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Supply Chain Risk Management of Production in PT Pindad (Persero)

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Abstract: *Supply chain of production Panser Anoa 6x6 at PT Pindad (Persero) is a risk in every business process. The purpose of this study is to analyze and assess risk in the supply chain process of production Panser Anoa 6x6 and seek alternative risk mitigation alternatives prioritized. The purpose of this study is to analyze risks in the supply chain process of Panser Anoa 6x6 production and to rank the risks that were prioritized first. The approach used in this research is quasi-qualitative approach. The data and information obtained are mapped using the Supply Chain Operation Reference (SCOR) model and analyzed using the House of Risk (HOR) model. In addition, the authors use the Pareto 80-20 principle to sort out the identified risk events and causes of risk. The total risks identified in this research were 15 risk events and 36 risk agents. The results of data processing are 4 significant causes of risk with a cumulative percentage of 23,84%. There are 8 mitigation strategies that can be used.*

Keywords: *Supply chain; risk; SCOR; HOR;*

I. Introduction

PT Pindad (Persero) is an industrial and manufacturing company in Indonesian engaged in the manufacture of military and commercial products, namely weapons, munitions, combat vehicles, explosives, and so on. The special vehicle division is one of the divisions of PT Pindad (Persero) which produces combat vehicles both chain-wheeled fighting vehicles (Tanks) and tire wheel fighting vehicles (Panser). Products that have been produced in the special vehicle division of PT Pindad (Persero) are Anoa, Komodo, Water Canon, Harimau Medium Tank, Badak, and Sanca. Panser Anoa is one of the superior products in the special vehicle division of PT Pindad (Persero). In 2018, Panser Anoa contributed the largest amount of production of the Special Vehicle Division by 64.44% [1]. In the production activities of Panser Anoa at PT Pindad (Persero), based on orders (make to order) from the Ministry of Defense of the Republic of Indonesia. PT Pindad (Persero) also implements a zero stock inventory policy, which is the inventory ordered following the number of products to be made, so that the number and time of arrival of raw materials must be following the scheduled. Sometimes there is an inaccuracy of the allocation of time and raw material needs that result in disruption of the production process so that the production target and the number of deliveries of Panser Anoa to the Ministry of Defense as the main customer of PT Pindad (Persero) is less than the specified amount or late to get a penalty [2].

The process of supply chain production does not rule out the possibility of other risks that can affect the flow of the supply chain. Some of the risks that may occur in the supply chain of Panser Anoa production include a shortage of raw materials/components, supplier failure, increasing prices of raw materials/components, inoperative production facilities,

uncertain demand, change of order, and transportation failure. Potential events of these risks can occur, and if they occur, it will certainly have an impact on the performance of the company's supply chain management [3]. Solutions address risk problems in production supply chain processes that can affect supply chain flows with appropriate and appropriate risk management. Supply chain risk management, i.e. identifying and managing risks through a coordinated approach among supply chain members to reduce overall supply chain vulnerabilities[4]. Risk management of PT Pindad (Persero) is carried out in a coordinated and integrated manner. Referring to the results of monitoring corporate risks per the year 2019, it can be concluded that risk control efforts carried out by PT Pindad (Persero) must still be more effective to be able to reduce the impact and possibility of risk, where it still appears to be the achievement of company targets that are still far from the Company's targets or targets[5].

Based on this, research on the analysis of the implementation of risk management in the supply chain is very interesting and needs to be studied given the complexity of the production supply chain process and the development of risks or uncertainties that can occur. In this study, the scope and scope of his research, namely panser anoa supply chain risk management at PT Pindad (Persero) was associated with the production part of Panser Anoa 6x6. First for the identification of the supply chain process panser Anoa 6x6 using the Supply Chain Operation Reference (SCOR) model. Second, to identify risk analysis that occurs in the production supply chain process using the House of Risk (HOR) model. So that risk mitigation efforts are obtained in the supply chain process of Panser Anoa 6x6 production.

II. Literature Review

2.1. Supply Chain Management

The definition of a supply chain is a complex network, consisting of various processes such as order process, purchase, inventory control, manufacturing, and distribution [6]. According to Turban, there are 3 types of supply chain components, namely, upstream supply chain, internal supply chain management, and downstream supply chain. Supply chain management is a form of coordination between a company and another company that aims to improve performance between companies to create something unity of performance. The purpose of implementing supply chain management consists of several things such as reducing budgets and increasing revenue to increase profits and increase asset utilization, and increasing customer satisfaction through the fulfillment of products and services [7]. These things, make the company have an advantage in competing.

2.2. Risk Management

Risk and uncertainty are one but have differences. Differences in risk and uncertainty are seen in the parameters and possibilities that will take place on a certainty. Risk is a state in which parameters and possibilities are known, whereas uncertainty is a state in which the parameters may be known and the possibilities are unknown[8]. According to Goh, risks in the supply chain consist of two types, namely risks arising in the internal supply chain and risks derived from the external environment of the supply chain [9]. According to Peck, supply chain risk becomes three, namely [10] internal risk of the company, external risk of the company, external risk of the supply chain.The source of risk or the cause of risk (risk agent) is a factor that affects the performance of a business process. Most risk management approaches tend to be similar, consisting of three stages: risk identification, risk estimation, and risk evaluation [11].

2.3. Supply Chain Risk Management

Supply chain risk management is a combination of supply chain management and risk management. Supply chain disruptions are unplanned events or disruptions that can affect the flow of materials and components in a supply chain [12]. The goal of supply chain risk management is to ensure that the supply chain continues as designed, and the flow of goods from the initial supplier to the end customer is uninterrupted [8]. Under different circumstances, supply chain risk management can prevent risk events accept upcoming risks, and normalize supply chain performance as soon as possible. The following 3 steps of risk management in the global supply chain are risk identification, risk assessment/priority, and risk mitigation[13]. Mitigation is an effort or action to reduce or minimize the impact of risk. Mitigation includes 4 responses, namely risk avoidance, risk reduction, risk transfer, and risk retention [14].

2.4. Supply Chain Operations Reference (SCOR) Model

Supply Chain Operation Reference (SCOR) is an approach to knowing the performance of the supply chain. The SCOR model is a process framework that can improve the effectiveness of supply chain management and the efficiency of supply chain improvement. So that the SCOR model can be used in various contexts to define, design, and reconfigure various types of business activities in the company. This SCOR model focuses on 5 supply chain processes, namely, plan, source, make, deliver, and return [15].

2.5. House of Risk (HOR) Model

House of Risk (HOR) is a development of the Failure Mode and Effect Analysis (FMEA) method and the Quality Function Deployment (QFD) method developed by I Nyoman Pujawan and Laudine H. Greladine [15]. The HOR model consists of two parts, namely the risk identification phase and the risk mitigation phase. Preventive measures against risks that may occur in the supply chain network are the objective of the development of this HOR model. Minimizing the risk of a risk agent will reduce the possibility of a risk event. In their research, Geraldine and Pujawan

[15]mengemukakan bahwa House of Risk terdiri dari HOR fase 1 dan HOR fase 2. House of Risk consists of HOR phase 1 and HOR phase 2. HOR phase 1 plays a role in determining which risk agents are the priority for prevention. As for HOR phase 2 plays a role in determining effective steps for these priorities taking into account financial circumstances and the availability of appropriate resources.

III. Research Methodology

This study uses a quasi-qualitative approach. First, do the identification stage, where direct observation is carried out to identify the problems at the research site. The problems that have been identified further formulate the problem and set research objectives. Then literature studies and field studies are conducted to support research so that research runs well and correctly. The second phase is data collection, which consists of mapping the supply chain of Panser Anoa 6x6 production and identification of risk events and risk agents. Panser Anoa 6x6 supply chain mapping is obtained by observation, interview, and library study. After that, the supply chain production process of Panser Anoa 6x6 is mapped in the SCOR (Supply Chain Operations Reference) model to classify supply chain activity. While the identification of risk events and risk agents is identified based on supply chain activities that have been classified by brainstorming.The next stage is the data processing stage, including risk analysis that determines the severity of the risk event and the occurrence of the risk agent which is then mapped in the house of risk (HOR) model. In the model, risk events and

risk agents are assessed as correlations, with the final result being the aggregate risk priority (ARP) value. From these results, it is then summarized using the 80/20 principle of the Pareto diagram to produce selected risk agents. The fourth stage is data analysis. This analysis is a descriptive description of the selected risk agent from the HOR model and designing a proactive handling strategy or action that can be applied at PT Pindad (Persero) to reduce the occurrence of selected risk agents.

IV. Result and Discussion

The result of the research that has been done at the beginning is mapping supply chain activities using the SCOR model, this mapping process is done by brainstorming. Referring to the model, the description of Panser Anoa 6x6 supply chain production activity is shown in table 1. The results of the mapping process with the SCOR model in table 1, further identify risk events and risk agents. Then conducted an interview determine the assessment with the company to adjust the category of impact level (severity) and the level of appearance (occurrence) with the conditions in the company. This is done so that the results of the questionnaire are made, following with the actual conditions at PT Pindad (Persero). While the results of the identification of risk events and risk agents can be seen in Tables 2 and 3.

Table 1. Mapping the supply chain activity of Panser Anoa 6x6 production on the SCOR model

Plan	1.	List of materials
	2.	Checking material stock
	3.	Validate vehicle design
	4.	Production scheduling
	5.	Personnel planning
	6.	Cost planning
Source	1.	Receipt and storage of materials
	2.	Production system
	3.	Human Resources
	4.	Equipment

Make	1.	Fabrication
	2.	Assembly
	3.	Painting
Deliver	1.	Distribution of materials/products
Return	1.	Quality assurance monitor

Source: Author`s illustration

Table 2. Risk events

Ei	Risk Events
E1	Material risk
E2	Administrative risks
E3	Risks of investment realization are not on time
E4	HPP risk (cost of product)
E5	Risks of material storage
E6	Equipment risk
E7	Risk of exposure to covid
E8	Risk of unused production capacity (idle capacity)
E9	Risks of rework
E10	Risk of production overload
E11	Risk of process delay
E12	Risk of work accidents
E13	Risks of environmental pollution
E14	Risk of late delivery
E15	Risk of rejecting products

Source: Author`s illustration

Table 3. Risk agents

Ai	Risk Agents
A1	The impact of covid 19 outbreaks causes the inhibition of the procurement process
A2	An increase in the foreign exchange rate causes changes in the price of materials or components
A3	Lack of thoroughness of the input process so that it is not following the conditions in the field
A4	Investing requires time and special study
A5	Changes in funding priorities
A6	Changes in material specifications and components outside of planning
A7	Cost absorption control is less than optimal
A8	Material lost
A9	Damaged components/materials
A10	Scattered material
A11	The age of the machine is old
A12	Machine spare parts are difficult to find on the market
A13	Disobedient prokes 5M
A14	There is no contract/PO/SO
A15	Some contracts withdraw or cancel
A16	Validation of immature engineering images
A17	The material entered does not match the specifications
A18	Material quality is not appropriate

A19	Employment contracts that exceed production capacity
A20	Demand for changes in product specifications from consumers while production is underway
A21	There was an unexpected malfunction to the engine on one of the production lines
A22	Limitations of ability and production capacity
A23	Delay in the testing process
A24	Engine factor damage
A25	Delay in the engineering process
A26	Worked not according to procedure
A27	The work environment does not comply with the 5R principle
A28	Fatigue at work
A29	The sound of the engine coming out of the machine
A30	Waste production (water and air)
A31	Lack of awareness from stakeholders related to the environment (K3LH function)
A32	Production schedule backdated
A33	Lack of understanding and examination of the suitability of the product with the image in any process by the quality function
A34	Image data and specifications are incomplete
A35	Design/image work time along with production time
A36	Formal feedback (GO/NO GO label or report) of quality functions for each production process has not been optimal

Source: Author`s illustration

After identification is done, then do an assessof the severity and the assessment of occurrence with each scale of 1-10[16]. After that, a relationship assessment is carried out, which is the relationship between risk events and risk agents based on values 0, 1, 3, and 9. Furthermore, calculation of aggregate risk potential (ARP) values is carried out to determine the priority of the risk agent that needs to be handled first and provide preventive measures against the risk agent. The value of ARP is obtained through the formula along with the example of the calculation, then all results can be seen as follows table 4:

$$ARPj = O \times \Sigma Si \times Rij$$

$$ARP1 = O1 \times \Sigma S1 \times R1$$

$$ARP1 = 6{,}8 \times ((9 \times 5{,}8) + (5{,}4 \times 4{,}4) + (9 \times 5{,}4)\ ) + (9 \times 5{,}2) + (1{,}8 \times 5{,}6) \ \ +(9 \times 5{,}6) + (9 \times 5{,}8))$$

$$ARP1 = 1931{,}5$$

Information

ARP : aggregate risk potential

Si : severity

Oi : occurrence

Rij : relationship

Table 4. Risk Agent Rank based on ARP Value

Rank	Code Risk Agents	ARP	Cumulative Percentage
1	A1	1931,5	8,27
2	A20	1290	13,80
3	A11	1211	18,99
4	A6	1133,1	23,84
5	A22	1080,4	28,47
6	A9	992,45	32,72
7	A24	962,69	36,84
8	A36	925,99	40,81
9	A25	918,96	44,74
10	A19	882,34	48,52
11	A35	817,65	52,02
12	A33	737,44	55,18
13	A23	708,22	58,22
14	A34	708	61,25
15	A18	706,19	64,27
16	A21	659,98	67,10
17	A12	644,03	69,86
18	A17	613,89	72,49
19	A8	588,5	75,01
20	A16	578,24	77,49
21	A15	556,27	79,87
22	A3	508,16	82,04
23	A32	483,55	84,12
24	A5	457,25	86,07
25	A14	452,05	88,01
26	A2	442,93	89,91
27	A10	365,71	91,47
28	A26	362,45	93,03
29	A7	341,09	94,49
30	A27	321,66	95,87
31	A4	241,59	96,90
32	A28	173,31	97,64
33	A30	173,04	98,38
34	A31	160,56	99,07
35	A29	122,69	99,60
36	A13	94,08	100,00

Source: Author`s illustration

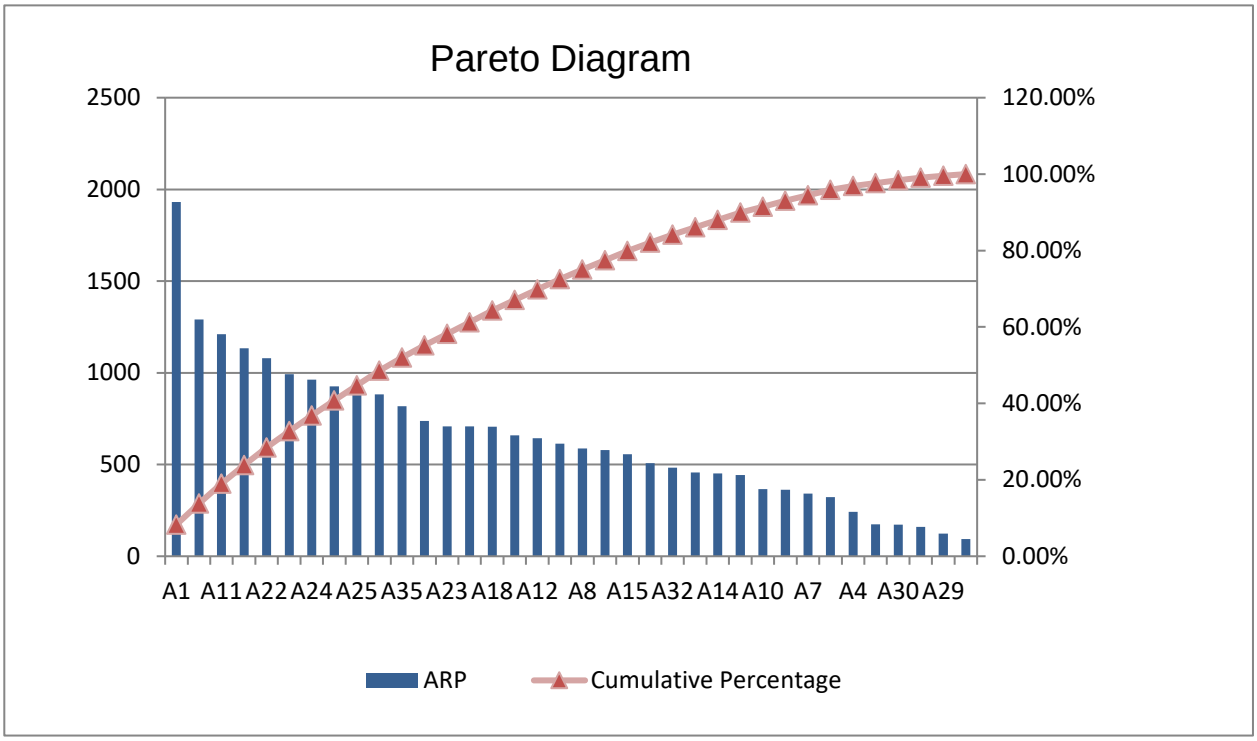

Figure 1. Pareto diagram of risk agents
Source: Author`s illustration

Based on the calculation of Aggregate Risk Potential in HOR, a Pareto Diagram was created to find out the risk agent that affects causing risk to the system. Following the principle of Pareto Diagram 80-20, the priority of the problem to be solved is a problem with a percentage of up to 20% and can be seen in Table 5.

Table 5. Priority Risk Agent Based on Pareto Diagram

Ai	Risk Agents	ARP
A1	Pandemic covid 19 causes hampered procurement process	1931,5
A20	Demand for changes in product specifications from consumers while production is underway	1290
A11	The age of the machine is old	1211
A6	Changes in material specifications and components outside of planning	1133,1

Source: Author`s illustration

After looking at the Pareto diagram that the selected risk is on pandemic covid 19 causes hampered procurement process (A1), demand for changes in product specifications from consumers while production is underway (A20), the age of the machine is old (A11), and changes in material specifications and components outside the planning (A6). Here is table 6 which will display mitigation strategies following the selected risk agent.

Table. 6. Mitigation Strategy Planning

N0	Code	Risk Agents	Code	Mitigation
1	A1	Pandemic covid 19 causes hampered procurement process	PA1	Develop a procurement process strategy adapted to the covid 19 pandemic
2			PA2	Strengthening internal controls for the procurement process
3	A20	Demand for changes in product specifications from consumers while production is underway	PA3	Build effective communication with consumers regarding product specifications
4			PA4	Make a commitment with the consumer
5	A11	The age of the machine is old	PA5	Evaluate the use of an old machine
6			PA6	Replace with a more sophisticated machine
7	A6	Changes in material specifications and components outside of planning	PA7	Perform regular checks of material and component specifications
8			PA8	Coordinate effectively regarding material and component specifications

Source: Author`s illustration

V. Conclusion

Based on the results of the study, the risk event identified has the opportunity to arise in the supply chain of production of PT Pindad (Persero) which is 15 risks and risk agents identified as many as 36 which is then prioritized based on the ARP value of 4 risk agents, namely pandemic covid 19 causes hampered procurement process (A1), demand for changes in product specifications from consumers while production is underway (A20), the age of the machine is old (A11), and changes in material specifications and components outside the planning (A6). Furthermore, to reduce the impact of risks that occur in the company, where 8 mitigation strategies that can be used to eliminate or reduce the emergence of risk agents, namely develop a procurement process strategy adapted to the covid 19 pandemic (PA1), strengthening internal controls for the procurement process (PA2), build effective communication with consumers regarding product specifications (PA3), make a commitment with the consumer (PA4), evaluate the use of an old machine (PA5), replace with a more sophisticated machine (PA6), perform regular checks of material and component specifications (PA7), coordinate effectively regarding material and component specifications (PA8).

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