Risk Analysis Of Component Delays In The H7114 Transko Dara Shipbuilding Project Using The House Of Risk (HOR) Method

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Abstract. Executing the project in accordance with the contract is essential for the success of shipbuilding. The H7114 Transco Dara Ship project is a shipbuilding project ordered by a state-owned company. The H7114 Transco Dara shipbuilding project faces various risks, both small and large, which can cause losses to the company. One of the factors that cause risk is component delay. This research aims to identify the risk of component delays in the H7114 Transco Dara shipbuilding project, as well as design risk mitigation strategies for component delays in the project. The method used in this research is to use the house of risk method. In this study, through the phase 1 house of risk method, 5 risk events and 9 risk agents were found. For the results of the house of risk phase 2 as risk mitigation, 7 proposed mitigation strategies have been found, of the 7 proposed mitigations, 4 mitigation proposals are found to be the most prioritized for the ship project.

Keywords: Risk Analysis, Component Delay,House of Risk.

1 Introduction

The H7114 Transco Dara Ship project is a shipbuilding project ordered by a state-owned enterprise, the steel ship must be built and classified in accordance with the latest classification regulations and in accordance with the customer's request. For unlimited service conditions in tropical waters, special surveys for the hull and machinery must be carried out, and spare equipment must also be provided, for this H7114 Transo Dara shipbuilding process has been carried out by 85%. Based on previous research by Oka Hildawan (2021), it is explained that component delays can occur due to the impact of nature such as natural disasters or environmental disturbances in the region. And the research explained that for risk management analysis related to component delays there is still little research needed in shipbuilding projects, even though the shipbuilding industry is very risky. The materials must be organized as well as possible to reduce risk, ensure quality, cost, and timely availability.

To meet the needs of the company is part of procurement Probowati (2011). On the H7114 Transco Dara Ship at PT Batamec there are problems related to the risk of late components, but in this study will conduct an analysis specifically to analyze the risk of delays in the components of the ship's construction, then the problem of late components that make the ship's project work disrupted and delayed so that researchers conduct this research specifically to analyze these problems and find mitigation strategies for these problems. On this ship, the components to be analyzed are the SRP 340 FP Rudder propeller component, the component comes from Germany and also the diesel engine on the ship.

Fig. 1.SRP 340 FP Rudder Propeller

This research was conducted using the House of Risk (HOR) model, this model is used as a method to minimize risks that may occur and then create a risk strategy to improve company performance. The House of Risk (HOR) method consists of two phases, namely the risk identification phase (first phase) and the risk handling phase (second phase). To determine the main risks that need to be corrected and minimized, the first phase will involve calculating the Aggregate Risk Potential (ARP). Subsequently, the second phase will involve designing containing strategies that are based on the values that have been obtained in the first phase.

2. Literature Review

2.1 Theory Riview

1. Risk Management

Risk management, according to Suseno (2014) means performing management tasks to deal with risks, most notably those faced by families, companies, or communities. Therefore, all the work that includes designing, organizing, coordinating, and monitoring risk mitigation activities, as well as evaluation, must be covered.

2. Risk

Risk is the combination of the probability of an event and the outcome of the event, and does not exclude the possibility that there is more than one outcome of an event. Santosa (2009) states that the impact can be both positive and negative.

3. House of Risk (HOR)

The framework for managing supply chain risk events is the Supply Chain Risk Management Model (HOR), which combines the House of Quality concept and the Failure Modes and Effects Analysis (FMEA) technique. FMEA has the advantage of being able to evaluate reliability by examining failure modes and is a technique for systematically analyzing errors that occur Pujawan and Geraldine (2009). There are 2 stages of the House of Risk Method, namely the HOR phase 1 method and the HOR phase 2 method.

1. HOR phase 1 (Identification Phase)

The first phase of the HOR model links a set of requirements (what)

and a set of responses (how), each indicating one or more requirements. Specifically, the correlation level category consists of the numbers 0,1,3, and 9, each of which has a different meaning, i.e. no correlation is found between low (0), low (1), medium (3), and high (9) values. For the HOR phase 1 formula, namely:

ARPj : Oj $\sum$ Si Rij.

Description :

Oj : Probability of occurrence of risk agent (j)

Si : Magnitude of impact if risk occurs

Rij : Correlation between risk and risk agent

2. HOR phase 2 (Handling Phase)

In HOR phase 2 is the activity to determine the initial activities or actions to handle the risks that occur. The company should choose one action or activity to start with, considering effectively differences such as the involvement of sources and the difficulty of implementation. Similar to HOR phase 1, HOR phase 2 also requires a correlation assessment as an assessment of the relationship between the risk agent and the preventive action. And for HOR 2 is used to determine the first action or activity taken. For the HOR phase 2 formula, namely:

TEk : $\sum$ ARPj Ejk

Description:

ARPj : Aggregate Risk Potential at the th risk agent

Ejk : Correlation value between the th risk agent and the kth mitigation strategy

4. Procurement of Goods

According to Hamzah (1991) goods are “all the assets of an organization, both government and private”. Procurement is a business process in which a company selects resources, makes an order list, and can obtain goods. With time, transactions are not only made against goods but also against services. Procurement can include tangible or intangible goods.

5. Pareto Diagram

The process of stratification and determining levels using existing data is known as a pareto chart. This chart was first formulated by Italian economist Vilfredo Frederigo Samoso in 1897. Pareto depicts a histogram with the concept of important few and trivial many to find the main cause. According to Ramadhani (2014), a pareto chart is a graph that displays data categorized from left to right based on rankings from highest to lowest.

3. Research Methods

3.1 Data Collection Technique

The methods used in this research are as follows:

Observation

For observation, researchers conducted direct observations in the departments related to the component parts of the H7114 Transko Dara ship. For the department that was observed, namely project management to identify the risks that occur and will look for mitigation strategies to prevent these risks from occurring.

Interview

In the interview stage, researchers conducted interviews with departments related to the risks that might occur in component delays as well as looking for mitigation strategies for risks that occur at PT Batamec Shipyard. Interviews were conducted with project management.

Questionnaire

A questionnaire is a tool used in research or studies to collect data or information from respondents. In this study, questionnaires were used when interviewing the department which is useful for knowing data and assessing the risks and risk management that occur in component delays in the H7114 Transco Dara ship project at PT Batemec Shipyard.

Desk Study

The main purpose of a desk study is to gather existing knowledge on a particular topic or subject so that the researcher can understand and explore relevant and up-to-date information on the subject.

3.2 Data Analysis Technique

Data Reduction

Data reduction is a simplification of data that is done by selecting, focusing, and ensuring that raw data is relevant information to facilitate drawing organized conclusions. Researchers do not need to interpret data reduction as quantification. In this research, data reduction will continue until the research is completed in order to obtain raw information and will be managed by researchers.

Data Presentation

For qualitative data, the most common form of data presentation is narrative. Data presentation is a set of data that is well organized and easy to understand. Various matrices, graphs, networks, and charts can be used for better presentation. Researchers can see what is happening with the current component delays at PT Batamec Shipyard with this research.

Inference

The final conclusion must be verified to be truly accountable, not just happen during the data collection process. In this research, the conclusion will be done at the end of the research which contains a brief result of the research that has been done both from the results of the risks obtained and the mitigation strategies that will be carried out to prevent these risks.

Thinking Framework

Starting from the discussion of the risk of component delays by conducting observations, interviews, and filling out questionnaires. Then the researcher will use the House of Risk (HOR) method to identify the risk of problems in the risk of component delays and look for mitigation strategies from the risks that occur. In the HOR phase 1 method using questionnaires as well as HOR phase 2. After using the questionnaire, a pareto diagram is carried out to analyze the priority risks for HOR Phase 1. Then HOR Phase 2 also after using a questionnaire, a pareto diagram is also carried out to find the most important risk mitigation strategy.

4. Result and Discussion

PT Batamec is a company that is one of the largest shipyards in the country, with many supporting facilities and professionally designed infrastructure.Then for the flow of ordering ship components, it will be carried out starting from the CPU which is in charge of preparing schedules and documents for cooperation with suppliers for the required components, then proceed to Project Management which is in charge of preparing the required component data as well as making meeting plans with customers for the components needed for the project. Then Purchasing is in charge of making POs and cost estimates for components to be purchased, followed by the Store which is in charge of preparing component storage and checking components for the project.

4.1 Risk Identification

For risk identification, this is done by observation, interviews and distributing questionnaires to informants who know about the ship which is useful for identifying risks to risk events that may arise from risky events that can occur in connection with the flow of ordering components that occur at PT Batamec Shipyard. The informant is Mr. Sukarman S who is responsible as Project Management of the H7114 Transco Dara ship.

Table 1. Observation Results

Code	Risk Event
E1	Miscommunication between divisions
E2	Component specification request error by customer
E3	Shipments that are behind schedule from suppliers
E4	Delay in making contract documents with suppliers
E5	Delays in component procurement

followed by an interview to find out the risk agent (cause of risk) that makes the risk event (risk agent) occur. The interview was conducted with the informant, Mr. Sukarman S. In the interview, there were 9 risk agents After obtaining risk events and risk agents, the next step is to distribute questionnaires that are used to assess each risk that occurs.

Table 2. Interview Results

Code	*Risk Event*	*Severity*	Code	*Risk Agent*	*Occurance*	Correlation
E1	Miscommunication between divisions	2	A1	Misalignment of direction or communication given by each department head to employees	2	3
			A2	Project meetings that were not attended	3	3
E2	Component specification request error by customer	2	A3	Component specifications that customers change suddenly	4	3
			A4	Incomplete component information data from customers	2	3
E3	Shipments that are behind schedule from suppliers	5	A5	Long component manufacturing	6	3
			A6	External disturbance (weather disturbance)	5	9
E4	Delay in making contract documents with suppliers	4	A7	Delay in agreement of desired contract is not appropriate	5	9
			A8	Employees who work less effectively and disciplined	7	9
E5	Delays in component procurement	5	A9	Old component design specifications	6	3

4.2 Data Processing

After obtaining the risk value from the questionnaire filled in by the informant, it is continued by processing the risk value using the HOR method. House of Risk (HOR) is used to process data in two phases. The first phase of processing is used to identify risk agents or risk sources that must be prioritized to be given solutions by HOR Phase 2.

1. House of Risk Fase 1

The purpose of this calculation is to determine which risks will be prioritized for handling or mitigation.

Table 3. House of Risk Fase 1

Risk Event	***Risk Agent***									
	A1	A2	A3	A4	A5	A6	A7	A8	A9	**Si**
E1	3	3								2
E2			3	3						2
E3					3	9				5
E4							9	9		4
E5									3	5
Oj	2	3	4	2	6	5	5	7	6	
ARP	12	18	24	12	90	225	180	252	90	
Pj	7	6	5	7	4	2	3	1	4	

Risk Evaluation

This part of the risk evaluation is useful to find out the dominant risk agent that will be handled through the ARP calculation that has been done before. For this risk evaluation, it is carried out using a pareto diagram where the data is sorted from left to right based on the highest to lowest order.

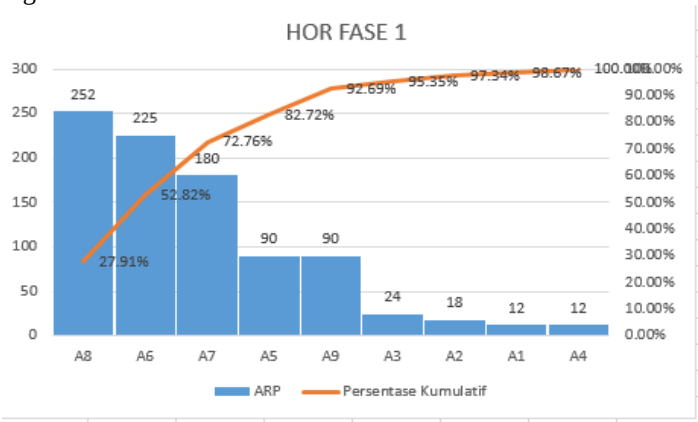

Fig 2. Pareto Diagram HOR Fase 1

Based on the ranking value of the Pareto diagram which contributes 80%, 3 risk agents have been found which will then be analyzed for risk mitigation actions from each selected risk agent. Meanwhile, the other 6 risk agents are not included in the group that requires risk mitigation proposals.

House of Risk Fase 2

HOR phase 2 is used to determine the most effective risk mitigation to minimize the possibility of risk events based on risk agents. This mitigation proposal is obtained from interviews with informants. Based on the results of interviews for mitigation strategies for 3 risk agents that occur.

Table 4 Risk Agent Identification and Preventive Action Results

Rank	**Code RA**	***Risk Agent***	**Code PA**	***Preventive Action***
1	A8	Employees who work less effectively and disciplined	PA1	Supervising employees by supervisors directly
			PA2	Give sanctions to employees who do not follow company work rules and rewards to employees who are diligent and follow company rules.
			PA3	Conduct periodic evaluations of each employee's performance
2	A6	External disturbance (weather disturbance)	PA4	Prioritize the creation of schedules and ordering documents for components that take a long time to make first.
			PA5	Coordinate with suppliers
3	A7	Delay in agreement of desired contract is not appropriate	PA6	Create and pre-draft concise, clear, and legally compliant contractual agreements
			PA7	Ensure that the content of the contract is mutually beneficial between the supplier and the company

After obtaining the proposed mitigation, a questionnaire was distributed to informants to assess the difficulty of implementing the proposed mitigation and the value of the correlation between the mitigation strategy and the dominant risk agent obtained.

From the weighting of the correlation value, the effectiveness of the mitigation strategy will be calculated. Then after getting the total effectiveness value, it is continued by determining the Effectiveness to Difficulty ratio value to determine the effectiveness and difficulty ratio in implementing each mitigation action.

Table 5 HOR Phase 2 Questionnaire Results

Rank	**Code RA**	***Risk Agent***	**Code PA**	***Preventive Action***	***Dk***	***Ejk***
1	A8	Employees who work less effectively and disciplined	PA1	Supervising employees by supervisors directly	3	9
			PA2	Give sanctions to employees who do not follow company work rules and rewards to employees who are diligent and follow company rules.	3	3
			PA3	Conduct periodic evaluations of each employee's performance	4	9
2	A6	External disturbance (weather disturbance)	PA4	Prioritize the creation of schedules and ordering documents for components that take a long time to make first.	4	9
			PA5	Coordinate with suppliers	4	3
3	A7	Delay in agreement of desired contract is not appropriate	PA6	Create and pre-draft concise, clear, and legally compliant contractual agreements	3	3

			PA7	Ensure that the content of the contract is mutually beneficial between the supplier and the company	3	9

Then after getting the results of the total effectiveness and the results of the difficulty ratio, continue to enter all the values obtained into the HOR Phase 2 calculation table as follows:

Table 6 HOR Phase 2 Calculation Results

Risk Agent	**Strategi Penanganan *(Preventive Action)***							**ARP**
	PA1	PA2	PA3	PA4	PA5	PA6	PA7	
A8	9	3	9					252
A6				9	3			225
A7						3	9	180
Total Effectiveness of Action	2268	756	2268	2025	675	540	1620	
Degree of Difficulty Performing Action	3	3	4	4	4	3	3	
Effectiveness to Difficulty Ratio	756	252	567	506,25	168,75	180	540	
Rank Priority	1	5	2	4	7	6	3	

After obtaining the value of HOR phase 2, a pareto diagram calculation is carried out to determine the main mitigation strategy with 80:20, which means that choosing 20% of the mitigation strategy can produce 80% of effective mitigation strategies. The following Figure 4.4 contains the HOR phase 2 pareto diagram from which the 4 most important strategies used to reduce the risks that occur have been found.

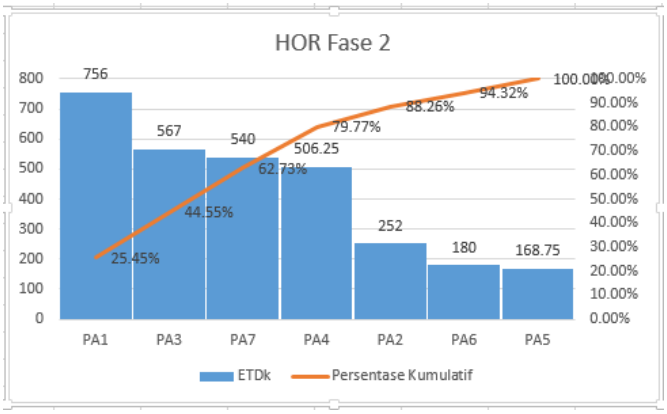

Fig 3. Pareto Diagram HOR Fase 2

Based on the pareto diagram of the proposed mitigation strategies above, the following 4 proposed mitigation strategies are the most prioritized, namely:
1.(PA1) Supervise employees by supervisors directly.
2.(PA3) Conduct periodic evaluations of the performance of each employee
3.(PA7) Ensure the content of the contract is mutually beneficial between the supplier and the company.
4.(PA4) Prioritize the creation of schedules and ordering documents for components whose manufacture requires a long time in advance.

Discussion

Comparison of the results of this study with previous studies Hildawan (2021) is to evaluate the overall results of this study. In previous research there were 14 risk events and 22 risk agents Then for the proposed mitigation strategies in previous research, 14 proposed mitigation strategies were found and the most prioritized one is (PA1) Prioritizing the planning schedule for purchasing imported materials and components first. Whereas in this study, 5 risk events and 9 risk agents have been found, for the results of the highest risk agent, namely (A8) Employees who work less effectively and disciplined, (A6) External disturbances (weather disturbances), and (A7) Delays in the desired contract agreement are not in accordance with the causes of the risk of component delays. Then for the proposed risk mitigation strategy, there are 7 proposed mitigation strategies and the most prioritized are 4, namely (PA1) Supervising employees by supervisors directly, (PA3) Conducting regular evaluations of the performance of each employee, (PA7) Ensuring the contents of the contract are mutually beneficial between suppliers and companies, and (PA4) Prioritizing the preparation of schedules and component ordering documents whose production takes a long time first. For the similarities, both use the house of risk method to find the risks that occur and propose mitigation strategies for the risks that occur.

5. Conclusion & Suggestion

5.1 Conclusion

Based on the results of the analysis and data processing that has been done, it can be concluded that the risk of component delays that have been identified on the H7114 Transco Dara Ship at PT Batamec Shipyard results in 5 risk events and 9 risk triggers (risk agents). At the HOR Phase 1 analysis stage based on the highest ARP is A8 Employees who work less effectively and disciplined, (A6) The existence of outside interference (weather disturbances), and (A7) Delay in the desired contract agreement is not in accordance with the contract. For the proposed mitigation strategy that can be carried out at PT Batamec Shipyard to reduce the risk of component delays on ships, namely based on the 3 risk agents that have been identified as many as 7 proposed mitigation strategies that have been found, then of the 7 proposed strategies by considering the effectiveness of mitigation actions in their implementation, 4 proposed mitigation strategies are found to be the most prioritized from the Pareto diagram, namely (PA1) Supervising employees by supervisors directly. (PA3) Conduct periodic evaluations of the performance of each employee. (PA7) Ensure the contents of the contract are mutually beneficial between the supplier and the company. (PA4) Prioritize the creation of schedules and ordering documents for components whose manufacture takes a long time first.

5.2 Suggestion

For companies need to make improvements and updates carefully for the 3 highest risk agents, namely (A8) Employees who work less effectively and disciplined, for mitigation strategies, namely according to Sintaasih and Wiratama (2013) management is also tasked with encouraging employee awareness to comply with all applicable regulations in the company such as HR may further increase employee checks according to performance evaluations and if performance is not carried out with company regulations, sanctions can be imposed in accordance with applicable regulations, then for (A6) The existence of external disturbances (weather disturbances), for strategies that can be carried out, namely coordinating with suppliers for components to be ordered for a long time or not. Then for (A7) Delay in the desired contract agreement is not appropriate, for the strategy carried out, namely making a prior meeting to determine the contents of the contract to benefit 2 parties.

Suggestions for future research are to use the House of Risk method to identify risks and internal risk mitigation strategies. In addition, future research is also expected to consider using other methods such as Fault Tree Analysis (FTA) and Event Tree Analysis (ETA), which can help in analyzing the risks that occur.

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