings: The factor of delays is an important key of the analysis to prevent delays in future projects

Design/methodology/approach: This research uses a case study at Batam Island. The analysis is done with SPSS 26 program.

Research limitations/implications: Analysis of delay caused by pile foundation in Batam island.

Practical implications: Analysis of the delay caused by a project according to the result of the questionnaire.

Originality/value: Original Paper

Paper type: A Case Study

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I. INTRODUCTION

The increase in the number of construction projects has made construction projects one of the major sources of state income for developing countries (Susanti, 2020). Indonesia is a developing country, and there are many construction projects. So that the infrastructure is in a booming stage or at its peak where every year, the number of projects under development in the country is increasing rapidly. Construction projects are divided into several sectors: education, industry, tourism, and health.

A project is a series of activities that have a temporary nature where there is a beginning and an end of activities that are carried out in stages because each project has different problems. So, it can be said that each project is unique (Patel & Joshi, 2020). Another contributing factor to success when running the project itself is resources. The resources that influence when running the project are man, materials, machine, money, and method. So, it can be concluded that the implementation of construction projects is very dependent on the management process and the supporting resources in it (Institute, 2017). A project also has constraints in achieving its goals. The limits in question are called Triple Constraints are the amount of budget or costs needed to run the project, the time that has been scheduled to complete a project, and the quality that must be following the agreement (Hassan et al., 2019). The Triple Constraint has the property of attraction; in other words, they are connected. If you want to improve quality, then costs will increase, and to prevent cost increases that exceed your budget, you must anticipate scheduling to speed up the time needed.

One of the important fundamentals in project construction is that the project completion can be ready at the promised time (Wang et al., 2018). Project delays are common in both developed and developing countries

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(Wuala & Rarasati, 2020). Project delay can be interpreted as a delay in the completion of a construction project or the completion of a project that has passed the promised date (Rashid Y, 2020). Suppose the project cannot be ready at the specified time. In that case, it will result in losses to the contractor due to having to pay workers and losses to the owner because the project cannot be inaugurated according to the specified date (Rachid & Mohammed, 2019). Project delays can be caused by the performance of contractors who cannot keep up with progress, the slow performance of consultants in planning project managers in dealing with problems during the project, and the late arrival of material. Because of these delay factors, the cost that had been estimated when the planning stage was changed. This can make the cost of the project can overruns (Rauzana & Dharma, 2022).

Each construction project has different characteristics and challenges (Mittal et al., 2020). Because they have different obstacles, so they have different levels of difficulty. A high value will make the level of complexity in project completion higher (Alaghbari et al., 2018). The complexity is the quality of the project being carried out, the project cost needs, and the completion time. It can also cause losses that result in delays in project completion and cost losses on ongoing projects. Although all activities are well planned, uncertainty is always present. So that project delays are not unexpected (Rauzana & Dharma, 2022).

By understanding and identifying the factors that cause delays, it is expected to minimize the risks that can lead to delays in project sustainability (Bekr, 2018). Several factors have been identified as causing delays in previous studies. Even so, delays can still happen because of insufficient planning by project managers, consultants, contractors, and others. Many infrastructure projects in developed and developing regions are delayed despite the severe impact of delays. To complete the project on time and within budget, the project manager must deal with the delayed effect. To project time performance, it is essential to identify the causes of delays (Mittal et al., 2020).

At the project's construction stage, the first work to be done is foundation work. Pile foundations are commonly used to support low-rise residential buildings over soft soil. Pile foundations can be classified into end-bearing piles and friction piles based on how they transfer load from one part of the structure to another, depending on their load transfer mechanism. Problems often occur in determining the correct type of piling tool so that the implementation can be more efficient both in terms of time and cost. Diesel Hammer tools have economic value in use because they are easy to use in remote areas and easy to maintain (Candra et al., 2021).

The purpose of this study was to find out what factors caused project delays in pile foundation work. The survey used a questionnaire via Google Forms which was distributed to the parties involved in pile foundation work in Batam Island. The analysis was carried out by asking the parties involved in project supervision and development to fill out a questionnaire containing the factors causing project delays from previous research. From this research, it was obtained the results of the assessment of the factors causing project delays by the parties involved and data processing was carried out using SPSS to determine the main factors that became the delay in the pile foundation work in Batam island. The research is expected to be used as a reference to minimize the main factors that cause delays for the next pile foundation project.

A. Literature Review

1. Project Construction

The construction industry has undergone significant transformation in the past few decades, as reflected by large investments, project execution processes, complex procurement scenarios, and recent technological advances. In the construction industry, human resources are heavily reliant on decision-making by project managers and others. Collaboration is an essential professional trait for facilitating successful project execution and meeting deadlines. A construction project's critical relationships are between the client, the contractor, and the subcontractor (Deep et al., 2021).

Compared to operational work, projects have specific characteristics and rules. There are many definitions offered in contemporary literature which emphasize the uniqueness of each project. Due to the temporary nature of projects, project teams become redundant, reassigned, or redundant after the project is completed to achieve goals or objectives. In construction failures, errors by the service user or service provider cause results to fall short of the agreed-upon work specifications. Construction projects are unique in that they serve both business production and basic human needs. As a result, the quality of a building and engineering project has a direct impact on the stable development and efficacy of the national economy's socioeconomic components. Furthermore, in a fiercely competitive market economy, an improvement in management quality has always been seen as a critical leading concern for building firms. A quality management strategy must be used at all stages of a project to ensure excellent quality (Nguyen et al., 2018).

Project management is one of the most contentious issues to consider when implementing construction projects. The three main pillars underlying any project are time, cost, and quality. If the project's handover is delayed for any unforeseeable reason, the project's economic and technical feasibility will be lost. Projects differ from operational work in terms of their characteristics and rules. A project is a temporary group established to

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achieve a specific goal or objective, resulting in a temporary team, redundant or reassigned after the project is completed. (Rezaee, Yousefi, & Chakrabortty, 2019).

2. Delay in Project Construction

Construction delays became an unavoidable part of the project's life cycle. Even with today's advanced technology and management understanding of project management techniques, construction projects continue to experience delays, and project completion dates are pushed back. There are numerous reasons why delays occur. Due to the interaction of many design-related factors and implementation technologies by the three parties involved in the construction industry (client, contractor, consultant), delays have become an unavoidable phenomenon in public construction projects in developing countries (Al-Jaf & Saeed, 2020).

Construction delays are defined as work being completed later than expected or according to the contract schedule (Ramli et al., 2018). Construction delays are a common risk, but they are also severe. To minimize the impact of a delay, an appropriate process must be used to manage the event that caused it. By managing systematically managing construction delays, the causes of the delay can be identified and documented as early as possible. The owner, as well as the contractor, are adversely affected by delays. When project deliverables are delayed, the owner loses the revenue potential and increases overhead costs associated costs with project management and contract supervision. Longer work periods, higher material and labor costs, and higher overhead expenses result in increased costs for the contractor as well (Rachid & Mohammed, 2019).

Therefore, poor productivity rates cause time delays and cost overruns for many construction projects. It is, therefore, necessary to identify and address factors affecting construction productivity to improve the economic performance of construction projects. To maximize productivity improvements, it would be beneficial to have a deeper understanding and a comprehensive overview of the factors that affect productivity. Construction projects are delayed when a certain act or event extends the timeline and budget for delivering the contract's deliverables. Owners and contractors can reduce the impact on their projects caused by delaying factors if they understand these factors. It is important to identify delay factors and assess them, but this can be challenging. Delays caused by such significant factors need to be prioritized (Hussain, Zhu, Ali, Aslam, & Hussain, 2018).

3. Pile Foundation Work

The structure of the building consists of an upper structure and a lower structure. The upper structure includes beams, plates, and columns, as well as the roof, and the lower structure, which is the foundation (Byun & Sohn, 2020). The foundation is a very important job in a civil engineering job because it is this foundation that carries and holds a load that works on it, namely the top construction load (Magar et al., 2020). This foundation will channel the stresses that occur in the load of the superstructure into a hard soil layer that can bear the load of the construction (Pazha et al., 2019).

As part of the foundation selection process, it is important to consider the load of the upper building where the load will be supported by the foundation, as well as the carrying capacity of the soil and the depth of hard soil, which will affect the choice of the foundation shape. There are many types of foundations, and choosing one depends on costs and implementation time (Sari et al., 2021). That is why the type of foundation should be chosen carefully. There are many different types of foundation poles and piling methods, and many factors need to be considered when doing foundation work.

Pile foundations can be classified into end-bearing piles and friction piles based on their load transfer mechanism. For low-rise residential buildings constructed over soft soil or when poor soil conditions are present near the surface, pile foundations are commonly used to handle heavy column loads from the building to deeper soil (Lee & Ling, 2022). The use of pile foundations enhances the bearing capacity of weak soils and reduces foundation settlement. As a result of the scarcity of space as well as demands for taller and heavier buildings, researchers in geotechnical sciences are increasingly studying pile foundations' reliability (Kumar et al., 2021). At the construction stage of the project, generally, the first work to be done is foundation work. Because the foundation work is the first stage to be carried out, it must be considered carefully. This is very important because it considers other work that will be hampered if the foundation work is delayed (Henindia & Suroso, 2022).

II. METHODS

A. Location of Case Study

The literature method is a set of procedures for gathering, classifying, and analyzing written data from libraries. Following the period of preparation before this research is conducted, this data gathering comes next. The information received complies with the study's plan for accurate and pertinent data (Rifai et al., 2015). In

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research and scientific modeling, data is a major strength (Rifai et al., 2016). Identification of the right problem is the first step in systematic scientific research (Rifai, 2021).

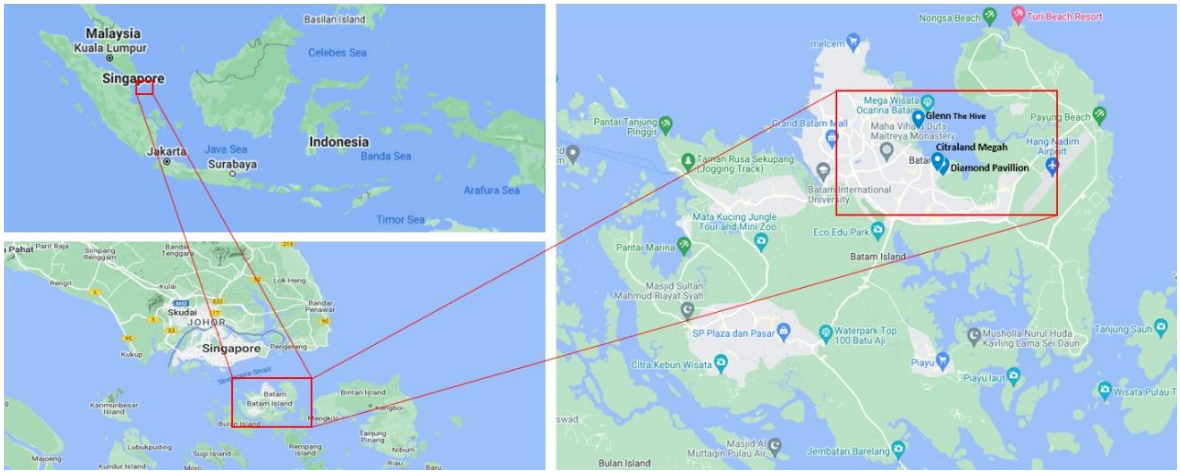

Figure 5 - Location of Study Case

In this study, we have used a questionnaire survey approach to determine the impact of various attributes on delay in pile foundation works at Batam Island. A survey was conducted among construction professionals representing various projects in Batam Island using pile foundation works in the project. The project that has been using this pile foundation is Diamond Pavillion Residence, Glenn the Hive Residence, and Citra Land Megah Residence. When examining the impact of various attributes on construction delay, the heterogeneity of respondents is an important factor to consider. By selecting respondents representing the key industry roles across the construction industry, the study maintains heterogeneity within the survey sample.

B. Preparation of Questionnaire

For the research to be successful, it is essential to identify critical attributes and create a questionnaire. Research has already been conducted on the causes of construction delays, and a peer-reviewed set of delay attributes has already been published. To conduct this study, a questionnaire was prepared that incorporates the main delay attributes reported in the literature. A total of 25 delay attributes were identified under five broad categories, namely client-related, contractor-related, consultant-related, material-related, and external-related, for gathering data. All gathered data must be taken into consideration when deciding using various methods that are generally accepted. The attributes are listed in Table 1. Respondents were asked to rank the importance and impact of a specific attribute on delay in a selected project on a five-point Likert scale (1 very low, 2 low, 3 average, 4 high, 5 very high).

Table 1. Identification of attributes and sources

No	*Category*		*Attributes Affecting Delay*	*Source*
1.	*Owner/Client Related*	*CLT1*	*Changes in instructions and scope of work during construction*	*(Wang, et al., 2018) (Wuala & Rarasati, 2020) (Bekr, 2018)*
		CLT2	*Delays in making decisions by the owner during construction*	*(Choong Kog, 2018) (Wang, et al., 2018) (Chen, 2019)*
		CLT3	*Design changes by the owner during construction*	*(Bekr, 2018) (Durdyev, 2019)*
		CLT4	*Delays in payments during construction*	*(Chen, 2019) (Bekr, 2018) (Mittal, Paul,*

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ISSN : 2597-4750 (PRINTED)

				Rostami, Riley, & Sawhney, 2020)
		CLT5	*Shortage of collaboration between client and contractor during construction*	*(Bekr, 2018) (Al-Jaf & Saeed, 2020)*
2.	*Consultant Related*	*CST1*	*Late in giving instructions to workers during construction*	*(Mittal, Paul, Rostami, Riley, & Sawhney, 2020) (Wuala & Rarasati, 2020) (Al-Jaf & Saeed, 2020)*
		CST2	*Delay in approving a change in scope of work during construction*	*(Rachid & Mohammed, 2019) (Yap, 2021)*
		CST3	*Delays in testing and checking work results during construction*	*(Yap, 2021)*
		CST4	*Delays in making design drawings during construction*	*(Wuala & Rarasati, 2020) (Rashid, 2020)*
		CST5	*Insufficient performance of consultants during construction*	*(Wuala & Rarasati, 2020)*
3.	*Contractor Related*	*CON1*	*Ineffective planning and scheduling during construction*	*(Chen, 2019) (Choong Kog, 2018) (Wang, et al., 2018)*
		CON2	*Lack of management and supervision during construction*	*(Rachid & Mohammed, 2019) (Chen, 2019) (Bekr, 2018)*
		CON3	*Lack of work experience resulting in incompetence during construction*	*(Choong Kog, 2018) (Chen, 2019) (Wang, et al., 2018)*
		CON4	*Rework for defects caused by negligence during construction*	*(Al-Jaf & Saeed, 2020) (Choong Kog, 2018) (Bekr, 2018)*
		CON5	*Less worker productivity during construction*	*(Bekr, 2018) (Al-Jaf & Saeed, 2020)*
4.	*Material Related*	*MAT1*	*Delays in delivery of construction materials during construction*	*(Mittal, Paul, Rostami, Riley, & Sawhney, 2020) (Rauzana & Dharma, 2022)*
		MAT2	*Poor material quality during construction*	*(Durdyev, 2019)*
		MAT3	*Lack of material stock during construction*	*(Mittal, Paul, Rostami, Riley, & Sawhney, 2020) (Rashid, 2020) (Mbala, 2018)*

ISSN : 2597-4785 (ONLINE)
ISSN : 2597-4750 (PRINTED)

		MAT4	*Errors in calculating material requirements during construction*	*(Rauzana & Dharma, 2022) (Susanti, 2020)*
		MAT5	*Material damage in storage during construction*	*(Rauzana & Dharma, 2022)*
5	*External Related*	*EXT1*	*Bad weather conditions during construction*	*(Ramli, et al., 2018) (Chen, 2019) (Durdyev, 2019)*
		EXT2	*High Inflation during construction*	*(Susanti, 2020) (Prasad, 2019)*
		EXT3	*Change of regulation by the government during construction*	*(Rachid & Mohammed, 2019) (Prasad, 2019) (Durdyev, 2019)*
		EXT4	*Equipment breakdown during construction*	*(Rauzana & Dharma, 2022)*
		EXT5	*Poor/unforeseen site conditions during construction*	*(Yap, 2021) (Durdyev, 2019) (Susanti, 2020)*

C. Validity Test & Reliability Test

Validity means the extent to which the accuracy and accuracy of a measuring instrument perform its size function. Validity is a test that shows the degree of accuracy between the actual data and the data collected by the researcher to determine the validity of an item by correlating the item score with the total of these items (r). The correlation between the question items and the total score must be 0.3 to be considered valid. Question items in the instrument are declared invalid if the correlation coefficient is less than 0.3 (Rizkifani, 2021).

The reliability test is a test used to ensure the level of reliability of the research questionnaire, which will later be used in collecting research variables. If the questionnaire has been measured repeatedly, and the results obtained are still the same or consistent, then this indicates that the questionnaire is reliable. The questionnaire needs to be rewritten if the value is less than 0.6. A value between 0.7 and 0.8 indicates some reliability. The reliability is very good if it exceeds 0.8 (Feng B, 2020).

D. Descriptive Statistical Analysis

Descriptive statistical analysis is an analysis that functions to find out and find the value of the characteristics/characteristics of the research variables. The method of analysis is through a description or depiction of the overall data that has been collected soberly, and there is no specific purpose to draw your own conclusions, both general and equally. The purpose of descriptive statistics is to calculate measures of central tendency and data variability.

III. RESULTS AND DISCUSSION

A. Characteristics of Respondents

This research questionnaire was distributed to people involved in the pile foundation project. Questionnaires were distributed to three housing projects using pile foundations as the substructure: Diamond Pavillion residence, Citra Land Megah residence, and Glenn the Hive residence. The questionnaire results, which the respondents filled out, were then presented in the table below.

ISSN : 2597-4785 (ONLINE)
ISSN : 2597-4750 (PRINTED)

Table 2. Characteristics of Respondents

No	*Characteristic of Respondents*	*Frequency*	*Percentage (%)*
1	*Occupation*		
	Client	*29*	*32.22*
	Consultant	*15*	*16.67*
	Contractor	*46*	*51.11*
2	*Long Experience in the Construction field*		
	< 5 years	*25*	*27.8*
	5–10 years	*39*	*43.3*
	10-20 years	*18*	*20*
	>20 years	*8*	*8.9*

Based on the results of the questionnaires that have been distributed, the number of respondents is 90. It can be seen in table 2 that most respondents who filled out the questionnaires were contractors, as many as 46 people (51.11%). The results of the questionnaire also obtained data on respondents by clients, as many as 29 people (32.22%), and consultants, as many as 15 people (16.67%). Most of the respondents who filled out the questionnaire had Experienced in the construction sector for a period of 5 to 10 years (43.3%).

B. Validity Test & Reliability Test Result

The result of the validity test for all variables in table 1 has a value of correlation coefficient of more than 0.3. Question items in the instrument are declared invalid if the correlation coefficient is less than 0.3. Therefore, the results of the validity test have stated that all variables are valid. Thus, the variable testing is continued with the reliability test.

Table 3. Reliability Test Result, SPSS 26.0

Variable	*Cronbach's Alpha*	*Min. Cronbach's Alpha*	*N item*	*Conclusion*
Client Related	*0.696*	*0.6*	*5*	*Reliable*
Consultant Related	*0.620*	*0.6*	*5*	*Reliable*
Contractor Related	*0.654*	*0.6*	*5*	*Reliable*
Material Related	*0.630*	*0.6*	*5*	*Reliable*
External Related	*0.601*	*0.6*	*5*	*Reliable*

ISSN : 2597-4785 (ONLINE)
ISSN : 2597-4750 (PRINTED)

The reliability test is a test used to ensure the level of reliability of the research questionnaire that will be used in collecting research variables. Table 3 shows all the variables in this study have Cronbach Alpha > 0.6. Thus, all variables can be considered reliable.

C. Descriptive Statistical Analysis

In table 4, it can be seen the results of the static descriptive analysis using the SPSS 26.0 program from the results of the questionnaire respondents. The results of the descriptive static analysis are sorted from the largest to the smallest average to see the average number of respondents who answered the questionnaire.

Table 4. Descriptive Analysis Results, SPSS 26.0

Ranking	*Variable*	*N*	*Minimum*	*Maximum*	*Sum*	*Mean*	*Std. Deviation*
1	*EXT1*	*90*	*2.00*	*5.00*	*376.00*	*4.18*	*0.80*
2	*MAT1*	*90*	*2.00*	*5.00*	*350.00*	*3.89*	*1.02*
3	*EXT5*	*90*	*1.00*	*5.00*	*335.00*	*3.72*	*1.22*
4	*MAT3*	*90*	*1.00*	*5.00*	*331.00*	*3.68*	*1.07*
5	*EXT4*	*90*	*1.00*	*5.00*	*315.00*	*3.50*	*1.09*
6	*CST4*	*90*	*1.00*	*5.00*	*307.00*	*3.41*	*1.25*
7	*CON1*	*90*	*1.00*	*5.00*	*304.00*	*3.38*	*1.30*
8	*CON4*	*90*	*1.00*	*5.00*	*300.00*	*3.33*	*1.21*
9	*MAT2*	*90*	*1.00*	*5.00*	*290.00*	*3.22*	*1.36*
10	*MAT4*	*90*	*1.00*	*5.00*	*290.00*	*3.22*	*1.25*
11	*CLT3*	*90*	*1.00*	*5.00*	*283.00*	*3.14*	*1.18*
12	*EXT3*	*90*	*1.00*	*5.00*	*277.00*	*3.08*	*1.43*
13	*CON2*	*90*	*1.00*	*5.00*	*276.00*	*3.07*	*1.24*
14	*CST3*	*90*	*1.00*	*5.00*	*276.00*	*3.07*	*1.25*
15	*CLT2*	*90*	*1.00*	*5.00*	*276.00*	*3.07*	*1.31*
16	*MAT5*	*90*	*1.00*	*5.00*	*269.00*	*2.99*	*1.52*
17	*CLT1*	*90*	*1.00*	*5.00*	*264.00*	*2.93*	*1.23*
18	*CON5*	*90*	*1.00*	*5.00*	*263.00*	*2.92*	*1.14*

ISSN : 2597-4785 (ONLINE)
ISSN : 2597-4750 (PRINTED)

19	*CST1*	*90*	*1.00*	*5.00*	*262.00*	*2.91*	*1.14*
20	*CST2*	*90*	*1.00*	*5.00*	*257.00*	*2.86*	*1.16*
21	*CLT5*	*90*	*1.00*	*5.00*	*246.00*	*2.73*	*1.23*
22	*CLT4*	*90*	*1.00*	*5.00*	*242.00*	*2.69*	*1.18*
23	*CON3*	*90*	*1.00*	*5.00*	*228.00*	*2.53*	*1.34*
24	*EXT2*	*90*	*1.00*	*5.00*	*217.00*	*2.41*	*1.05*
25	*CST5*	*90*	*1.00*	*5.00*	*213.00*	*2.37*	*1.14*

From the results of questionnaires filled in by respondents, the main factor causing delays was bad weather conditions or heavy rain. The study results are almost the same as the study of "Study of factors influencing construction delays in rural areas in Malaysia." In the study "Study of factors influencing construction delays in rural areas in Malaysia," one of the five main factors that cause delays is bad weather conditions or heavy rain. Weather conditions are an unavoidable phenomenon. Weather checking can only be done through weather forecasts to find out the weather conditions every day, but it is not 100% accurate. When the weather is rainy, all construction activities will generally stop waiting for the weather to clear or for the rain to stop. This is because it will be dangerous if you carry out activities such as piling during rainy conditions. After all, welding activities between sections of the pile will be complex.

The second major factor is the delay in material delivery during construction. The study results are almost the same as the study "The causes of delays in construction projects in the province of Aceh, Indonesia" delays in material delivery have a strong influence on project delays. It is also anticipated that this delay in material delivery will cause the overall project to be delayed.

The third major factor in the results of this study is the poor site condition during construction. According to the results of the study "Reviewing critical delay factors for construction: Analysing projects in Malaysia," poor land conditions had little effect on project delays. However, in this study, poor site conditions were one of the five main factors causing delays. The bad land factor causes the machine to be difficult to move, so sometimes an excavator is needed to assist in making roads or access roads for the machine.

The fourth main factor from the results of this study is the lack of material stock during construction. Based on the results of the research "Causes of Delay in Various Construction Projects: A Literature Review," the shortage of material stock is the factor with the second rank that can cause delays. Lack of materials during construction can result in delays. This is because when construction occurs, and there is a shortage of materials, construction cannot continue because they must wait for the arrival of materials. So, the material stock must be considered so that the use of material stock can be maintained and ordered immediately if the material stock is about to run out.

This study's main factor number five is equipment damage during construction. Based on the research "The cause of delays in development projects in the Province of Aceh, Indonesia," the factor of equipment damage is very influential on project delays. Equipment for construction activities is essential. This is due to progress in construction activities that rely on tools. Like piling a pile foundation, it requires a hydraulic hammer. So it is hoped that the contractor will pay more attention to the equipment so that the equipment is not damaged and immediately repaired if the obstacles do not cause delays in the project.

In this study, it is known that there are three factors with the lowest ranking: the lack of Experience of consultants, Inflation, and incompetent contractors. The research "Causes of delays in construction projects for developing Southeast Asia Countries" has similarities to the factor of inexperienced consultants. In the study "Causes of delays in construction projects for developing Southeast Asia Countries," the lack of consultant experience was not one of the 14 main factors that caused delays in the research.

The research "Cost overrun and time delay of the construction project in Indonesia" has similarities with this study. In that study, 15 factors became a factor in project delays. Factors related to Inflation have the lowest ranking of all these factors, namely rank 15. In this study, Inflation did not have much effect on project delays.

ISSN : 2597-4785 (ONLINE)
ISSN : 2597-4750 (PRINTED)

Over the past few decades, subcontractor selection has been hotly debated. Due to the instability and competitiveness of the construction industry, some clients are used to accepting the lowest bids from prequalified contractors. When selecting a contractor, it is essential to consider Quality, Time, and Cost. The pre-qualification process is crucial for clients who wish to achieve successful project outcomes through a balanced process.

A potential outsourcing risk is the selection of an unsuitable construction subcontractor, which may significantly impact the project's success. Successful project completion and business continuity for a general contractor depend on selecting the right subcontractor. The level of project success depends on the selection of suitable workers. Subcontractor selection criteria are quality of construction, control over work results, coordination system in projects, capital, payment methods, banking history, Experience related to demands or claims, and frequency of failure to fulfill contracts on time.

In the results of this study, there are differences with the research "Major Construction Delay Factors in Portugal, the UK, and the US." In this study, the incompetent contractor factor was insignificant for project delays. This is shown in table 4, where this factor is ranked 23. However, in the study "Major Construction Delay Factors in Portugal, the UK, and the US," it is stated that the study's results show that the lack of competent contractors is the main factor that causes project delays and gets the ranking. 2nd rank. In that study, contractors in UK countries did not show satisfactory performance.

IV. CONCLUSION

There are results and objectives as well as conclusions from this study. The purpose of this study was to determine the main factors that can cause project delays in pile foundations on Batam Island. The results of the research conducted on Batam Island with 3 case studies in Diamond Pavillion Residence, CitraLand Megah Residence, and Glenn the Hive Residence showed that there were several causes of delays in pile foundation work. Based on the results of the questionnaire in this study and data analysis from respondents using the SPSS 26 program, it was found that five main factors could cause delays in pile driving. The first factor is bad weather conditions; the second factor is delays in material delivery; the third factor is poor field conditions; the fourth factor is the shortage of materials during construction, and the fifth factor is Equipment breakdown during construction. In comparison, the variables that are considered not to affect the delay are the lack of Experience of the consultant, the Inflation, and the lack of competent contractors.

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