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Risk Management in Air Cargo Delivery: Addressing with the House of Risk Framework

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ABSTRACT

Objective*: The purpose of this study was to identify the root reasons of delayed products delivery and to create risk-reduction plans for logistics service providers that use air transportation.*
Methodology*: The House of Risk (HOR) approach was utilized, which entailed in-depth interviews and questionnaires filled out by people who were knowledgeable about the problem.*
Findings*: Twelve separate risk events were found, and eighteen risk agents were shown to be involved in these delays. Nine of them were identified as priority risk agents, indicating that they were the main reasons for the delays. In order to limit the hazards identified, the study developed eight preventive strategies that were carefully sequenced to address these difficulties. The study's conclusions are meant to help the business put the suggested mitigation plans into practice. These strategies specifically seek to lower or limit the possibility of delays when carrying air cargo. By putting these strategies into practice, the company may improve the dependability and efficiency of its logistics processes, guaranteeing the timely delivery of goods.*
Conclusion: *The ultimate goal of the research is to provide the organization with practical and effective strategies to reduce or eliminate the probability of disruptions in their logistical operations, particularly concerning aviation cargo shipments bound to Papua. By implementing the recommended preventive measures, the company is expected to increase the dependability and efficacy of their logistics operations, which is the anticipated result of this research. Through the implementation of this strategic approach, the company can effectively bolster customer satisfaction, sustain a competitive advantage within the logistics sector, and ensure punctual deliveries.*

Keywords*: Risk Management; Air Cargo; House of Risk.*

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INTRODUCTION

According to the Indonesian Logistics Association (ALI), the flow of shipping goods that occurred during the Covid-19 pandemic grew by 40%, this increase was contributed by the pharmaceutical industry, medical devices and consumer goods (Puteri, 2021) This certainly has a very significant impact on the delivery of goods in the post-pandemic period as it is now, logistics activities are growing and getting busier and consumers will increase. The development and competition that occurs in the logistics business world in Indonesia today is very rapid and tight, this rapid business development has covered all aspects of social life now, therefore a logistics company must be required to work quickly, precisely, and accurately so that the company can compete with other business opponents in the business world.

Air freight transport connects distant markets and worldwide supply chains in a timely and dependable manner. Improving air connectivity is crucial for sustainable economic growth, especially for high-value and perishable items moved globally. Improving air connectivity is crucial for long-term economic growth since goods are carried globally. Air freight transport plays a crucial role in multimodal supply chains and should be better integrated. Air freight transit plays a crucial role in intermodal supply networks and should be prioritised for further inclusion. Air freight transport is analysed in terms of volume and value in the EU and globally, as well as its contribution to global freight transit (Bartulovic et al., 2022)

This research focuses on identifying and assessing risks related to delays, using the House of Risk method to pinpoint the causes of these delays and develop strategies to mitigate them. The House of Risk is an innovative model that helps identify and evaluate potential risks within a supply chain. It combines the Failure Mode and Effects Analysis (FMEA) model with the House of Quality (HOQ) model, enabling companies to prioritize which risks to address first and determine the most effective actions to reduce them.

Research Gap

This research also uses a supply chain process, namely the supply chain is an integrated process, where a number of companies work together to obtain raw materials, convert raw materials into finished products and send them to suppliers and customers. Or in other words it can also be called a unity of Suppliers, Factories, Customers, and transportation and logistics service companies (Fahmy & Hariningsih, 2021).

There have been various studies on risk management and supply chain logistics; however, the specific focus on air cargo delays in Indonesia, particularly during the COVID-19 recovery period, has received less attention. Most prior studies focus on broad logistics hazards and solutions, but this study focusses on the risks associated with air freight in a specific geographical context, filling a regional and sector-specific gap.

The SCOR (Supply Chain Operations Reference) paradigm is widely adopted in supply chain management. However, the integration of SCOR and HOR to reduce risk in air freight transportation has not received significant attention in existing research. The work offers this theoretical linkage to improve the use of both models in real-world logistics risk mitigation. This empirical information fills a gap in the literature, which primarily focusses on larger logistical difficulties without providing region-specific insights.

The study adds to our understanding of risk mitigation techniques (such as diversifying air carriers or boosting daily freelance workers) designed to manage the post-COVID-19 logistics environment.

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The paper presents actual evidence that identifies the volume of items sent, offloaded luggage, and regulated agents warehouse lineups as the highest risk agents. Previous research had not identified these as key determinants in air cargo delays, particularly for logistics in Indonesia, therefore this provides new evidence for policymakers and businesses.

This work fills a methodological vacuum by quantifying the possible consequences of risk agents utilising HOR. It offers a real prioritisation of risks based on Aggregate Risk Potential (ARP) values, which is a novel technique in this field.

LITERATURE REVIEW

Air freight transports commodities and facilitates worldwide trade. Air carriers deliver USD 6.8 trillion of goods annually, accounting for 35% of world trade by value. As an example of the variety of air freight cargoes, in a typical 24-hour period, international air cargo transfers 80,000 flowers, 140,000 tonnes of cargo, 200 racehorses, and 1.1 million smartphones. Air cargo is typically transported in one of two modes. It may be carried on a cargo-only aircraft, often known as all cargo carriers or dedicated freighters. Passenger aircraft may also transport freight in their lower decks (Bartle et al., 2021).

Air cargo plays a vital role in the global economy by connecting markets across the world. It's a fast and dependable option, especially in regions where capital costs are high, making it crucial to reduce shipping times. While air shipments account for just 1% of the total cargo tonnage, their value represents 35% of the market when measured by worth rather than weight (International Air Transport Association (IATA), 2018).

The new coronavirus that causes COVID-19 has had a complicated and dynamic impact on worldwide air freight operations and supply networks, and it continues to do so. In response to the international public health crisis, the global air cargo network was activated to allow for the international movement of critical medical supplies, personal protective equipment (PPE), pharmaceutical products, and, eventually, vaccines. Air cargo also ensured the continued supply of imported foodstuffs and responded to increased demand for consumer products in support of national lockdown policies, individual countries' COVID-19 containment regulations, and shifting consumer purchasing patterns (not least the increased demand for online shopping and next-day home deliveries). As a result, aviation cargo transportation is a key component of the worldwide response (Budd & Ison, 2022).

Air cargo loading operations in terminals necessitate precise cargo load planning and fast airside loading operations to save expenses associated with excess cargo loading rework and unused space in the unit load device (ULD) or pallet. Real-time visualisation and load optimisation are becoming increasingly relevant as a result of dynamic loading issues such as the separation of dangerous items and intrinsic lithium batteries, weight balance, and oversize cargo handling. Airlines and air cargo terminals must comply with international safety standards and regulations when planning air cargo loads. Air freight loading requires intricate considerations of center of gravity (CG), payload and yield maximization, and computation time (Wong et al., 2021).

The air cargo industry has become a key player in the global economy, playing a crucial role in transporting high-value goods. The growing demand from industries and consumers has driven the rapid growth and evolution of the freight industry over the past few decades (Sahoo et al., 2022).

The air cargo business connects global markets and plays a crucial role in distribution. Demand for this industry can be particularly volatile: for a variety of reasons, it is common for

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requests to be dropped or placed on very short notice, forcing shipping airlines to be flexible in order to quickly adapt their schedules to cater to a greater number of customers and remain competitive in a very demanding industry (Delgado et al., 2020)

Air freight transportation is important in the global economy because it provides a dependable and efficient method of delivering goods from suppliers to buyers. Due to the interruption of global supply chains in the COVID-19 crisis, the need of an effective air cargo network has become apparent when uncertainties are encountered, such as when life-saving pharmaceuticals and medical equipment need to be delivered (Zhu et al., 2023). Door-to-door air cargo operators incur flight delay expenses due to late package delivery (Liu et al., 2019)

The most crucial component of any business, particularly those involved in production, is supply chain management. A well-managed supply chain will undoubtedly benefit the business both now and in the future. Every business is striving to advance its supply chain operations using a variety of strategies and tactics. To remain competitive and thrive in the market, every business will work tirelessly to increase output, efficiency, quick, simple service, and continue to develop new technologies (Oktarina & Gunawan, 2022).

The airline sector will experience a sharp decline in passenger demand when COVID-19 arrives. Airlines' primary source of revenue under COVID-19 is cargo. This is to be expected in the post-COVID-19 environment, at least temporarily. Additionally, airlines will re-engineer their business processes in order to reduce operating costs. It is anticipated that airlines will utilize business automation and data analytics solutions extensively in order to increase productivity. Future research on the impact of these interventions on company risk is warranted (Choi, 2021).

From the point of origin to the point of consumption, supply chain management covers the transportation and storage of all finished items, work-in-process inventory, and raw materials. The purpose of the supply chain is to enhance the value of a product by transporting it from one place to another or by performing a process of modification. When it comes to supply chain risks, supply chain risk management encompasses a broad range of tactics designed to recognize, evaluate, reduce, and track unanticipated occurrences that could potentially affect any link in the chain, primarily in a negative way (Kurniawan et al., 2021).

Global trade and supply chain management (SCM) present inherent hazards. Globalisation and commercial openness have exacerbated SCM susceptibility and increased hazards (Zhao & Huchzermeier, 2018).

Effective supply chain management (SCM) aims to meet operational requirements while minimising costs and risks. Reducing costs often entails reducing inventory, negotiating unit and delivery prices, and other classic cost-cutting measures. Reducing risk is usually focused on the regular demand-driven stock outs, the risk of routine supply chain interruptions (supply failures, delivery or timing issues, and related supply chain quality concerns), emergent supply and demand forecasting failures (weather emergencies driving demand up and supply down, for example), and other such mismatches between supply and demand that are fundamentally external to the organisation (Davis & Vogt, 2021).

The supply chain management operation method was used for mapping supply chain activities, the house of risk 1 was to determine the priority of the risk agent. The method to find out and reduce unexpected costs that the company may experience caused by the risks in supply chain (Kurniawan et al., 2021).

To conduct risk analysis in logistics, to analytically model risk by employing some risk measures, such as variance downside-variance, spectral risk, and so on (Choi, 2021).

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The House of Risk (HOR) method is a supply chain risk management paradigm that builds on the principles of the House of Quality (HOQ) and Failure Models and Effects Analysis (FMEA) (Oktarina & Gunawan, 2022).

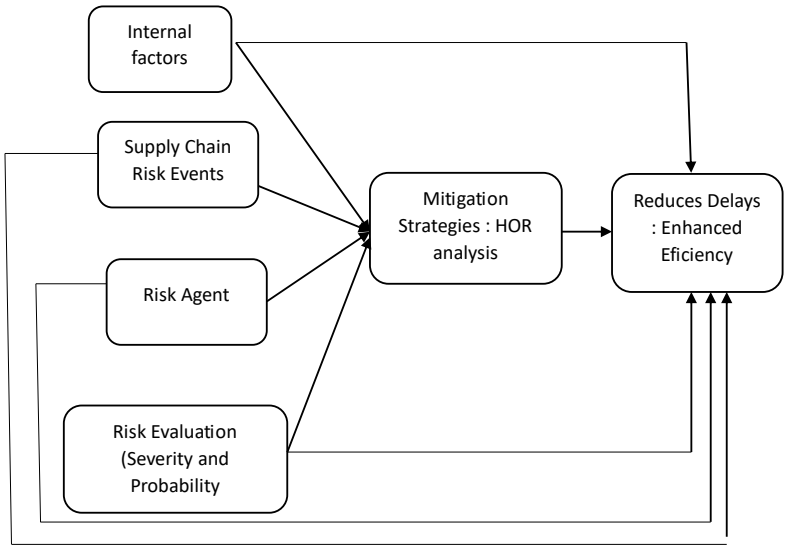
The House of Risk, also known as HOR, is an extension of the Quality Function Deployment (QFD) model and the Failure Modes and Effect Analysis (FMEA) approach. Its objective is to prioritize the identified risk sources so that the most efficient steps can be taken to lower risks and risk sources. Reducing the risk factors typically results in the prevention of some risk events. The House of Risk is a risk management approach that prioritizes preventive steps to identify the root cause of risk, which is a critical step before determining the most suitable mitigation strategies (Wibowo & Ahyudanari, 2021).

SCM performance measurement is very important to reduce costs, fulfil customer satisfaction and increase company profits and to determine the extent to which the company's supply chain performance has been achieved (Listiyono et al., 2024).

The House of Risk (HOR) technique is a model for evaluating the risk of occurrences in the supply chain that is generally used as a framework (Palengka et al., 2024).

Supply chain management (SCM) is a unified procedure. Production activity involves obtaining raw materials from suppliers, creating value, keeping inventory, and distributing finished items to merchants and consumers (Rachmadhani et al., 2023).

Figure 1 Conceptual Framework



METHOD

This research uses the House of Risk method (Risk identification, Risk Analysis, Risk Evaluation) and Supply chain operation (SCOR).

The SCOR model's strength lies in its ability to provide a standardized format that makes communication easier. It's a valuable tool for upper management to design and reshape their supply chain in order to achieve the desired performance (Huan et al., 2004).

Using the SCOR model to measure supply chain performance based on processes allows companies to evaluate their supply chain as a whole. This approach helps them monitor and control operations, align organizational goals across different functions,

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understand their position relative to competitors, and identify areas for improvement to gain a competitive edge (Putri et al., 2019).

The Respondents were Operational Managers, Operational Supervisors, and Air Cargo dispatchers from logistics service providers involved in air cargo transport to Papua. They were chosen for their direct role in the day-to-day operations of air cargo services and their expertise in managing logistical risks.

The initial data analysis technique used SCOR method. The application of SCOR used 5 map the existing flows in the supply chain based on the SCOR perspective (Plan, Source, Make, Deliver, Return).

The analysis Technik used House of Risk analysis tool. The HOR analysis method is an analysis tool that helps in carrying out risk identification and risk mitigation activities in the goods distribution supply chain.

Table 1 Severity assessment scale for risk events

Scale	Name	Description	Scale	Name	Description
1	No Effect	Has no effect on the whole lateness	6	Medium influence	Affects around 50% of the total lateness
2	Almost no effect	Affects about 10% of the total lateness	7	Quite big influence	Influences around 60% of the total lateness
3	Very low impact	Influences around 20% of the total lateness	8	Big impact	Influencing around 70% of the total lateness
4	Quite low impact	Affects around 30% of the total lateness	9	Very big influence	Influence > 70% on the whole lateness
5	Low Influence	Influencing around 40% of the total delay	10	The goods are definitely late	The goods are definitely late

Table 2 Scale for assessing the occurrence of risk agents

Scale	Name	Description	Scale	Name	Description
1	Almost never happens	from 10 deliver 1 times occured	6	Currently likely to happen	Out of 10 deliveries 6 times occurred
2	Very small chance happen	Out of 10 deliveries 2 times occurred	7	The probability of this happening is quite high	Out of 10 deliveries 7 times occurred
3	Very few possibilities happen	Out of 10 deliveries 3 times occurred	8	High possibility happen	Out of 10 deliveries 8 times occurred
4	Little possibility happen	Out of 10 deliveries 4 times occurred	9	Very high possibility happen	Out of 10 deliveries 9 times occurred

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5	Small chance happen	Out of 10 deliveries 5 times occurred	10	Must be happen	Out of 10 deliveries 10 times occurred

Table 3. Correlation Assessment Scale between risk agents and risk events for HOR stage 1, as well as correlation values between preventive action.

Table 3 Correlation assesment scale

Scale	Description
0	No correlation
1	Low correlation
3	Middle correlation
9	High correlation

Table 4 Scale of Degree of Difficulty / Level of Difficulty in Implementing Preventive Action

Scale	Description
3	Mitigation actions are easy to carry out
4	Mitigation actions are somewhat difficult to implement
5	Mitigation actions are difficult to implement

RESULTS AND DISCUSSION

Results

Risk agents are things or causes of the occurrence of a risk event. In this research, risk agents are defined as factors that lead to risk events which can result in delays during the process of shipping goods via air cargo. Based on observations and interviews that have been carried out, 18 risk agents were found from 12 previously identified risk events regarding delays in the shipment of goods via air cargo.

Correlation assessment between event risk and agent risk

Correlation assessment between each risk event and risk agent is carried out to determine the value of the relationship between the two. This assessment was carried out using a correlation scale of 0, 1, 3, 9 which was assessed by interviewing and filling out a questionnaire by the three respondents who directly handled and understood the process of shipping goods via air cargo. The results of filling out the correlation assessment questionnaire between each risk event and the risk agent causing delays in air cargo.

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Table 5 Matriks House of risk

Code		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	Si
Risk	E1	9																		6
	E2	3	9	1										9						8
	E3		1	9		1			3					3						8
	E4				9				9	9		3								7
	E5			3		9			3	3		3		3						9
	E6						9													10
	E7			3	3	1		9	9	3	9	9		3						8
	E8			3	3	1		3	9	9	9	9		3						7
	E9							3		3	3	9	9	9						3
	E10			1					3						9	9				9
	E11														3	9	9			8
	E12	3							9	3					3	9	9	9	9	6
	Oi	3	2	5	3	7	2	3	6	3	5	2	3	2	7	6	6	2	3	
	ARP	280	170	800	320	725	180	305	1985	615	720	425	810	395	863	1245	755	109	165	
	Grade	12	14	4	10	5	13	11	1	8	7	9	17	15	3	2	6	18	16	

Table 5 House of risk showed the risk agent with the highest ARP value, namely risk agent (A8) with an ARP value of 1985 "the number of goods sent is considered too many" and the risk agent with the lowest ARP value is risk agent (A18) with ARP value 165 " Activities in the transit warehouse are not properly supervised.

The Risk Assessment stage at House of Risk is carried out to obtain the existing aggregate risk potential value based on the severity value for each risk event, occurrence for each risk agent, and the correlation between each risk event and the risk agent.

The aggregate risk potential calculation obtained in this research shows how big or small the risk is based on the risk agent that has been identified regarding delays in sending goods using air cargo.

The formula for determining the aggregate risk potential (ARP) value is as follows :

$$ARP_j = O_j \sum S_i \, R_{ij} \quad (1)$$

Description :

ARP_j : Aggregate Risk Potential
O_j : The probability value of the risk agent occurring (occurrence)
S_i : Assess the impact of the risk event (Severity)
R_{ij} : Correlation value between risk event and risk agent

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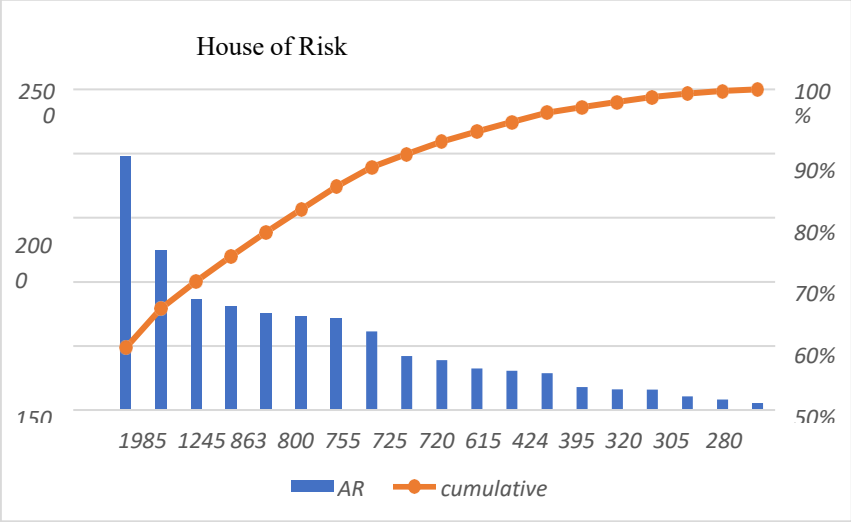
The risk evaluation stage aims to determine the priority risk agents that will be handled based on the aggregate risk potential value which has previously been assessed based on the stage 1 house of risk matrix. Risk evaluation is carried out using Pareto diagram analysis and risk mapping using the Probability Impact Matrix.

Figure 2 Diagram Pareto



In the Pareto diagram, a classification will be sorted from left to right to show the order value from highest to lowest. Pareto diagrams help in finding a problem that will be prioritised for handling/mitigation. With the concept of 80:20, where by prioritising 80% of handling of risk agents with the highest ARP value through the risk of the process of shipping goods via air cargo.

Based on data from the Figure 2 and Table 5 there are 9 priority risk agents that will be given mitigation treatment. Some of these risk agents include A8, A15, A14, A3, A16, A5, A10, A9, and A11 with a total cumulative value of 79.8%. The following is a table of priority risk agents along with aggregate risk potential values.

Discussion

Table 6 Priority risk agents along with aggregate risk potential values

Stage	Code	*Risk Agent*	ARP
1	A8	The number of items sent is considered too many	1985
2	A15	The plane's cargo was unloaded	1245
3	A14	There was a backlog for products at the RA warehouse.	863
4	A3	The pickup schedule provided by the original warehouse does not follow the schedule.	800
5	A16	Aeroplane delays are caused by numerous factors	755
6	A5	The fastest flight baggage slots to Papua region are full.	725
7	A10	The transit warehouse is insufficient to hold all items.	720
8	A9	Wrapping, tagging, and labelling activities provide slow-release energy throughout the day.	615
9	A11	Activities in the transit warehouse are not properly supervised.	424

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The description from table priority risk agents along with aggregate risk potential values, the explanation as follows :

1. **(A8) The number of goods sent is considered too many**

Risk agent (A8) The number of goods sent is considered too much and has the highest ARP value, namely with a score of 1985. Based on the interview results, the number of goods is considered too much because in one delivery, it is simultaneously followed by deliveries to other areas.The questionnaire results obtained in this research show that the risk agent (A8), has a correlation/relationship with several risk events, including having a high correlation with risk events (E4), (E7), (E8), (E12). And has a moderate correlation with risk events (E3), (E5), (E10).

2. **(A15) The plane's cargo was unloaded**

Risk agent (A15) Offloaded aircraft baggage so you have to wait for the next flight has an ARP value of 1245. Based on the results of the interview, offloaded aircraft baggage is a situation when goods cannot be entered into the aircraft's baggage even though already got a baggage slot on that day. This is because the aircraft used is a commercial aircraft / passenger aircraft, so the priority baggage to enter the aircraft is the passenger's baggage, sometimes the airline also has a queue for deliveries from other companies that have not been sent, so the company has to wait for the flight furthermore. The questionnaire results obtained in this research show that the risk agent (A15) has a correlation/relationship with several risk events, including, having a high correlation with risk events (E10), (E11), and (E12).

3. **(A14) There was a backlog for products at the RA warehouse.**

Risk agent (A14) There was a queue of goods at the RA warehouse with an ARP value of 863. Based on the results of the interview, the RA / Regulated agent is a security inspection agency for the contents of goods to be sent by airplane. Queues for goods at the RA warehouse can occur because the RA is full and there are many procedures that must be gone through, such as re-weighing of goods, x-ray inspection and document inspection. The questionnaire results obtained in this research show that the risk agent (A14) has a correlation/relationship with several risk events, including having a high correlation with the risk event (E10). And has a moderate correlation with risk events (E11) and (E12).

4. **(A3) The pickup schedule provided by the original warehouse does not follow the schedule.**

Risk agent (A3) The pick-up schedule provided by the original warehouse is not according to the schedule with an ARP value of 800. Based on the results of the interview, when picking up goods at the original warehouse, the original warehouse was not on time in releasing the goods. The questionnaire results obtained in this research show that the risk agent (A3) has a correlation/relationship with several risk events, including having a high correlation with the risk event (E3). Has a moderate correlation with risk events (E5), (E7), (E8). And has a low correlation with risk events (E2) and (E10).

5. **(A16) Aeroplane delays are caused by numerous factors**

Risk agent (A16) Airplane delays caused by several factors have an ARP value of 755. Based on interview results, aircraft used for delivery activities often experience delays such as bad weather, engine maintenance. The questionnaire results obtained in this research show that the risk agent (A16) has a correlation/relationship with several risk events, including having a high correlation with risk events (E11) and (E12).

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6. **(A5) The fastest flight baggage slots to Papua region are full.**

Risk agent (A5) The fastest airplane baggage slot for the Papua West Papua region is full with an ARP value of 725, based on interview results, the fastest airplane baggage slot for the Papua West Papua region is often full, because company In 1 day there are only 2 flight schedules for the Papua region, West Papua.The questionnaire results obtained in this research show that the risk agent (A5) has a correlation/relationship with several risk events, including having a high correlation with the risk event (E5). And has a low correlation with risk events (E3), (E7), and (E8).

7. **(A10) The transit warehouse is insufficient to hold all items.**

Risk agent (A10) The transit warehouse is not enough to accommodate all goods with an ARP value of 720. Based on the results of interviews, The questionnaire results obtained in this research show that the risk agent (A10) has a correlation/relationship with several risk events, including, having a high correlation with risk events (E7), (E8). And has a moderate correlation with event risk (E9).

8. **(A9) Wrapping, tagging, and labelling activities provide slow-release energy throughout the day.**

Risk agent (A9) daily freelance staff in wrapping, marking and labeling activities. Having an ARP value of 615, based on the results of interviews, the existing casual daily workers are slow in carrying out activities, because the casual daily workers are tired, the number of goods sent is too large, and there is a lack of supporting equipment during activities. The questionnaire results obtained in this research show that the risk agent (A9) has a correlation/relationship with several risk events, including, among other things, having a high correlation with risk events (E4), (E8). And has a moderate correlation with risk events (E5), (E7), (E9) and (E12).

9. **(A11) Activities in the transit warehouse are not properly supervised.**

Risk agent (A11) Activities in the transit warehouse are not monitored properly. Having an ARP value of 424, based on the results of interviews, activities in the transit warehouse are actually well monitored, but there are often communication problems between employees and casual daily workers, and some casual daily workers often look confused at the start of activities. The questionnaire results obtained in this research show that the risk agent (A11) has a correlation/relationship with several risk events, including, having a high correlation with risk events (E7), (E8), (E9). And has a moderate correlation with risk events (E4) and (E5).

Probability Impact Matrix Analysis Before Mitigation

Based on the results of the Pareto Diagram analysis, 9 priority risk agents were identified. These priority risk agents will be depicted on a risk map using a probability impact matrix table. This is intended to see the risk condition before mitigation steps are carried out. The following is a depiction of the risk before it is carried out. mitigation steps:

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Table 7 Probability Impact Matrix table before mitigation

Probability	Very High					
	High		A5	A14		
	Moderate			A16	A15	A8
	Low			A3, A10		
	Very Low				A9, A11	
		Very Low	Low	Moderate	High	Very High
				Impact		

Risk mitigation strategy

The following is a table of priority rankings for mitigation strategies based on the House of Risk stage analysis:

Table 8 Mitigation priority order

Grade	Code	*Preventive action*	ETD_k
1	PA8	Flexible schedulling by work with multiple airline	11838
2	PA6	Enhanced collaboration with local authorities	9765
3	PA4	Implement real time tracking systems	9556
4	PA2	Leverage technology for customs and documentation	9239
5	PA3	Training for all ground handling staff	6777
6	PA7	Increase staff of ground handling	6534
7	PA5	Provide cargo insurance policies	5629
8	PA1	Regulatory simplification	3485

Probability Impact Matrix Analysis After Mitigation

Based on the results of the Risk Mitigation Analysis, a risk map will be drawn using a probability impact matrix table, this is intended to see the expected risk conditions after the sequence of mitigation strategies that have been identified are implemented. The following is a depiction of the risks after mitigation is implemented:

Table 9 Probability Impact Matrix table after mitigation

Probability	Very High					
	High					
	Moderate	A5	A14			
	Low	A8	A15, A3			
	Very Low	A11	A9	A16, A10		
		Very Low	Low	Moderate	High	Very High
				Impact		

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This study highlights the main risk factors that cause delays in air cargo deliveries, especially in Papua. The results resonate with previous studies on logistics risks, which emphasize how crucial operational challenges and inefficiencies in logistics are to the overall supply chain delays. The suggested preventive strategies, like offering flexible scheduling with multiple airlines and fostering better collaboration with local authorities, provide actionable insights for logistics providers. These approaches are based on the idea that better coordination and planning across different levels can significantly reduce risks, as highlighted by frameworks like the SCOR model and the House of Risk (HOR). Resource limitations make it even more challenging to put these strategies into action. For instance, while hiring more staff for ground handling can help reduce delays from slow or inadequate labour, it demands a considerable investment in recruiting, training, and keeping employees. Similarly, ensuring that essential technology, like real-time tracking systems, is implemented across the network can require a significant financial investment. These challenges are especially relevant in the post-COVID-19 logistics landscape, where many companies are still working to recover financially. The success of these mitigation strategies will rely on a company's ability to adapt to changing market conditions, all while making sure their logistics operations aren't held back by high costs or limited resources.

CONCLUSSION

There are 12 unique risk events were identified through the utilization of the HOR analysis in the research. These events or circumstances possess the capacity to cause product delivery delays. In addition, nineteen risk agents were identified in total. The mentioned risk agents are substances or origins that aid in the occurrence of the risk events. Nine (9) risk agents were determined to be of the greatest significance out of the entire set. As these priority risk agents were identified as the main contributors to the delays, they became critical targets for mitigation strategies.

As a response to these critical risk factors, the research proposed a set of eight preventive measures. The primary objective of these measures was to directly tackle the causes of delays that were identified. In order to maximize their effectiveness, they were executed in a specific order. A methodological approach for risk mitigation was upheld by organizing the sequence of actions according to the potential consequences and feasibility of implementing each measure.

The ultimate goal of the research is to provide the organization with practical and effective strategies to reduce or eliminate the probability of disruptions in their logistical operations, particularly concerning aviation cargo shipments bound to Papua. By implementing the recommended preventive measures, the company is expected to increase the dependability and efficacy of their logistics operations, which is the anticipated result of this research. Through the implementation of this strategic approach, the company can effectively bolster customer satisfaction, sustain a competitive advantage within the logistics sector, and ensure punctual deliveries.

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