

Analysis of Factors and Risk Variables for Delays in the Construction Process of the School Building Area

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ABSTRACT:In every process of building construction, costs, quality or time are obstacles in every project. But these obstacles are defined as the project target that determine the success of a project. Each project always has risks, natural and human risks that affect time so that it can cause losses. The risk of project failure resulting from delays in the construction process will have an impact on the initial cost loss, as well as reduce the quality of the project. The desire to avoid project delays in terms of time is required to analyze the risk of delays in construction projects. Problems arising from the risk of this delay occur and are very important in the discussion of school buildings. School buildings cannot be tolerated if delays are identified so that project failures can harm various parties, one of them is the project managers at service providers. The research problems to be solved in this study were to examine the construction process of school buildings and find out what factors and risk variables of delay. The methodology was review of issues, identification of research problems, and review of various literature. The method used in this study is qualitative. This study aims to find factors and risk variables for delays in the construction process of school buildings.

KEYWORDS:construction process, school buildings, project delays, factors and risk variables..

I. INTRODUCTION

Each construction project has an implementation plan and schedule within a certain period of time. Construction projects are planned based on the method of work, resources, and schedule time to start and finish. Making a construction work plan or schedule often refers to the estimation that exist when the development plan is made, while in the implementation there are always problems that occur in the construction process. Problems in the construction project may have an impact on the initial plan which results in delays of project completion. At the planning stage of the project, the service provider together with the consultant and the contractor will determine the implementation process starting from the beginning until the completion target. Project implementation schedules can be done by a Gantt chart, pert / cpm, or a very simple bar chart.

In the implementation process, many aspects are affected and factors that influence it can disrupt the process of implementing the construction. The results of delays that exceed the unacceptable limits will be detrimental to the project owner, and the service provider. Therefore the factors causing the construction project delay are identified. South Sumatra is not the largest and richest province in Indonesia, but this province is special due to its achievements in many fields, such as agriculture, surplus rice, surplus electricity to illuminate the island of Java, sports, and others. Musi Banyuasin Regency, South Sumatra is the originator of a free school program since 2002. However, there are still school buildings which are not suitable for use. This was evidenced by the existence of an elementary school that was only roofed with tarpaulin and soil floor. The Education Office (Disdik) of Palembang city plans to

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build or renovate existing schools with multi-storey buildings. School's resources are not sufficient so it encourages the private sector to participate in the construction of schools in the South Sumatra area.

School construction must be on time because there is a responsibility to the parents who enroll their children to attend school. In addition, the school is also bound by the standard curriculum of the government so that the construction of school buildings is very close to the work schedule and its completion cannot get the tolerance of delay. If there is a delay in time management, it is very important to prevent or transfer risks that can overcome project failure.

Research Problems

The research problems that will be discussed in this study are:

- How was the construction process of building a school building in LubukLinggau, South Sumatra?
- What were the factors and risk variables for the delay in the construction process of a school building?

Limitation of Research

The location of this research object was in LubukLinggau City, South Sumatra Province. The object of research as a case study was a school building that had completed its construction period and was currently operating in accordance with the national curriculum.

The research process was carried out from the beginning of planning until the completion of the construction process of the school building. Factors and variables that influence each other were obtained from literature studies and data processing from the last 10 years books and journals, interviews and data collection in the form of expert tests related to the construction process in SDH LubukLinggau.

Research Objectives

The purpose of this study was to analyze and examine the construction process of school buildings in LubukLinggau and to understand the factors and risk variables for delays in the construction process of the LubukLinggau school building.

II. RELATED WORK

Risk Management

The risk is a variation that might occur naturally in a situation (Fisk, 1997). The risk is a threat to life, property or financial benefits due to the dangers that occur (Duffield & Trigunarsyah, 1999). In general, the risk is associated with the likelihood (probability) of occurrence of events beyond what is expected (Suharto, 1995). Therefore, the risk is a variation that might occur naturally or the possibility of an event beyond what is expected which is a threat to property and financial benefits due to the danger that occurs. The risks involved in construction projects are very large, but not all of these risks need to be predicted and considered to start a project because it will take a long time. Therefore the parties in the construction project need to prioritize the important risks that will influence the project's benefits.

The risks in a construction project are failed solutions according to a predetermined design / construction time, failure to obtain planning drawings, detailed planning / permits with time available, unexpected soil conditions, very bad weather, labor strikes, unexpected price increases for labor and materials, accidents that occur in locations that cause injuries, damage to structures due to poor ways of working, unexpected events (floods, earthquakes, etc.), claims from contractors due to loss and late production costs due to detailed design by the design team, and failure in project completion with a predetermined budget.

Risk Analysis

The next step after risk identification is risk analysis. Risk analysis is estimating and evaluating the consequences related to the impact of risk, or a combination of each risk using analytical techniques, then assessing the impact of these risks by using several types of measurement techniques (Bahar, 1990). The measurement of risk analysis according to Roger Flanagan can be done quantitatively and qualitatively. Risk analysis and evaluation can be defined as summarizing quantitative uncertainties, using probabilistic theory, carried out to measure the potential influence of the risks. The risk analysis and evaluation process scheme can be described as follows:

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- **Data collection**

The first step in the process of risk analysis and evaluation is to collect data that is relevant to the risk to be evaluated. This data can come from the experience on previous projects or based on expert experience

- **Uncertainty Modelling**

The uncertainty modeling is explicit from the quantification of events and consequences based on available information about the evaluated risks

- **The Evaluation of the Potential Impact of Risk**

After making a model of risk uncertainty, the next step is to evaluate all effects of these risks in a unified global picture. Evaluation of certain risk inputs on a project depends on the probability of the occurrence of these risks, the frequency of events and the impact of these risks. In comparing project choices and the various risks involved, risk indices are often used, i.e. Risk Index = Frequency x Impact.

In the analysis and evaluation of risks, the relationship between frequency or probability and impact will form the basis of a discussion about whether a condition is an acceptable risk for a project

Project Scheduling

The main key to the success of implementing projects on time is the completion and appropriate project planning and scheduling. Delays can be considered as a result of not fulfilling the planned schedule because the reality is not the same / in accordance with the conditions when the schedule was made.

Activity identification aims to find out in detail the activities that will be present in the project implementation. Identifying good and complete activities is obtained from a careful review, understanding, and analysis of all existing project contract documents; therefore the contract document must completely inform the scope of the work to be carried out.

The estimated duration of the activity is to estimate the length of time needed to complete the activity. The duration of the activity is a function of the amount (quantity) of work to be completed and the work product of each unit of time (Production Rate). The quantity of work can be known from the scope/contract document, while the work product per unit time is obtained from data and experience taking into account the availability of all resources (materials, tools, labor) and constraints that might affect productivity.

After carrying out risk identification, the next step is to provide follow-up of the possible risks. Strategies to handle risk are formulated based on the sources and impacts that occur. The aim of the risk strategy is to eliminate the possibility of potential impacts and increase control of the risks (Bahar and Crandall, 1990). Overall there are two approaches to dealing with risk, i.e. an approach to avoiding risk or reducing the likelihood of a loss occurring, and the second is taking preventive action.

Project Delays

Project delays can be caused by contractors, owners, planners, other parties or force majeure. Project delays mean an increase in the time of completion of the project that has been planned and listed in the contract document. Completion of non-timely work is a shortage of productivity levels and of course, this will result in waste in terms of financing, both in the form of direct financing spent on government projects, as well as tangible investment swelling and losses on private projects.

Delays in project completion can be avoided or reduced if an assessment of the project schedule is carried out properly. The active role of management is one of the main keys to the success of project management. Project delays often occur in the implementation of a project. A study focused more on internal elements (project owners) of several factors related to project delays, i.e. the ability of the project management team, the accuracy of field investigation data, document contracts, communication between project elements, and variation orders (Chan, 1998). An experienced project management team will increasingly provide assurance of project completion on schedule. Accurate field investigation data will make detailed design work more precise according to field conditions, so there are not many changes that might be made during project implementation.

According to Kraiem and Dickmann, the causes of delay in project implementation time can be categorized in 3 major groups, i.e. the delay that deserves Compensable Delay, which is caused by action; negligence or fault of the project

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owner (NonExcusable Delay), which is caused by the action, and negligence or error of the project owner (Excusable Delay), which is caused by events beyond the control of both the owner and the contractor.

School Building

The word of “school” comes from the Latin language: skhole, scola, scolae or skhola which means: leisure or leisure time. At that time the school is a leisure activity for children in the midst of their main activities, i.e. playing and spending the time to enjoy childhood and adolescence. Activities in leisure time are learning how to count, how to read letters and get to know about moral (character) and aesthetics (art).

However, now the word of “school” has changed its meaning into a building or institution for learning and teaching as well as a place to receive and give lessons. The school is led by a Principal. The principal is assisted by the vice principal. The number of vice principals in each school varies depending on their needs. The school is also an institution designed for teaching students under the supervision of the teacher. Most countries have a mandatory formal education system. In this system, student’s progress is assessed through a series of education in schools.

Construction Process

In general, there are five stages in a construction project, including:

- Stage of planning. A stage in project management that lays the foundation of goals and objectives while preparing all technical and administrative programs to be implemented.
- The design stage. A continuation of planning in the form of regional design, facilities, and infrastructure needed in the implementation of construction. The design phase includes two sub-stages, i.e. Preliminary Design stage and the Development Design stage or Detail Design.
- Procurement / auction stage. The purpose of this stage is to appoint contractors as executors or a number of contractors as sub-contractors who carry out construction in the field. The first thing to be considered at this stage is the prequalification stage. The second stage is a contract document. The contract document itself is defined as a legal document that outlines the duties and responsibilities of the parties involved. The contract document will exist after a cooperation agreement between two parties or more. Before that, there is a procurement process or auction process where an auction document or tender document is needed.
- Implementation stage (construction). It aims to actualize the building that has been designed by the consultant planner within the agreed cost and time limits, and with the quality that has been required.
- The maintenance stage. It aims to ensure that buildings are in accordance with contract documents and all facilities are working properly

III. RESEARCH AND METHODOLOGY

Research

The implementation of the construction project must be timely, functional and effective so that it can be assured that it will benefit the service providers and project owners. Each party will try to minimize project delays by making improvements and making decisions based on the analysis of various factors so as to avoid the risk of delays.

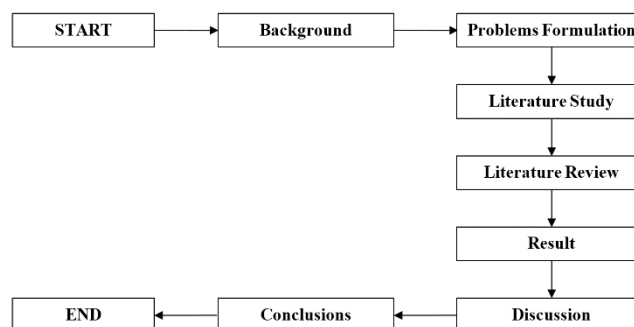


Fig 1: Research Process

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Construction management has a broad scope because it covers the initial stages of work implementation until the end of the implementation in the form of development results. School buildings cannot negotiate with delays because they are related to consumer trust in the school.

Method

This research was conducted on the implementation of school development projects with qualitative methods aimed at obtaining a systematic, static, and accurate description. The initial stage of the background of the existing problem issues was the formulation of the problem based on the facts. After that, risk identification research was carried out by conducting literature studies, reviewing bibliography, and taking risk factors from previous studies. From the results of the data collection, a list of questions was compiled to be considered as the variables factors related to research problems, the questions were arranged in such a way as to make it easier for the expert to answer, the results from the questionnaire were given to experts who were directly involved in the construction of schools. The experts directly involved were the field service provider, architect, and interior designer who were responsible for designing the entire building, as well as the construction project manager during the construction process.

IV. RESULTS AND DISCUSSION

The Construction Process Of Building A School In LubukLinggau, South Sumatra

The case study from this study was SDH LubukLinggau located in South Sumatra, a private school with a national curriculum built in the shopping area in LubukLinggau. This school construction area is ± 2000 m² which is divided into 2 floors. On the 1st floor, there are 3 kindy classrooms, 3 junior classrooms, facility rooms such as computer rooms, libraries, kindy play areas, junior canteens, and health rooms. While on the 2nd floor there are 2 senior classrooms, facilities such as a music room, 2 laboratory rooms, a multipurpose room that functions as a sports area, a senior canteen and a counseling room. In addition, there is room to support the operational process of the school such as the principal's office, vice principal's office, 5 staff rooms on the 1st floor, and a counseling room and meeting rooms on the 2nd floor. The school also provides a lobby area, reception, registration rooms and bookstores on the 1st floor and toilets for men and women on each floor.

Initially, the development planning began in August 2016 and was targeted to be completed in early June 2017. It started with the feasibility study followed by a preliminary picture, the auction process and development permits in that location. The date of school opening was made at the deadline for this school to be completed in the process of building both structural and nonstructural to the placement of all furniture according to needs and functions to be ready to operate. During the implementation process, there were many problems both internally and externally, both directly and indirectly, such as funding problems and payments to contractors, as well as protests by local residents due to the noise generated from the project development.

Factors and Risk Variables For Delays In The Construction Process Of School Buildings

From the results of the discussion regarding the process of building a school in LubukLinggau, 11 factors were able to cause the risk of project delays, i.e. the licensing process risk design process risk, auction process risk and employment contract, labor risk factors, material risk, equipment risk, place characteristic risk, managerial risk, financial risk, risk of relations with government, risk of other factors. These factors were divided into 63 variables as follows:

Table 1: Factor Table

No.	Variabel	No.	Variabel
1.	Public response	11.	Clarity and completeness of documents
2.	Planning maturity	12.	Tender Procedure
3.	Project licensing	13.	Clarity and completeness of tender documents
4.	Type of project	14.	Provisional price estimates from service providers
5.	Project Work Completeness	15.	Implementation schedule
6.	Project Location	16.	The relationship between projects
7.	Topographic type	17.	Payment system

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8.	Estimation of market prices	18.	Labor discipline
9.	Completeness of bidding documents	19.	Work motivation of workers
10.	Workforce expertise	20.	Absence rate
No.	Variabel	No.	Variabel
21.	Availability of labor	43.	Project location
22.	Replacement of new workforce	44.	Project supervision
23.	Communication between the workforce and the supervisory body	45.	Physical characteristics of buildings around the project site
24.	Ethnicity or nationalism or labor culture	46.	Field manager experience
25.	Timeliness of order	47.	Calculation of material needs
26.	Scarcity due to specificity	48.	Changes in design
27.	Material changes to shape, function and specifications	49.	Communication between consultants and contractors
28.	Delivery of materials	50.	Communication between construction and owner
29.	Availability of ingredients	51.	Schedule of delivery of materials and equipment
30.	Quality of ingredients	52.	Work schedules to be completed
31.	Availability of equipment	53.	Preparation / designation of place design
32.	Quality of equipment	54.	Payment by owner
33.	Equipment damage	55.	Price of material
34.	Lack of equipment	56.	Financial availability during implementation
35.	Ability of less skilled foreman / operator	57.	National economic situation
36.	Tool productivity	58.	Obtain government permits
37.	Surface and subsurface conditions	59.	Obtain permission from the workforce
38.	Vision or response of the surrounding environment	60.	Convolutated bureaucracy in project operations
39.	Material / material storage	61.	Rainfall intensity
40.	Access to the project location	62.	Work accident
41.	Work space requirements	63.	Sudden design change from the owner
42.	Quality of job control		

V. CONCLUSION

At the first day of school operations, it turned out that the construction had not been completed 100% so the school construction was declared to have experienced project delays. Influenced by a collection of several work activities that were interrelated with one another, delays in project completion can occur due to the late start of the activity or the extension of the duration of the activity. Delay in an activity will make the overall project delay. The following were the factors that influence the time or schedule of construction implementation in a project : existing facilities, labor relations, work safety, involvement of third parties, project organization model, design errors, project entry, additional work, design changes, project complexity, project duration, standard contract documents, temporary facilities, drawing approval, financial management, material and documentation, project management resources, material damage, commitment to schedules, overhead increases, reporting rules, and a series of activities (Faridi, 2006).

The results of the expert test can be concluded as follows. There were 28 variables and 4 factors that were identified can lead to the risk of delays in the construction process. These variables were public response, planning maturity, project licensing, complexity, project work, project location, type of topography, clarity and completeness of documents, implementation schedule, workforce expertise, labor discipline, absenteeism, labor availability, timeliness of orders, material changes in shape, function and specifications, shipping of materials, availability of materials, availability of equipment, quality of equipment, lack of equipment, physical characteristics of buildings around the project site, quality of job control, calculation of material requirements, design changes, communication between construction and owner, delivery schedule material and equipment, financial availability during implementation,

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complicated bureaucracy in project operations, and sudden design changes from the owner, as well as the dominant factors that affect the project so there was a delay. The dominant factors were licensing risk, design risk, material risk, and managerial risk

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