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Supply Chain Risk Mitigation for Logistics Service Companies

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Abstract. The increasing use of expedition services due to the Covid-19 pandemic has also increased various types of risks in companies. This study discusses solutions to the complexity of supply chain management in the expedition services industry due to pandemic Covid-19. This study aims to analyze the risk of security management systems based on every activity in the supply chain of an expedition company. The method used in this study is the matrix risk assessment to determine the risk ranking by multiplying the possibilities and consequence values. Descriptive analysis approaches and in-depth interviews are needed to identify the types of risks in the supply chain of PT.X. The application of risk assessment consists of five stages: development mapping of supply chains, risk identification, risk assessment, risk response development, and risk response control. The results of this study indicate that three types of extreme risks need to be handled in priorities by providing proposed mitigation, namely bad weather, road accidents, and damaged items. Risk mitigation strategies are carried out to prevent the types of extreme risks in the company.

Keyword: Risk, Supply Chain, Pandemic Covid-19, Mitigation

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1. Introduction

In the technological era, business competition in Indonesia is increasing, along with many similar companies engaged in the same field [1], [2]. Companies attach great importance to and play an important role in the supply chain system [1]. Supply chains within companies are increasingly important and can be linked to the globalization of trade [3]. A company needs a supply chain management system to create an organization that is safe, measurable, reliable, achieves consistency in the quality of the products it supplies, and complies with government regulations [4]. Companies need to handle security systems to be able to meet requests from customers so that they can develop a business and increase customers [4]. With the growth and development of companies in the logistics and cargo sector, there will be more risks in the logistic service, such as internal business risks, environment, and nature, competitiveness, future infrastructure, economy, and politics [5], [6]. Competence in handling unexpected risks from the supply chain effectively will provide a strategic competitive advantage in the process of creating value added to customers [7], [8], [9]. One company that is very concerned about supply chain risk

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management is the company at PT. X. PT. X is a freight forwarding company that provides a variety of delivery services to serve a business (Business to Business - B2B) and customers (Business to Customer - B2C) [9], [10]. Currently, PT. X is required to be able to carry out his activities and manage his business properly in the field of cargo and logistics in accordance with the times, so it requires experts who are specifically in their field to avoid risks in increasingly complex operational activities.

The Covid-19 pandemic pushed industrial companies in the logistics and cargo sectors to improve the quality of their services [10], because during the Covid-19 pandemic, there was an increase in orders and delivery of goods through expedition services. The increase in the delivery of goods occurred because people prefer to buy their needs online. Government policies also limit all activities outside the home [10], [11], [12]. In addition, the quality improvement in expedition services is due to the government response to the COVID-19 virus pandemic with three strategies: 1) Limiting the spread of the coronavirus through large scale social restrictions policies, 2) Strengthening facilities and services to deal with pandemics, 3) Reducing the economic impact caused by economic activities which are slowing down by strengthening social safety nets and fiscal support to the affected business world and Micro, Small and Medium Enterprises (MSMEs) [13]. The effects of the Covid-19 pandemic have had a major impact on PT. X, one of which is the demand side. Therefore PT. X must have a strategy to overcome these problems. PT. X still needs to make a mitigation strategy related to its supply chain. In this way, PT. X requires strategies in terms of quality improvement and customer satisfaction. In addition, many researchers have called for empirical research on the impact of risk on Supply Chain Risk Mitigation (SCRM), especially on how an industry is hit by the COVID-19 pandemic crisis [14], [15], [16], [17]. SCRM practices have been very successful and can be useful when implemented. It is hoped that successful SCRM practices in other industries can be beneficial when applied to PT. X. By mapping the supply chain at PT. X then aims to increase competitiveness and customer satisfaction by mapping the supply chain at PT. X [18], [19].

Supply chain mapping at PT X [20], [21], [22], [23], [24] is useful for mapping actors in each activity so that they can determine the best resource allocation in their services. In addition, it can more easily analyze risk mitigation at PT. X. Therefore, it is necessary to do this research which aims to identify the types of risks in each stage of the supply chain at PT. X to make an accident reduction strategy. The reduction in accidents in the supply chain makes organizational performance increase optimally. If the risks in the organization are not mitigation, they will endanger workers and the organization.

2. Literature Review

Supply chain risk mitigation is the process of identifying, assessing, and managing the potential risks that can affect the operations and performance of a supply chain. The objective of supply chain risk mitigation is to minimize the impact of disruptions and uncertainties on the supply chain and improve its resilience [20], [21]. This literature review aims to explore the current state of research on supply chain risk mitigation and its practices.

2.1. Supply Chain Risk Mitigation

Risk mitigation is an effort to reduce or eliminate risks associated with the supply chain [25], [26]. This can be done in various ways, such as diversifying suppliers, improving product or service quality, using technology to monitor and manage risks, and developing cost reduction and efficiency strategies in the supply chain [26], [27]. Several researchers have studied the various aspects of supply chain risk mitigation and proposed different strategies and practices to manage risks [15], [25], [26]. One of the key strategies is to build a resilient supply chain that can withstand disruptions and adapt to changes [15], [25], [26]. A resilient supply chain can be achieved by implementing various risk mitigation practices such as diversification, redundancy, and flexibility. In addition to these risk mitigation practices, several studies have highlighted the importance of collaboration and communication in managing supply chain risks [16], [26], [27]. Collaborative relationships among supply chain partners can help improve information sharing, coordination, and decision-making, which are critical for effective risk management. Effective communication among supply chain partners can help identify and address potential risks before they become major disruptions [16], [26], [27].

2.2. Risk Assessment Matrix

The risk assessment matrix is a tool used to evaluate risks and estimate their impact on a project or activity [11]. A risk assessment matrix can help identify significant risks, analyze, and evaluate the impact of these risks, and determine risk mitigation priorities that must be carried out. Basically, the risk assessment matrix is built based on two main components, namely the possibility of a risk occurring and the impact or consequences of that risk [11]. Risk scoring is given to risks based on the assessed likelihood and consequence in the risk assessment matrix [11]. Evaluation of the importance and priority of each risk is usually carried out using a lookup table or a probability and impact matrix [11]. The matrix determines the combination of probability and impact that leads to assessing risk as a low, medium, or high priority. The following is the formula for finding the risk assessment matrix's risk score [11].

$$\text{Risk Score (R)} = \text{Likelihood(L)} \times \text{Consequence (C)} \quad (1)$$

Formula 1 explains that Risk Score (R) is the Risk Value, likelihood (L) is the possibility of a risk event, and consequence (C) is the significance or impact of the risk [11].

3. Methodology

This research was conducted at PT. X uses the risk assessment matrix method with a descriptive analysis approach to identify risks in each activity in the supply chain. Each stage in the study is explained in Figure 1. This study begins with observations of the field and literature studies that are relevant to risk mitigation. The first step, namely mapping the supply chain at PT. X. which will be used in identifying risks at each stage of the supply chain. The second step is to identify the potential types of risks that exist in PT. X. The third step is to carry out calculations by paying attention to the likelihood and occurrence values and to classify the types of risk with a risk assessment. The fourth step is risk response development which will provide mitigation proposals for risks with the highest ranking. The final step is risk response control, namely implementing and monitoring the results of the proposed mitigation strategy. Figure 1 describes the stages of this research.

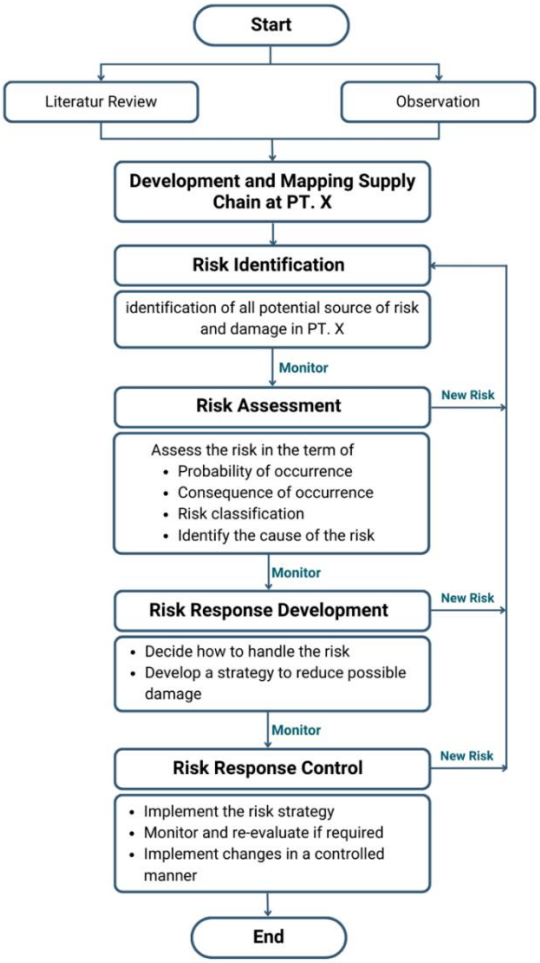

Figure 1 Research Phase

In this research, the primary data needed is business process data from PT. X was obtained through observation and in-depth interviews with experts, namely division heads at PT. X. Characteristics as interview respondents, namely workers with more than three years of experience in operations in supply chain mitigation. While the secondary data in this study were obtained through a review of the literature and supporting documents regarding PT. X to help map the supply chain and risk mitigation at PT. X.

4. Result and Discussion

4.1. Development and Mapping Supply Chain

It maps the actors in each activity and determines the best resource allocation in PT. X can more easily monitor the distribution of materials and products to the customer [28]. In addition, it is easier to make the evaluation and improve materials if there are problems in every process at PT. X. In this way, PT. X is expected to minimize internal problems and can make PT. X is the best company in the field of cargo and logistics. The preparation of the supply chain model is carried out through observational data and business processes at PT. X is shown in Figure 2.

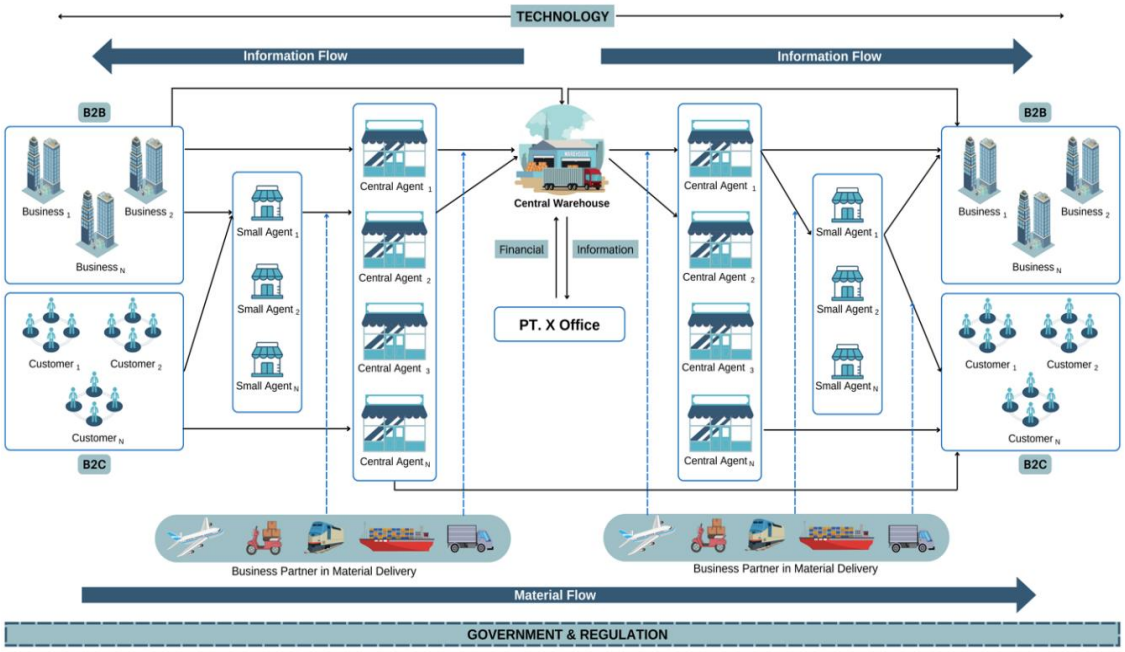

Figure 2 Supply Chain Mapping at PT. X

Figure 2 explains the stages of the supply chain at the company PT. X. There are several stages in the organization's supply chain, ranging from customers to agents, agents to the warehouse, warehouse to agent, and agent to the customer. At every stage of the supply chain, there is information flow, cash, and finance [28]. Supply chain at PT. X is very helpful in mapping stakeholders and mapping the types of risks that exist in PT. X. A business, one of which is PT. X, to operate smoothly within its supply chain network, requires specialized supply chain risk management competencies [16].

4.2. Risk Identification

In evaluating risk, it is important to understand where the risk comes from and what events can lead to risk [29]. Risk identification is carried out to identify and evaluate risks that may occur in a project or activity. This includes collecting data related to risk from various sources and conducting risk analysis on this data [29]. The following Table 1 describes the risk identification for each stage of the supply chain at PT. X.

Table 1 Identification the Types of Risk

Activity	Risk Identification	Source of Risk
Customer to Agent	Demand side	Market demand is uncontrollable, resulting in a buildup of goods, such as increases in certain seasons and events, before Eid and Christmas.
	Data entry error	Human error
	Demand side	PT. X which is not in accordance with the procedure
Agent to Warehouse / Warehouse to Agent	Error sending item	Error PT. X is in the process of separating goods
	Bad weather	Unable to predict the weather and has become a law of nature
	Delayed delivery	Too many packages and the availability of means of transportation
	Accident in the road	Bad weather, drivers are sleepy, tired, and not alert, too much transport volume
	Sabotage / theft	Passing through deserted lanes, prone to robbery and theft
	Damaged goods	Not careful in packing, squeezed by other items when shipping on the road
	Lost parcels	Courier error in delivering or placing the package at the customer's place
Agent to Customer	Error sending item	Error PT. X is in the process of separating goods
	Damaged goods	Not careful in packing, squeezed by other items when shipping on the road
	Delayed delivery	Too many packages and the availability of means of transportation
	Bad weather	Unable to predict the weather and has become a law of nature
	Customer dissatisfaction	Courier error PT. X in serving and delivering packages

4.3. Risk Assessment

The next stage is the risk assessment stage. Risk assessment is carried out to evaluate risks based on the likelihood of their occurrence and the resulting impacts or consequences [30]. Risk assessment also includes the development of scenarios to measure the impact of the identified risks [30]. The purpose of a risk assessment is to ensure that the risk control of the processes, operations, or activities carried out is at an acceptable level. The assessment in risk assessment is Likelihood and Consequence. The likelihood criteria are shown in Table 2 [30]. Meanwhile, the Consequently criteria are shown in Table 3 [30].

Table 2 Qualitative Measures of Likelihood

Level	Likelihood	Description
A	Almost certain	An event will occur in all conditions / every activity carried out.
B	Likely	An event is likely to occur in almost any condition
C	Possible	An event will occur under certain conditions.
D	Unlikely	An event may occur under certain conditions, but it is unlikely that it will occur.
E	Rare	An incident may occur in a special condition / extraordinary / after many years.

Table 3 Qualitative Measures of Consequence

Level	Consequence	Description
1	Insignificant	Low financial loss, No injuries,
2	Minor	Medium financial loss, first aid treatment, on-site release immediately contained
3	Moderate	High financial loss, medical treatment required on-site release contained with outside assistance

Level	Consequence	Description
4	Major	Major financial loss, extensive injuries, loss of production capability, off-site release with no detrimental effects
5	Catastrophic	Huge financial loss, death, toxic release off-site with detrimental effect

Table 4 Risk Matrix Likelihood and Consequence

	Consequence				
Likelihood	1	2	3	4	5
A	High	High	Extreme	Extreme	Extreme
B	Moderate	High	High	Extreme	Extreme
C	Low	Moderate	High	Extreme	Extreme
D	Low	Low	Moderate	High	Extreme
E	Low	Low	Moderate	High	High

Where,

Extreme : extreme risk; immediate action required

High : high risk; senior management attention needed

Moderate : moderate risk; management responsibilities must be determined

Low : low risk; manage with routine procedures

This risk matrix classifies risks into four categories, namely extreme, high, moderate, and low. The purpose of the analysis using the matrix in Table 4 is to separate acceptable minor risks from risks that have large losses [30]. In addition, mapping out the types of risks can provide data to assist in evaluating and handling risks [16], [20], [30]. Each potential solution for each identified risk needs to be evaluated, and the success of the decision at PT. X prior to addressing certain risks was considered during this evaluation process [5]. By conducting field surveys and collecting data on PT. X and the possibility of a risk occurring in each stage. After searching for supply chain information on all PT. X. After that, namely, setting the context and defining the basic parameters where risks must be managed and addressed for decision-making [31]. The magnitude of the consequences of an event and the probability of events and consequences at PT. X, assessed in the context of existing controls. However, a possible consequence can be determined using statistical analysis and calculations because at PT. X, no past data is available, then subjective use can be made to parameterize the degree of individual or group belief that a particular event or outcome will occur [30]. According to [5], [30], in conducting a semi-quantitative analysis for each description, it is not necessary to have an accurate relationship with the magnitude of consequences in PT. X. The numbers can be combined by one of a set of formulas provided the system used for prioritization matches the approach chosen for generating the numbers and aggregating them. The aim is to create better priorities than is usually achieved in qualitative analysis [5], [30]. From Table 1, the types of risk that will be mapped have been identified by conducting a Likelihood (L) and Consequence (C) assessment to obtain a risk rating for each activity in the supply chain shown in Table 5.

Table 5 Risk Assessment

Activity	Risk Identification	Risk Event	L	C	Risk Rating
Customer to Agent	Demand side	Market demand is uncontrollable, resulting in a buildup of goods, such as increases in certain seasons and events, before Eid and Christmas.	E	1	Low
	Data entry error	Human error	C	3	High
	Customer service and satisfaction	PT. X which is not in accordance with the procedure	D	4	High
Agent to Warehouse	Error sending item	Error PT. X is in the process of separating goods	D	2	Low
	Bad weather	Unable to predict the weather and has become a law of nature	B	4	Extreme
	Delayed delivery	Too many packages and the availability of means of transportation	B	3	High
	Accident in the road	Bad weather, drivers are sleepy, tired, and not alert, too much transport volume	D	5	Extreme
	Sabotage / theft	Passing through deserted lanes, prone to robbery and theft	E	5	High
	Damaged goods	Not careful in packing, squeezed by other items when shipping on the road	B	4	Extreme
Agent to Customer	Error sending item	Error PT. X is in the process of separating goods	D	2	Low
	Damaged goods	Not careful in packing, squeezed by other items when shipping on the road	B	4	Extreme
	Delayed delivery	Too many packages and the availability of means of transportation	B	3	High
	Bad weather	Unable to predict the weather and has become a law of nature	D	5	Extreme
	Customer dissatisfaction	Courier error PT. X in serving and delivering packages	D	4	High

4.4. Risk Response Development

Risk Response Development is the process of developing and evaluating response strategies to risks that have been identified in the risk assessment matrix [30]. The purpose of doing this is to develop a response strategy to the risks identified in the risk assessment matrix, with the aim of reducing the impact of risk, increasing the probability of success, optimizing resources, and minimizing costs. From the risk assessment at PT. X, this type of risk is high risk. If left unchecked, work accidents or significant losses will occur [31], [32]. From the risk matrix assessment, a response to the mapped risks will then be carried out. From the results of Table 5, there are 4 categories of risk types, namely, extreme, high, moderate, and low. After determining the risk rating, the actions that can be taken in dealing with risk are risk retention, risk reduction, risk transfer, and risk avoidance [31]. Based on the results of the mapping of the risk matrix, Table 6 shows that risk events are included in the extreme category, which will be a priority for action to be taken first [5], [31], [33]. The results of risk mitigation solutions can be used as a reference in stakeholder decision-making [34] to analyze the risk of a security management system based on each activity in the supply chain of shipping companies [35].

Table 6 Extreme Level Risk Mitigation

Risk	Risk Mitigation
Bad weather	Currently, bad weather conditions cannot be avoided by logistics services because it has become a law of nature, but can be reduced by taking alternative steps, such as: 1. Implement a delivery time range policy, 2. Pre-agreement with the customer if there are unwanted weather events.
Accident in the road	1. Provide job training for couriers 2. Outreach to drivers/couriers to be more alert and careful on the road 3. Perform maintenance on machines and equipment 4. Provide rest periods and work shifts for couriers in accordance with standard operating procedures (SOP)
Damaged goods	1. Arrange goods according to size and type of goods 2. Give instructions on the goods in the form of a symbol

4.5. Risk Response Control

The next stage in this research is risk response control, namely implementing the risk strategy that was given in the previous stage, then evaluating and controlling what has been implemented [5], [35]. Risk actions need to be monitored to ensure changes in circumstances do not change risk priorities [30]. The calculation of the risk ranking results can be used as stakeholder decision-making to be followed up. With proper risk handling, the performance quality of the company will improve [36].

5. Conclusion

This study proposes a framework for SCRM that is used for effective collaborative risk management. The SCRM-based risk management system can help PT. X in dealing with issues related to its supply chain activities. From the results of the calculation analysis, 3 types of risks need to be addressed in priority so as not to harm PT.X, namely bad weather, road accidents, and damaged goods. This study only provides risk mitigation proposals based on risk assessment. A deeper analysis of the SCRM effect must be carried out to build a more complex mathematical model so that it can accurately represent supply chain networks in the field of logistics, especially PT. X.

There are several implications in this research. First, companies can use the RAM method to identify risks that may occur more accurately and systematically. This can help companies be better prepared to face possible risks, thus minimizing losses and negative impacts on business. Second, companies can prioritize risks based on their level of importance and impact on the business. This can assist companies in choosing the right mitigation measures, thereby increasing the efficiency of risk mitigation, and reducing costs incurred. And finally, by minimizing risk, freight forwarding companies can improve the quality of services provided to customers. In the service industry, service quality is very important and can affect customer satisfaction and corporate image to achieve a competitive advantage in the market.

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