OPERATIONAL RISK ASSESSMENT SHIP CONSTRUCTION CAUSES MATERIAL IMPORT USING HOUSE OF RISK (HOR) and CRITICAL CHAIN PROJECT MANAGEMENT: CASE STUDY IN GRESIK SHIPYARD INDUSTRY

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ABSTRACT

This research is aimed to conduct risks assessment of ship building process in the part of materials procurement especially imported materials. The problem in Gresik shipyard industry is late material import, which impact the project delay. This research used House of Risk (HOR) combination and Critical Chain Project Management (CCPM) method analysis. Data analysis was obtained from data sample on new construction work of 2 x 1200 HP tug-boat at the Gresik Shipyard. The data used was related with materials procurement especially imported materials. The analysis used House of Risk (HOR) method and obtained 14 risk events which occurred in planning process and imported components for tug-boat 2x1200HP construction and 22 events as risk agent. There were 14 highest risks needing risk mitigation to reduce the impact. Rescheduling result of the material arrival and imported component used Critical Chain Project Management (CCPM) method. It was able to save time duration from activities schedule of 50%; previous schedule was 84 days become 42 days.

Keyword: Imported material, risk mitigation, project management, risk agent, risk assessment

Introduction

The shipbuilding industry is an industry with specific characteristics and complex business environment and it is one of industries with high risk and needs careful management (Basuki et al, 2012). Generally, ship builders need such a long time to build a ship in the national shipyard, so they got difficulty to compete with other shipyards. There are four internal strategic factors to the process of shipyard in management, in new shipbuilding activities. Those four internal strategic factors are shipyard management, technology process, product performance (quality and delivery time), and price offer. Meanwhile, there are four strategies for external side, namely interim supply (quality and material specifications), shipbuilding order, global barriers, and policies in maritime sectors. These factors greatly influence the advantage competitive and sustainability of national shipbuilding industrials. The problems had an important effect to the financial risk of shipbuilding companies especially product performance factor and Interim Supply.

In a new shipbuilding process, completing of ship construction of the time agreed in the contract was really important (Cahyani and Pribadi 2016). There are a lot of factors influenced and caused delay of new shipbuilding projects. One of the factors which can delay in ship completing delay is ship materials delay, especially imported materials. Shipyard industry must anticipate the existence of imported materials. It needed an application of risk analysis and risk assessment in order to delay anticipate in project completion (Basuki et al. 2012). It needed to be conducted because risk management analysis and risk assessment in a process of ship building is still few. Because of this reason, it needed risk management analysis related with materials and main components delay. Although shipbuilding process has high risk, risk management application in various cases of shipbuilding production process is still limited (Basuki and Wijaya, 2008; Basuki and

Setyoko, 2009; Basuki and Choirunisa, 2012; Basuki et al. 2014).

Basically, qualitative and quantitate risk analysis in risk management is a process of impact assessment and identified risk possibility. This process is carried out by risk arranging based on the impact on project objectives. Basuki and Setyoko (2009), Basuki and Choirunisa (2012), Basuki et al. (2014), Basuki and Putra (2014), Asdi and Basuki (2021) stated that quantitative risk analysis was the numeric probability of analysis process from each risk and its consequence on project objectives. This analysis is usually followed by qualitative analysis and depended on the availability of costs, time, and performance of the company conducting the project.

Critical Chain Project Management (CCPM) is a scheduling project focusing on completing critical chain project in a time and buffer time was the way to change safety time to buffer time. Buffer time consists of feeding buffer and buffer project. Feeding buffer is buffer time connecting non-critical chain activities with critical chain activities. In addition, buffer feeding function is a spare time for delay of non-critical chain activities. Buffer project was a buffer time where was located in the end of critical chain in a project as a spare time to all projects. Both buffer time would ensure critical chain and integrity of project schedule as a whole (Aulady and Orleans, 2016). The research's aim using HOR and CCPM method was to reduce the risk of materials and components delay in a shipbuilding project, so costs, schedules, performances, and qualities are accordance with those sets by the parties involved in the projects.

The process of risk mitigation in materials and main ship components procurement used House of Risk (HOR) method to new shipbuilding project. Risk mitigation was used to rescheduling process by using CCPM method and it allocated in the resources to support accelerate rescheduling, project completing time, reduce costs, and improve company performance.

Methodology

This research was conducted on September to December 2020 on one of shipyards in Gresik. Focusing of this study was assessing the risks delay in materials procurement, especially imported materials in a new shipbuilding project. The research design had several stages; 1) the research objective was the construction of new tug boat 2 x 1200 HP, especially in the materials section, 2) data collection was carried out with primary and secondary data, namely the data from the shipyard, 3) data analysis was conducted with HoR and CCPM methods to determine risk assessment and risk mitigation. Risk analysis stage was used HOR method in phase I. The stage of risk management used HOR in phase II and CCPM method.

Result and Discussion

Risk Identification

Table 1. Risk Events

Risk Code	Risk Events
Risk Plan of Materials and Components Scheduling Process	
(Unit of Management Project)	
E1	Request error in materials and components purchase
E2	The specification of changing request from the owner
E3	Bad coordination between the units involved
E4	The request schedule changing from the owner
E5	Materials and Components arrival licensing process
The Risk of Materials and Component Procurement Process	
Logistic Unit	
E6	The tardiness of materials and components delivery
E7	Misinformation of materials and components specifications
E8	Incorrect supplier selection
E9	Limited availability of materials and components
E10	Incompatible quantity of materials and components
The Risk of Materials and Components Purchasing Process	
Accounting Unit	
E11	Increasing of materials and components price
E12	Lack of funds for materials and components need
E13	Losing of supplier confidence in the company's financial capability
E14	Cost estimating errors in materials and components

Table 2. Risk Agents

Risk Code	Risk Agent
Risk Plan of Materials and Components Scheduling Process	
(Unit of Management Project)	
A1	Agreed contract didn't state clearlymaterials and components type
A2	Unclear and incomplete materials and components data
A3	The supplied doesn't understand data specification of materials andcomponents
A4	Lack of supervision from leadership
A5	Lack of Human resources
A6	Negligent labor (Human Error)
A7	Prioritize more urgent job
A8	Human resources are less competent
A9	There is a pandemic, a natural disaster inthe region
The Risk of Materials and Component	
Procurement Process	
Logistic Unit	
A10	Incorrect supplier selection
A11	The lateness of issuance purchase order (PO)
A12	Materials and components were not available in a supplier
A13	Same spare parts were not available in the market
A14	Administration completion was taking a long time
A15	Long duration of purchase negotiations
A16	Procedure errors
A17	There was no supervision from the supplier
A18	The information data of purchasing order was error
The Risk of Materials and Components PurchasingProcess	
Accounting Unit	
A19	Increasing in exchange rate to the Rupiah against foreign currencies
A20	Over budget against the initial budget plan
A21	Bad company track record in supplier payments
A22	Inaccurate budget estimations

Table 3. Criteria of Severity Scale

Impact			
Score	**Rank**	**Financial**	**Schedule**
5	Very high	The financial loss was more than 300 million Rupiah	Delay was more than 3 months
4	High	The financial loss was around 200-300 million Rupiah	Delay was around 2 to 3 months
3	Medium	The financial loss was around 100-200 million Rupiah	Delay was around 1 to 2 months
2	Low	The financial loss was around 50-100 million Rupiah	Delay was around 0.5 to 1 months
1	Very Low	The financial loss was less than 50 million Rupiah	Delay was less than a half of a month

Table 4. Criteria of Occurrence Scale

Score	Possibility	Description	Frequency
5	Almost certainly/often	The event was predicted to happen	The frequency was more than 5 times in a year
4	Most likely/ has happened before	The event might happen	The frequency was around 3-5 times in a year
3	Maybe/able to happen	The event might be happened at some times	The frequency was around 1-2 times in a year
2	Rarely	It could happen but it is not expected	The frequency was not more than a time in 2 years
1	Very rarely	It was happened only in certain situation	The frequency was not more than a time in five years

The result of risk event identification was obtained 14 risk events of materials and import components delay in tug-boat 2 x 1200 Hp construction project as shown in Tables 1 and 2 was the risk agent.

Risk analysis with the Aggregate Risk Potential (ARP) value was used as a basic material for mitigating action to the risk agent.

Furthermore, the researchers would rank to determine mitigation actions priority on HOR. The result of ARP calculating used severity and occurrence criteria such as Tables 3 and 4.

Mitigation risk from event and agent risks which were measured to the risk rank was presented in Table 5.

Table 5. Recapitulation of Priorities for Preventive Action Selection

Rank	PA Code	Preventive Action
1	PA1	Prioritize the planning schedule for materials and imported components purchase compared with other materials purchase
2	PA2	Assign experienced humanresources
3	PA8	Provide punishment for workerswho did not working according to standard operational
4	PA5	Conducting briefing and coordination with the supplier
5	PA3	Conducting spare budget formaterials and imported components in initial budget estimate
6	PA11	Choose suppliers offering cheaper price with good quality
7	PA9	Verify the owner
8	PA14	Make evaluation/ budget monitoring for each month
9	PA12	Improve employees' skills and competencies
10	PA4	Cross subsidies for other budgets
11	PA6	Looking for comparison suppliers who did more professional and competent
12	PA7	Making Standard operational for checking employees' jobs before the leadership checked employees' jobs.
13	PA10	Conduct a survey to several right supplier before the company purchased the materials
14	PA13	Employees displace to another division according to their expertise field

Conclusion

The result of risk event identifications obtained 14 risk events occurred the process of material planning and imported components on Tug Boat 2 x 1200 HP construction. The result of risk agent identification obtained 22 risk events occurred in a process of materials and imported components planning on Tug Boat 2 x 1200 HP construction. Risk management result used House of Risk (HOR) and it obtained 14 priorities of preventive actions to the risk agent on a process of materials and imported components delay in tug-boat 2 x 1200 HP construction project. The reschedule result of materials and imported components in tug-boat 2 x 1200 HP construction which used Critical Chain Project Management (CCPM) method was reduction amount of the activities schedule duration about 50% from the initial activities schedule. Old schedule was 84 days and new schedule was 42 days after the researchers used CCPM method. To solve reducing schedule problems, the schedule was replaced by additional buffer at the end of each activity. The buffer function was as a buffer time from the end of each activity process. CCPM method could maximize time which have been used as safety time and it could help speed up the process of materials and imported components arrival.

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