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Analysis of the Implementation of Bridge Construction Project Risk Management

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ABSTRACT

This study aims to analyze the implementation of risk management for bridge construction projects. This research is constructing a bridge in the Gayungan sub-district, Surabaya. This research uses qualitative research with a descriptive analysis approach. The types of data used in this research are primary and secondary data. The direct data collection technique uses a questionnaire technique regarding risk research to collect two opinions: the opportunities and consequences of risk. The method used is expert sampling, namely determining samples known to have experience or expertise in a field. Meanwhile, secondary data collection uses literature study techniques following the research object. Based on the results of the data and analysis, it can be concluded that the risks identified from the respondents' answers are: 18% unacceptable, 58% not expected, 17% acceptable, and 7% ignored. The handling of risks that are classified as extreme risk and high risk based on the largest source of trouble, namely by contractors with more emphasis on project implementation planning and choosing the correct method according to the situation and field conditions, as well as implementing work safety programs to create safe and safe working conditions minimize accidents in the workplace.

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1. Introduction

The construction project is an industry that is dynamic and has the nature of uncertainty that should be reduced (Yetrina, 2018). Elements of uncertainty risk include cost, time, and quality. These three things are closely related to each other. In short, it can be said that the level of risk is directly related to costs, the length of the project time, and the quality and quality of project management (Maddeppungeng et al., 2017). It all depends on the skills of a project manager in the decision-making process and identifying risks that could potentially occur during the project (Yuliana, 2017).

Risk can be understood as damage in an activity carried out. Many risks occur outside of what was previously planned; these risks can have positive and negative effects, both desired and not, both beneficial and affecting a project's objectives or vice versa (Pertiwi, 2017). Several factors that support uncertainty in construction projects include 1) Planning and design; 2) The existence of pressure from several factors; 3) Resources; and 4) Economic Condition (Enderzon & Soekiman, 2020; Sujono, 2021).

In addition, the risk is also an inseparable part of all activities; the following components characterize risk: 1) A risky event is an event that may provide an advantage or disadvantage to the project; 2) Uncertainty events are an opportunity for an event that may occur and ensure that the event does not pose a risk, both favorable and unfavorable; and 3) Potential gains and losses, is the number of losses and gains involved as a result of the occurrence of an event or a consequence of the occurrence of the event (Nisa et al., 2020).

Among these risks are accidents, the number of work accidents in Indonesia is still relatively high. BPJS Employment in 2019 noted that work accident cases in Indonesia reached 114,235, while in the following year, in 2020, in the January to October period, the figure came 114,235. One hundred

seventeen thousand one hundred sixty-one cases of work accidents. The possibility is great if you see patients that the government has not recorded; therefore, applying a culture of Occupational Health and Safety (Hazriyanti et al., 2020).

This is a risk, an accumulative of the occurrence of various uncertain and often accidental and adverse or adverse events; in other words, the risk is divided into three components, namely: 1) Unwanted change events; 2) The possibility of the incident happening; and 3) The impact of the incident (Labombang, 2011). In general, the uncertainty and risk faced are directly proportional; the higher the anticipation of damage, the higher the threat faced. Therefore, uncertainty and risk must be considered, and risk analysis carried out correctly.

Several previous studies that examined similar things, including the research conducted by Pertiwi et al. (2016), conducted research to produce a project plan to be completed on time. Planning is prepared through WBS, RASIC matrix, Gantt Chart, Critical Path Method (CPM), and Project Crashing.

Furthermore, a study conducted by Wena et al. (2015) uses the FMEA method in analyzing risk factors that arise during the implementation of marine seismic projects carried out off the coast of Alexandria, Egypt, and the Barent Sea of Norway. This research gets concrete results about what happens until the problem or risk factor is resolved to meet the agreed criteria or contract specifications. Suwinardi (2016) also conducted a similar study, which led to a risk analysis, which identified potential failure modes, the effects of each failure mode, the causes of failure modes, and detection methods for 6-inch Double Wheel Castor Assembled products. The FMEA Analysis carried out includes system functions (FMEA System) and the design of assemblies and components (FMEA Design).

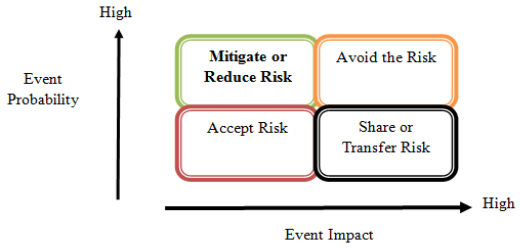

Figure 1. Project Risk management concept
Source: data proceed

The value of the project is highly dependent on clear objectives when the project is prioritized for execution by the company's top management. For this reason, it is necessary to understand the meaning of project management clearly. Project management must pay attention to several knowledge areas, including the following: a) Project Scope Management. Project Scope Management includes ensuring that the project consists of all the work performed and only necessary for the project's success; b) Time Management. Time Management consists of the processes carried out in managing time related to projects, interactions between, and setting the stage of activities; c) Cost management. Cost Management is concerned with estimating, budgeting, and controlling. The cost aspect becomes essential due to changes in interest rates, exchange rates, and changing prices of public goods, such as gasoline and electricity (Maddeppungeng et al., 2017); d) Quality Management. Quality Management is an activation process that considers policies, procedures, and strategies to ensure that project implementation can achieve its goals satisfactorily as expected by consumers; e) Human Resource Management. Human Resource Management is the primary determinant of project success because human resources (HR) are the project implementers from beginning to end. HR projects are done for the benefit of humans in general and the final determinant of the decisions taken; f) Communication Management. Communication Management includes matters related to the collection, distribution, storage, search, disposition of timely and appropriate information (Yuliana, 2017); g) Risk Management. Risk Management includes planning, identification, analysis, response, control requests related to risk; h) Procurement Management. Procurement Management provides the procurement of goods and services, the organization of external teams, and contract arrangements. This is important

because it relates to resources, schedules, and time that must be appropriate; and i) Project Integration Management. Project Integration Management is a process or activity of identifying integrative actions in project planning, development, and control to successfully fulfill customer needs and meet expectations (Anwar et al., 2015; Enderzon, 2020).

As with other activities, to deal with project risks, a golden rule is known which indicates that you should not take risks if: a) The organization concerned is unable to bear it; b) The benefits achieved are smaller than the risks that may arise; c) There are still several alternatives, and d) There is no contingency plan to deal with it. Risks should only be taken when the potential and benefits of success are more significant than the costs required to cover possible failures. About projects, risk can be defined as the cumulative impact of uncertainty that hurts project objectives (Joni & Putu, 2012).

2. Method

This research uses qualitative research with a descriptive analysis approach. The types of data used in this research are primary and secondary data. The direct data collection technique uses a questionnaire technique regarding risk research to collect two opinions: the opportunities and consequences of risk (Lokobal et al., 2014). This research is constructing a bridge in the Gayungan sub-district, Surabaya. The method used to select respondents is the no-probability sampling method, first setting specific goals and plans or having predefined groups and specificities sought. The technique used is expert sampling, namely determining samples known to have experience or expertise in a field. Meanwhile, secondary data collection uses literature study techniques that follow the research object.

3. Result and Discussion

3.1 Risk Analysis

The purpose of risk analysis is to reduce the risk that corrective action is taken on a project, scheduling, budget, project price/quality can be minimized. Risk reduction requires analysis to decide the impact on the project.

Effect of risk = possible risk due to risk

The possibility of natural disasters, such as a) embargo wars; b) Blasting; c) import restrictions; d) Port restrictions; e) Weak mass transportation and mass communication; f) War operations; g) Announced that there are obstacles for carrying out the work; h) Not announced work Assault industrial problems; i) Violating the foreign agreement deed of limitation or fraud on the supply of weapons; j) Civil war; k) Rebellion of infectious diseases that require quarantine; l) Disease outbreak rebellion. Risks should only be taken if the potential and benefits of success are more significant than the costs required to cover possible failures (Nurlaela & Suprapto, 2014). About projects, risk can be defined as the cumulative impact of uncertainty that hurts project objectives.

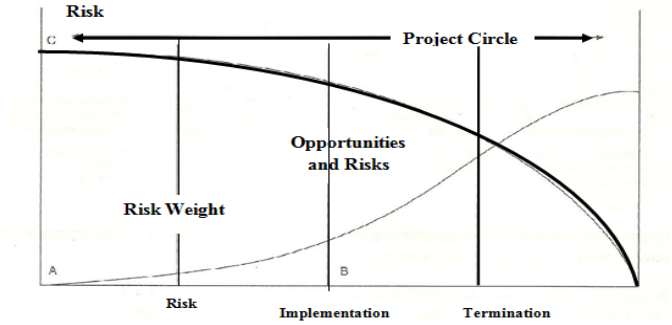

Figure 2. Risk Analysis Curve
Source: data proceed

Based on the analysis of respondents' assessment of implementation risk, it is done by determining the percentage of the frequency of various risks that often occur with answers often, sometimes, rarely, and very rarely. The next stage is to determine the percentage of acceptance with the categories of unacceptable, unexpected, acceptable, and can be ignored. The results of the questionnaire respondents' answers to risk acceptance are presented in the following figure:

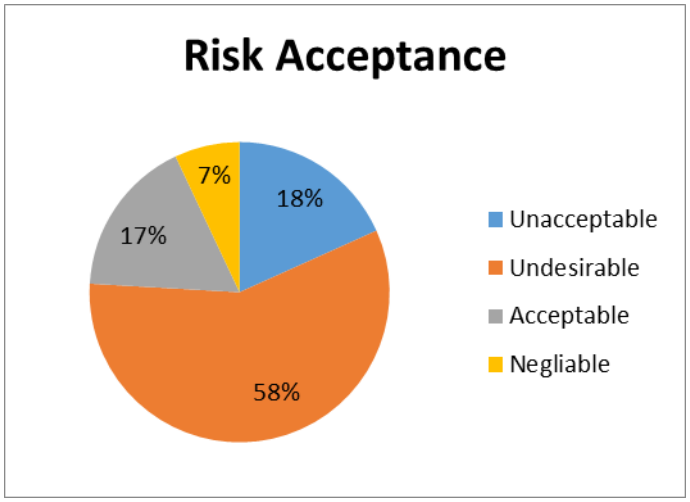

Figure 3. Risk acceptance questionnaire results
Source: data proceed

Based on these results, it can be seen that respondents who answered with an unexpected answer reached 58%, which became the majority answer, followed by an unacceptable answer with a figure going 18% of the total solutions. At the same time, the answer is ignored to be the answer with the lowest number with a percentage of 7% of the complete answers. After knowing the consequences and probabilities of the risk, a risk matrix is formed. This matrix has two axes: the axis for the probability value and the axis for the consequence value.

Based on these two classifications, a risk matrix can be formed, where risks will be divided into four groups: low risk, moderate risk, high risk, and extreme risk. Next is to determine the risk level to show the level of urgency of a threat (Pertiwi, 2017). This risk level is obtained by matching the probability and consequence with the risk matrix. The existing risks can be mapped into a risk map by knowing the current risk level. This risk map shows the location of the risk based on its status (Purwandono & Pujawan, 2010). The risk map is used to evaluate the existing risks. The considered risks are classified as extreme and high risks because they have enormous potential to affect project implementation.

3.2 Risk Mitigation

Risks with two categories, namely high risk and extreme danger, need special attention because various risks will significantly impact the implementation of a project. At this level, different mitigation actions will be identified to choose which steps are needed to minimize the consequences of the risk (Yetrina, 2018).

Based on the research on extreme risks, the most significant threats come from project and technical risks. Thus risk management focuses more on the project implementation planning process or how construction management is applied to achieve project goals or objectives. Civil construction projects have different characteristics from other industrial projects. Namely, they have unique and singular features (Sepang et al., 2013). This condition requires planning and development programs that are different from previous projects. The consequence of this characteristic of civil projects is that it creates the need for a more flexible technique or management to be applied in various projects (Rahmawati & Tenriajeng, 2020). Project management will be successful if all management functions are carried out effectively. This can be achieved by providing the necessary resources to carry out each

part and providing the right conditions to enable each project personnel to carry out their respective duties.

Sources of risk that have a relatively large percentage of the extreme risk and high risk are safety and the environment. The construction development process is generally an activity containing many accident risk elements. The project location is one of the work environments with pretty significant risks. As the responsible party in the field for the duration of the construction process, the project management team must support and implement programs that can guarantee or minimize work accidents or preventive actions. In implementing this work safety program, approaches are needed to make it easier to carry out, especially implementation (Setiawan et al., 2014). The approaches are the behavioral and physical approaches, namely creating and implementing safe working conditions by the project manager and providing education and training on the correct methods and procedures. The proportion of risk recipients is presented in the following figure:

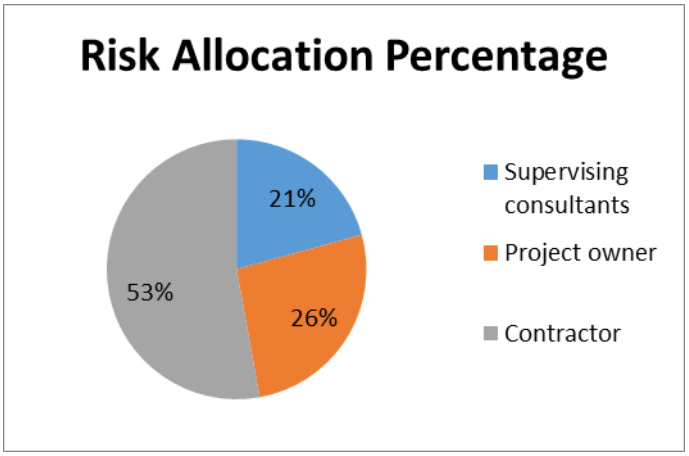

Figure 4. Risk Allocation Percentage
Source: data proceed

At this stage, the ownership of the risks that fall into the high risk and extreme risk categories is allocated to the parties involved in project implementation, namely project owners, consultants, and contractors. So that all these risks are under the control of one party and can be appropriately handled. What needs to be done is to identify trouble that may occur. Risk identification is a system that takes place on an ongoing basis, grouping assumptions about the initial risk in a construction project. In general, in implementing risk management, risk identification is the first stage carried out. At this stage, the sources of risk are classified according to their source and impact on the project or the likelihood of it happening (Soputan et al., 2014).

Risk management is an integral part of the decision-making process in construction companies. The implementation of risk management consists of six stages, namely: a) Risk Management Planning is the determination of the approach, as well as planning in analyzing the risks contained in project activities; b) Risk Identification is a risk determination that provides a possible effect on the project as well as documenting it; c) Qualitative Risk Analyze is risk sharing based on the effect that will occur on the priority objectives of the project; d) Quantitative Risk Analyze is a measurement of the probability and consequences of risks and estimates and applications in the project; e) Risk Response Planning is an improvement of procedures and techniques to increase opportunities and reduce threats to project objectives, and f) Risk Monitoring is the monitoring of identified risks and other possible unidentified risks.

Things that have been identified in risk management should be followed by actions such as a) Ensuring risks related to the construction industry; b) Evaluate things that may go wrong and have an effect on the completion of projects related to finance; c) Identifying uncertainties and develop management procedures to minimize adverse effects; and d) Avoid project failures to control

construction project risk speculation and maintain company credibility (Suparno et al., 2015; Utomo et al., 2019).

The risk analysis and evaluation process follows the following schema: a) Data Gathering. The risk analysis and evaluation process begins with the collection of data pertinent to the risk being analyzed. This data may be derived from past projects or from specialist knowledge; b) Modeling Uncertainty. Uncertainty modeling is the explicit quantification of events and consequences based on existing information about the risks under consideration and c) the assessment of the risk's possible impact. Following the creation of an uncertainty model for the risk, the next stage is to assess the risk's complete impact in a unified global image.

The evaluation of specific risk inputs in a project is contingent upon a) the risk's chance of occurrence, frequency of occurrence, and b) the risk's impact. When assessing project options and the numerous hazards associated with them, a risk index is frequently employed in the following:

Risk Index = Frequency x Impact

The link between frequency or likelihood and impact is used in risk analysis and evaluation to determine whether a situation is an acceptable risk for a project. Following risk identification, the next stage is to investigate potential risks. Risk management strategies are developed in accordance with their sources and consequences. A risk strategy's objective is to remove the chance of adverse consequences while increasing control over the risks that do exist.

In reducing potential financial risk and controlling risk, the most important thing is a combination of solid financial influence and a low level of risk control. This risk can no longer be overcome if the variety that occurs is low economic influence and a low level of control. High then, this risk can be overcome (Wirawan et al., 2015). Overall, there are two approaches to dealing with risk: an approach to avoid danger or reduce the likelihood of a loss occurring, and the second is to take preventive action. Based on the management's response, two steps can be taken, namely:

Risk avoidance is a common and useful strategy in risk management. By avoiding means that losses due to risk do not occur, the possibility of losing opportunities/profits is also the impact of risk. One example is with an exception clause that can avoid certain risks or the consequences caused by hazards; b) Loss reduction and risk prevention; another strategy is to reduce losses and prevent risk in two ways, namely decreasing the possibility of danger and reducing the likelihood of financial losses due to chance. One way to minimize risk is divided into four basic categories, namely: Education and training of employees in dealing with potential threats, Physical protection to reduce losses in the surrounding environment, System to guarantee consistency in reducing risk 4) Physical protection to protect people and property (Wicaksono & Singgih, 2011).

The next step is risk retention. If the risk can be transferred but does not provide economics, the best way is to make arrangements or retention. Risk-retention can be regular or irregular. Stable risk retention is an assumption carried out carefully and carefully on the identified risks. In contrast, unplanned retention can occur in the companies involved, not knowing the existence of risks and assuming the risks unconsciously regarding the losses that occur.

The last step is the risk transfer technique. The transfer of risk is generally carried out by negotiation, even though there is a supporting contract clause, but the general form of risk transfer is insurance.

4. Conclusion

Based on the data and research results, it can be concluded that the risks identified from the respondents' answers are: 18% unacceptable, 58% not expected, 17% acceptable, and 7% ignored. The handling of risks that are classified as extreme risk and high risk based on the largest source of trouble, namely by contractors with more emphasis on project implementation planning and selecting the correct method according to the situation and field conditions, as well as implementing work safety programs to create safe and safe working conditions minimize accidents in the workplace.

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