

Risk Analysis of Supply Chain of SS2 Weapon Raw Materials Procurement at PT Pindad (Persero)

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Abstract: *This study uses a quasi-qualitative approach. The supply chain in the SS2 weapon raw material procurement process is essential in SS2 weapon production activities. Failure to manage the procurement process will hurt production activities. This impact is caused by the risks that arise from the lack of supervision in collecting the raw material procurement process. The purpose of this study is to identify and analyze the risks that occur in the supply chain for the procurement of raw material for SS2 weapons at PT Pindad (Persero) and identify risk mitigation by proposing preventive actions in dealing with risks. The method used is the House of Risk (HOR) and the Pareto 80:20 principle to identify risks and determine the priority risk agents who will be given risk management. The real risks identified in this study were 17 risk events and 27 risk agents. Based on the data processing results, six priority risk agents have the highest ARP value, namely the total cumulative ARP percentage of 49.43%. The handling of these risk agents is carried out by providing 14 proposed preventive actions to reduce the impact of risk agents that occur in the procurement of raw material for SS2 weapons.*

Keywords: HOR, Preventive Action, Procurement, Risk, SS2, Supply Chain

I. Introduction

PT Pindad (Persero) is the oldest defense industry and the first state-owned company to provide strategic Alutsista products (Main Armaments System) in weapons, munitions, special vehicles, and explosives to meet the needs of national defense. The first product produced by PT Pindad (Persero) was in the field of weapons. The weapons made consist of light weapons, handguns, and heavy weapons. One of PT Pindad's (Persero) weapons products that have become worldwide is the Assault Rifle 2 (SS2), which is classified as a light weapon type [1]. The assault rifle 2 (SS2) has a more ergonomic design, is resistant to humidity and has better accuracy. The development of the SS2 product, which has a superior concept and design, is proven in the international level military shooting championship. Product development resulted in many SS2 variants, and the production system applied to the SS2 weapon was a make-to-order system based on sales orders [2]. Based on the interview results, the Sales Order (SO) execution will result in a production plan, which will produce an RKM (Material Requirements Plan). The production process can be carried out if the RKM has been fulfilled according to the required number and specifications. The raw material is the essential aspect of the smooth production process. If the raw materials have not been met, then based on the RKM, a PR (Purchase Requisition) will be designed and submitted to the Procurement Unit to continue procuring SS2 raw material supplies.

Procurement is a business activity to obtain goods or services needed by the company in a transparent, effective, and efficient manner according to their needs and use and by quality, quantity, time, and affordable prices [3]. The Procurement Unit executes the PR to be continued at the stages of the procurement process, starting from selecting a vendor to reaching a contract agreement or Purchase Order (PO). The procurement unit also controls incoming materials when receiving raw materials sent by vendors based on agreed purchase orders. Considering the make-to-order production system implemented, the raw material procurement process is critical in SS2 weapon production activities. Properly managing the procurement process can hurt production activities such as project delays, poor material use, etc., and others. This impact is caused by the risks that arise from the lack of supervision in managing the raw material procurement process [4]. This case does not rule out the possibility that it can occur in the process of procuring raw material for SS2 weapons at PT Pindad (Persero). Based on PT Pindad (Persero)'s supply chain risk management data for 2020, several risk events have occurred in the procurement process, including delays in the delivery of raw materials by vendors, changes in specifications from the Sales Division or Weapons Division, materials

sent by vendors do not meet requirements and others. Risk events in the raw material procurement process can result in delays in the production of SS2 weapons. The lead-time in the sales order is not filed correctly to reduce customer satisfaction and switch to competitors. This problem cannot be left alone; it is necessary to handle risk events and causes that may arise during the procurement process in the Procurement Unit.

Good risk management will minimize risk events that can disrupt the stability of the production process. Risk not be eliminated but can be controlled based on the company's needs. Risk management carried out in a structured and comprehensive manner can improve company performance while increasing the profit occurrence of unexpected risks [5]. In the raw material procurement process, risk handling can be done by compiling risk mitigation based on risk management. The Procurement Unit can play an optimal role in the smooth production of SS2 weapons. The Procurement Unit at PT Pindad (Persero) is part of the Supply Chain Division, using the House of Risk (HOR) method to assist researchers in dealing with risks. Therefore, this research is fundamental to be carried out with the aim of the study is to identify risk events and risk agents in the procurement of raw material for SS2 weapons at PT Pindad (Persero), analyze the risk agents that have the most significant potential based on the Aggregate Risk Potential (ARP) value—Obtained from the calculation of the House of Risk (HOR) model, analyzing potential risk agents that must be handled, and formulating a risk mitigation strategy by proposing preventive actions in dealing with risk agents that have the highest potential in the procurement of raw material for SS2 weapons.

II. Literature Review

Procurement management has a broader scope than purchasing management (Purchasing) because it does not only carry out procurement activities (Goods) but can also be in the form of services (Services). Procurement is a Profit Center because it is directly involved in the production process and activities that directly impact performance and determine company profits [6].

The supply chain is a coordination system among several actors in a chain in succession, starting from the primary producer to the final consumer [7]. According to Pujawan, the supply chain is a network of suppliers, manufacturers, distributors, and retailers who work together to create and deliver a product to reach consumers [8]. Supply Chain Management is a series of methods, tools, or approaches in managing activities that include coordination, scheduling, and control of the procurement, production, inventory, and delivery of products or services to customers, which provides for daily administration, operations, logistics, and information processing from customers to customers. To suppliers [9]. Supply Chain Management, of course, includes materials or finished goods and includes auxiliary materials, components, spare parts, work in process, and various types of equipment used to support the company's overall operational activities [10]. Given the importance of Supply Chain Management, every manager of the company's organization must plan, implement, control, and manage risk on the supply chain management process. In general, supply chain performance is related to reliability, speed of response, accuracy in procurement, fulfillment of fulfillment, flexibility, cost, and lead times of logistics activities. Tenable for the implementation of material procurement in a supply chain: the element of technology, the part of bargaining power or the bargaining position of an industry, and the third is the commitment of top management in managing the supply chain [11].

Risk is uncertainty over an event that has the opportunity for something undesirable to occur; in other words, the risk is an internal and external threat that can affect the achievement of organizational goals [12]. Risk management is a strategy to prevent risk and reduce the risk. The sequence of the risk management process that is generally carried out starts from risk identification, risk measurement, and risk mitigation. Supply chain risk management is a risk management process that requires coordination or collaboration with all supply chain members to gain profitability and maintain business sustainability [13].

The House of Risk (HOR) method can identify and analyze potential risks that impact the company and the environment around supply chain activities. The House of Risk (HOR) method is a supply chain risk management model that combines the concepts of House of Quality and Failure Modes And Effects Analysis (FMEA) to develop a framework for managing Supply Chain risk [14].

III. Methodology

This research was conducted using a quasi-qualitative approach. The research starts from a preliminary study by conducting a literature study and field survey to identify problems at the research location, then formulating problems and research objectives based on the issues that have been identified. The following research stage is data collection and data processing. Field studies can collect data obtain data such as risk events in the company, sources of risk, and

preventive measures. Data collection was carried out by observing and interviewing four experts from the Supply Chain Division of PT Pindad (Persero) to map the SS2 weapon raw material procurement process activities.

Data processing is carried out using the House of Risk (HOR) method, a supply chain risk management model that combines the concepts of House of Quality and Failure modes and effects analysis (FMEA). The sequence of steps in data processing includes two stages: identifying risk events and applying the HOR model. Identification and assessment of risk events are carried out using the FMEA method to find the severity and occurrence values. House of Risk (HOR) aims to find the relationship between risk agents and risk events and arrange risk agent priorities based on the Aggregate Risk Potential (ARP) value. Then ARP is identified using the Pareto diagram principle to determine the priority risk agent. After that, analysis and discussion related to the handling of priority risk agents was carried out, namely designing risk mitigation by proposing preventive actions to reduce the occurrence of risk agents in procuring raw materials for SS2 weapons.

IV. Result and Discussion

Activity mapping in the SS2 raw material procurement process is based on the stages carried out in the Supply Chain Division, including the Procurement Process, Vendor Management, Material Distribution, and Incoming Material Control. There are 17 risk event and 27 risk agents identifications that experts have validated to assess severity and occurrence, as shown in Table 1. and Table 2. below.

Table 1. Risk Events Identifications

Activity	Code	Risk Events	Severity
Procurement Process	E1	Uncertainty about the procurement plan from the user division	8,50
	E2	There is a change in material demand, both specifications, and quantities	8,00
	E3	Inadequate supporting documents and technical documents are available	7,25
	E4	Delays in aandwijzing and negotiation in the procurement process	6,75
	E5	The length of time for the completion of the material procurement contract	8,25
Vendor Management	E6	Vendors cannot attend Aandwijzing	4,75
	E7	Vendors cannot meet PO/contract targets	7,50
	E8	Vendor limitations	6,75
	E9	Late payments to vendors/material providers	6,75
Material Distribution	E10	Material delivery delay	8,25
	E11	The material stuck in a port	8,25
	E12	Probability of accidents in the distribution process	6,50
Incoming Material Control	E13	Delay in procuring incoming materials	8,00
	E14	The quality of incoming materials does not match the specifications offered	8,50
	E15	Insufficient quantity of incoming material according to PO	6,50
	E16	Damage and buildup of materials	6,75
	E17	Errors in checking or inputting incoming material data	5,00

Table 2. Risk Agents Identifications

Activity	Code	Risk Agents	Occurrence
Procurement Process	A1	There is a product design revision from the user	7,50
	A2	Changes to the number of components and material specifications	7,25
	A3	Additional material purchases	6,25
	A4	Procurement documents/data are incomplete	5,50
	A5	Making PR by users is not mature enough	6,50
	A6	There is a change in technical documents during the procurement process	6,75
	A7	Material price fluctuation	7,25
	A8	The negotiated price value is more significant than HPS	6,00
	A9	Material unavailability by the vendor	7,25
	A10	There are special requests outside the procedure in the contract finalization process	4,75
	A11	Execution and evaluation of the procurement process more than 25 days	5,00
Vendor Management	A12	The impact of the Covid-19 pandemic	6,00
	A13	Material unavailability by the vendor	6,25
	A14	Late delivery of contract goods	4,75
	A15	Unavailability of materials at local vendors	6,50
	A16	The completeness of the billing document is not complete	3,25
Material Distribution	A17	Uncertainty of transportation time	6,50
	A18	Lack of completeness of travel permit filing	7,00
	A19	Uncertain weather factor	4,50
	A20	Human error	4,50
Incoming Material Control	A21	There is a delay in delivery from the vendor	5,25
	A22	Lack of precise technical specifications of PR	5,50
	A23	Wrong execution in material delivery by the vendor	4,50
	A24	Product contamination and limited storage space	5,00
	A25	Human error	4,50
	A26	There is no Work Instruction (SOP) in data input	4,00
	A27	The monitoring process is not carried out gradually and periodically	4,50

After getting the severity and occurrence values, the next step is correlation analysis, determining how strong the relationship between risk events and agents is. The correlation between risk causes and risk events is assessed on a scale of 0, 1, 3, and 9. The next step is to calculate the Aggregate Risk Potential (ARP) value to determine the priority risk agent, shown in Table 3. below.

Table 3. Aggregate Risk Potential (ARP) Value

Ranking	Code	Risk Agents	ARP	Cumulative ARP (%)
1	A2	Changes to the number of components and material specifications	630,8	9,51%
2	A5	Making PR by users is not mature enough	610,2	18,71%
3	A4	Procurement documents/ data are incomplete	567,9	27,27%
4	A13	Material unavailability by the vendor	534,4	35,32%
5	A22	Lack of precise technical specifications of PR	526,6	43,26%
6	A15	Unavailability of materials at local vendors	409,5	49,43%
7	A6	There is a change in technical documents during the procurement process	325,7	54,34%
8	A21	There is a delay in delivery from the vendor	291,4	58,74%
9	A18	Lack of completeness of travel permit filing	288,8	63,09%
10	A3	Additional material purchases	266,4	67,10%
11	A1	There is a product design revision from the user	263,4	71,08%
12	A9	Material unavailability by the vendor	251,0	74,86%
13	A23	Wrong execution in material delivery by the vendor	243,0	78,52%
14	A14	Late delivery of contract goods	213,8	81,74%
15	A11	Execution and evaluation of the procurement process more than 25 days	187,5	84,57%
16	A24	Product contamination and limited storage space	121,3	86,40%
17	A25	Human error	111,9	88,09%
18	A16	The completeness of the billing document is not complete	109,7	89,74%
19	A12	The impact of the Covid-19 pandemic	108,0	91,37%
20	A17	Uncertainty of transportation time	107,3	92,98%
21	A10	There are special requests outside the procedure in the contract finalization process	96,8	94,44%
22	A20	Human error	95,6	95,89%
23	A19	Uncertain weather factor	77,1	97,05%
24	A7	Material price fluctuation	73,4	98,15%
25	A8	The negotiated price value is more significant than HPS	60,8	99,07%
26	A27	The monitoring process is not carried out gradually and periodically	51,8	99,85%
27	A26	There is no Work Instruction (SOP) in data input	10,0	100,00%

The priority risk agent value in the raw procurement process SS2 material will be identified using a Pareto diagram to describe the risk agent rating that needs to be addressed with preventive actions.

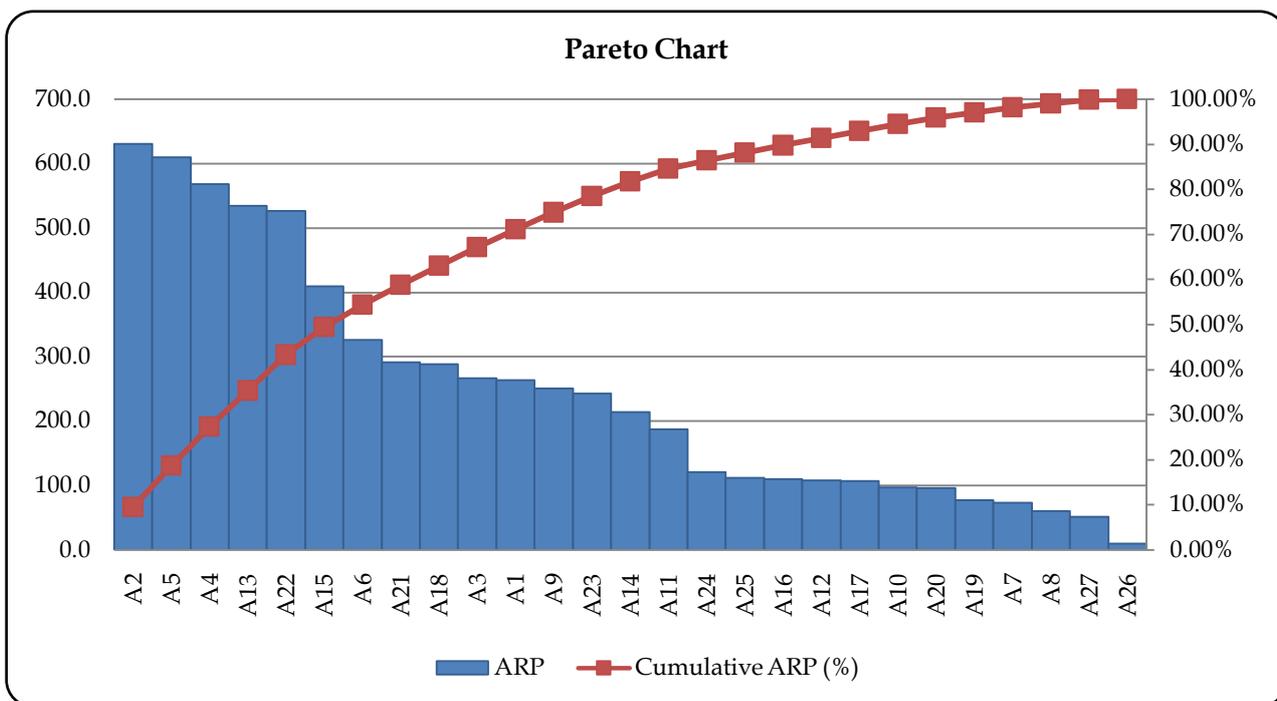


Fig. 1. Pareto Chart of ARP

The Pareto principle with the 80:20 rule explains that 20% of the causes of risk in supply chain activities for the procurement of SS2 raw materials at PT Pindad (Persero) can describe the entirety of other risk causes. Based on the Pareto diagram above, it shows that the priority risk agent that needs to be handled with preventive action is the risk agent who has a point of intersection between the ARP value and the cumulative ARP, which describes the results of 20% of the overall risk agent. The priority risk agents can be seen in Table 4. below.

Table 4. Priority Risk Agent

Ranking	Code	Risk Agents	Cumulative ARP (%)
1	A2	Changes to the number of components and material specifications	9,51%
2	A5	Making PR by users is not mature enough	18,71%
3	A4	Procurement documents/data are incomplete	27,27%
4	A13	Material unavailability by the vendor	35,32%
5	A22	Lack of precise technical specifications of PR	43,26%
6	A15	Unavailability of materials at local vendors	49,43%

Based on the priority risk agents above, the proposed preventive actions that will handle the risks in the procurement of SS2 raw materials are as follows.

Table 5. Proposed Preventive Actions

Activity	Code	Risk Agents	Code	Preventive Actions
Procurement Process	A2	Changes to the number of components and material specifications	PA1	Increase accuracy in ensuring specifications and quantities of goods before tendering
			PA2	Coordinate effectively with customers regarding material specifications and number of components
			PA3	Make commitments and agreements with consumers not to propose changes.
	A4	Procurement documents/data are incomplete	PA4	Ensure the completeness of documents/data before proceeding to <i>aandwijzing</i>
			PA5	Checking documents/data received from users regularly
	A5	Making PR by users is not mature enough	PA6	Ensure the user regarding the details of the PR to be issued
			PA7	Provide training for employees regularly according to the development of science and technology
			PA8	Upgrading employee work instructions (SOP) to be more effective and efficient
Vendor Management	A13	Material unavailability by the vendor	PA9	First, get to know the vendor's capabilities
			PA10	Conduct quality vendor selection
	A15	Unavailability of materials at local vendors	PA11	Choose the right vendor
Incoming Material Control	A22	Lack of precise technical specifications of PR	PA12	Ensure that the purchased material is following the specifications and terms of acceptance
			PA13	Communicating with all vendors related to PO
			PA14	The vendor sends conduct inspections directly to the field before the material.

V. Conclusion

Based on the research results, the identified risks have the opportunity to appear in the procurement of raw material for SS2 weapons at PT Pindad (Persero), namely 17 risk events and 27 risk agents, which are then assessed to calculate the aggregate risk potential. The Pareto diagram has identified six priority risk agents based on the aggregate risk potential value. The six priority risk agents include changes in the number of components and material specifications (A2), making PR by immature users (A5), incomplete procurement documents/data (A4), unavailability of materials by vendors (A13), lack of precise specifications technical aspects of PR (A22), and unavailability of materials from local vendors (A15).

The risk management carried out to reduce the impact of risk agents that occur in the procurement of raw material for SS2 weapons is to develop risk mitigation by providing proposed preventive actions, including increasing accuracy in ensuring specifications and quantities of goods before tendering (PA1), coordinating effectively with related consumers material specifications and total of components (PA2), making commitments and agreements with consumers not to propose changes (PA3), ensuring the completeness of documents/data before proceeding to *aandwijzing* (PA4), checking documents/data received from users periodically (PA5), ensuring users regarding the details of PR to be issued (PA6), providing training for employees sometimes according to the development of science and technology (PA7), upgrading employee work instructions (SOP) to be more effective and efficient (PA8), first getting to know the capabilities of vendors (PA9), conduct quality vendor selection s (PA10), choosing the right vendor (PA11), ensuring that the purchased material is in accordance with the specifications and acceptance requirements (PA12), communicating with all vendors related to PO (PA13), conducting direct inspections to the field before the material is sent by the vendor (PA14).

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