INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN BUSINESS & SOCIAL SCIENCES

Vol 14, Issue 9, (2024) E-ISSN: 2222-6990

Identifying Delay Factors in Maritime Operations: A Case Study of Ship Owner Perspective

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To Link this Article: http://dx.doi.org/10.6007/IJARBSS/v14-i9/22318 DOI:10.6007/IJARBSS/v14-i9/22318

Published Date: 04 September 2024

Abstract

International seaports and shipping lines frequently faced communication failures, leading to significant costs for ship owners. This study aimed to identify and address these issues by analyzing operational processes. Through in-depth interviews with personnel across various departments, a business process model was developed, highlighting ten interrelated processes susceptible to communication errors. Key processes, actors, risks, potential errors, and recovery plans were identified. An analysis based on cause-and-effect relationships revealed 34 root causes of communication delays. Notably, from the shipowners' perspective, crew activities were identified as a major factor impacting port communication. Additional findings included delays caused by STS vessels occupying the port, adverse weather conditions leading pilots to avoid boarding, and uncleaned barges upon arrival. For future work, these insights suggested that improving coordination, leveraging technology, and establishing clear protocols could help mitigate communication disruptions, particularly those related to crew activities.

Keyword: Business Process, Cause-And-Effect, Communication, Delay, Maritime.

Introduction

The surge in port operations demands has become a significant concern not only for businesses in shipping-related industries but also for policymakers and planners. Ports enhanced their intelligence and efficiency to accommodate more vessels in shorter durations by minimizing delays in port operations(Nikghadam, 2021). But communication failures throughout the process expose stakeholders to various risks, including cargo loss, ship incidents, potential loss of life, shipment delays, poor vessel performance, and more. (Zaib, 2022). Looking at maritime business flow, a variety of stakeholders, such as port communities, shipping companies, and supply chain facilitators, actively participate in the logistics system (Osman, 2022). The ship owner's duty is to ensure the safe and timely transportation and delivery of goods or cargo, ensuring the absence of damage or loss. They are obligated to safeguard the vessels within their ownership and operational purview according to the

regulations stipulated by governmental authorities. International conventions governing maritime transportation establish guidelines to determine the extent of the carrier's accountability, whether it pertains to the entirety of the assigned cargo or a specific portion that has been affected (Jaradat, 2021). These regulations cover diverse facets, spanning safety standards, environmental prerequisites, crew qualifications, and various legal obligations. This responsibility is paramount for the preservation of the comprehensive legality, safety, and environmental conscientiousness of maritime operations (Serra, 2020). In relation to that, effective communication is crucial in ensuring the safety, efficiency, and overall success of maritime operations. However, the occurrence of failures in communication within this complex and interconnected system can have far-reaching consequences (Jevon, 2022). It is essential to identify cause-and-effect relationships daily. Visualizing these relationships helps to identify, examine, and deal with the causes of problems; however, there is a knowledge gap because the communication model lacks the views of ship owners.

Thus, this study investigates this based on the following objectives: (a) to identify delay key factors and business processes involved in operations; (b) to identify and analyse the delay factors in communication links; and (c) to model the process, key actors, and delay factors. The focus centres on the frequently occurring delays that directly impact ship owners and shipping lines. This paper is organized as follows: Section 2 provides a review of the literature. Section 3 presents the methodology, followed by analysis and findings. Sect. 4 presents the discussion, and finally, Sect. 5 concludes the study and puts forward future research directions.

Literature Review

Essential processes in maritime shipping includes shipping, logistics, port operations, vessels management and other associated services (Akan, 2023). To ensure efficiency, there are significant responsibilities borne by ports and operators that lead to unique behavioral patterns among merchant ships, which strive for swift arrival at the port to effectively meet their operational need (Gonzalez, 2021). Apart from that, in a vertical shipping network, diverse individuals and stakeholders play distinct roles in the structure of the system. Contributors to the liner shipping ecosystem encompass ship owners, shipping agents, forwarders (transportation brokers), ship supply companies, container port operators, shippers, class and insurance companies, stevedoring companies, customs administration, maritime police, banks, and various other stakeholders (Okur, 2022).

Effective and prompt communication is essential for ensuring a well-functioning ship and the overall success of maritime activities. Furthermore, it is a continual process and meeting the needs for continuous and prompt information exchange between the vessel, operations manager, and agent is crucial for the ship's positioning procedures and routine progress monitoring. This safeguards effective control over potential delay in both time and costs (LIAPAKI, 2010). Effective communication is vital in the shipping industry, influencing numerous facets of maritime operations and logistics (Ji An, 2022). Moreover, management communication is not an isolated event, it heavily depends on situational and cultural events (Muhamedi, 2017).

A study by Shad (2022), highlights that effective project management requires communication management to ensure the project's tasks are performed efficiently and

effectively. This involves planning, executing, controlling, and monitoring communication activities. In maritime prospects, there are technologies that facilitate distance-controlled information systems and allow online communication between ships and management offices situated onshore by (Demirel, 2022). While monitoring long-distance wireless communication over the sea, Changzhen Li (2021), focused on the wireless channels between ships and coastal infrastructure, as well as between ships in coastal waters. The study highlights the importance of robust communication systems in maritime operations, which is further supported by the endorsement of a Port Community System (PCS) by all stakeholders due to its associated advantages and responsibilities. Literally, ports are encouraged to accelerate the implementation of port community system, striving to create a unified information hub that allows all users and stakeholders to efficiently exchange information and documents through a single portal (Mthembu, 2022).

Research Methodology

This study consists of three main steps, and Figure 1 shows the overall steps. Step 1 is the creation of an inventory of information-sharing links between actors, which entails recognizing and charting communication and information-sharing connections among the involved parties, adhering to established Business Process (BP). This step holds particular significance, given that certain information-sharing links, particularly those involving bilateral communications, may not be officially documented in procedural guidelines, making them challenging to trace.

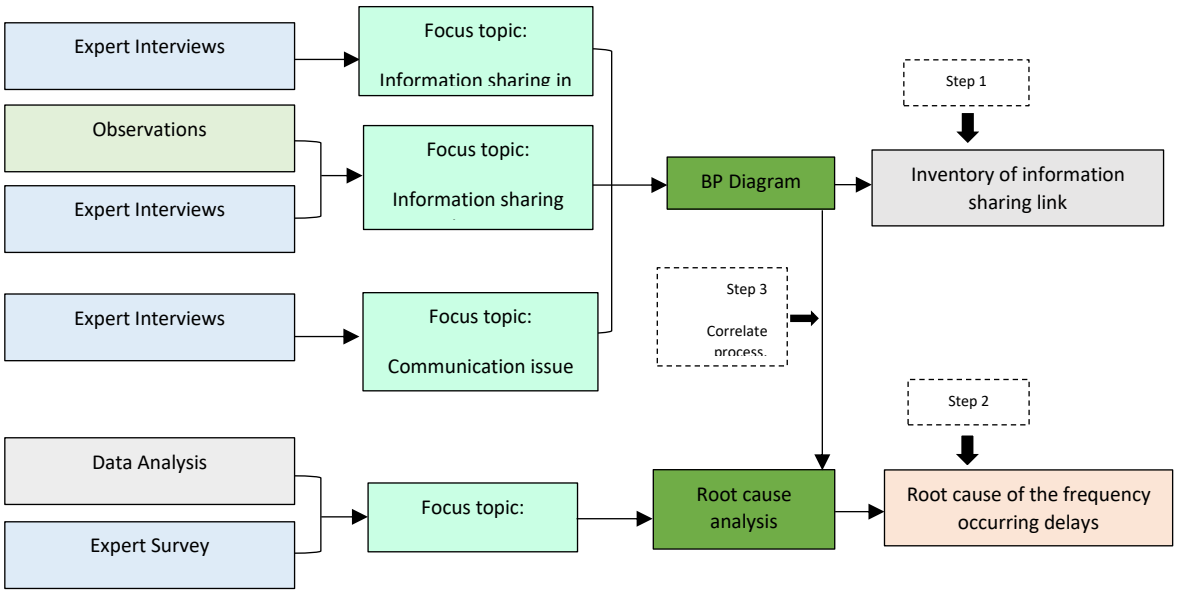


Figure 1. Research methods.

Step 2 concentrates on identifying the root causes of frequent delays. During this phase, a thorough examination is conducted to pinpoint key areas within the process where mitigating delays is most important. In this case study, tacit knowledge regarding the planning and execution of processes has been gathered from one of the local ship owner companies in Malaysia. A cause-and effect diagram adapted from Nikghadam (2021), has been used to identify the existing events and additionally to identify potential delays occurring specifically based on respondents perspectives. Step 3 identified critical information-sharing links and

issues in the BP and correlated the actors with the cause-and-effect diagram to be analysed. By reconstructing the sequence of events from the root cause to the delay, various communication opportunities and management actions can be assessed. When information links involve the same entities or pertain to the same subject, they can be grouped.

Case Study from one of the Ship Owner Liase in Klang Port

The method were applied to a maritime shipping company located in Klang Valley, Malaysia. This company has operated for more than 30 years and is a Malaysia-registered owner and service provider for tugs and barges handling 70–90 shipments per year. It has actively transported containers, bulk, and project cargo with our barges, plying routes in Malaysia, Singapore, Thailand, Indonesia, Cambodia, and South Vietnam. They offered barge charters for various types of cargo, such as coal, PKS, pet coke, sulfur, gypsum, feldspars, and other types of mineral cargo. Barges are also available for project cargo. All their vessels are manned by qualified crews, well equipped, and comply with international marine requirements. The exploration distinguished between information sharing in the planning and operational domains. For the planning domain, semi-structured interviews with various departments of the actors in the period of September–October 2023 have been conducted. Three (3) experts and managers each from the internal departments of finance, business operations, and maritime operations themselves. The experts will explain the communications involved in delivering their services to incoming and outgoing vessels. For the operational domain, two semi-structured expert interviews and field observations were conducted in the same period. The interviewees were an executive and manager for the said shipowner company located in Klang Valley, Malaysia. After the information-sharing links have been derived, they have been validated by experts. To find out the delay factors, a root cause analysis serves as the method to uncover such indirect causes. There were two semi-structured, in-depth interviews—one with the ship owner's port agent from Lumut Port and the other with the ship owner's marine manager in Klang Valley.

Findings

The findings reveal an interrelated business process model, as illustrated in Figure 2, which identifies ten main processes highly susceptible to communication errors. The diagram emphasizes that the flow involves various documents, departments, and personnel, highlighting the need for integrated and efficient communication. Figure 2 outlines the major processes and departments involved, including order confirmation, vessel arrangement, agent notification, bunker calculation, sailing, port arrival arrangements, berthing arrangements, loading/unloading, process completion, and clearance.

A model of information-sharing links between the actors is presented in Figure 3. The outlined process and information-sharing links have been benchmarked; since the operations are standard and generic, the diagram shows similarities to those presented by Nikghadam (2021). Next, the analysis correlated business processes (BP) with delay factors. This correlation highlights the processes along with associated delay factors, potential risk events, errors, and recommended recovery plans. Figure 4 shows snapshots of the findings; refer to Appendix 2 for the detailed list.

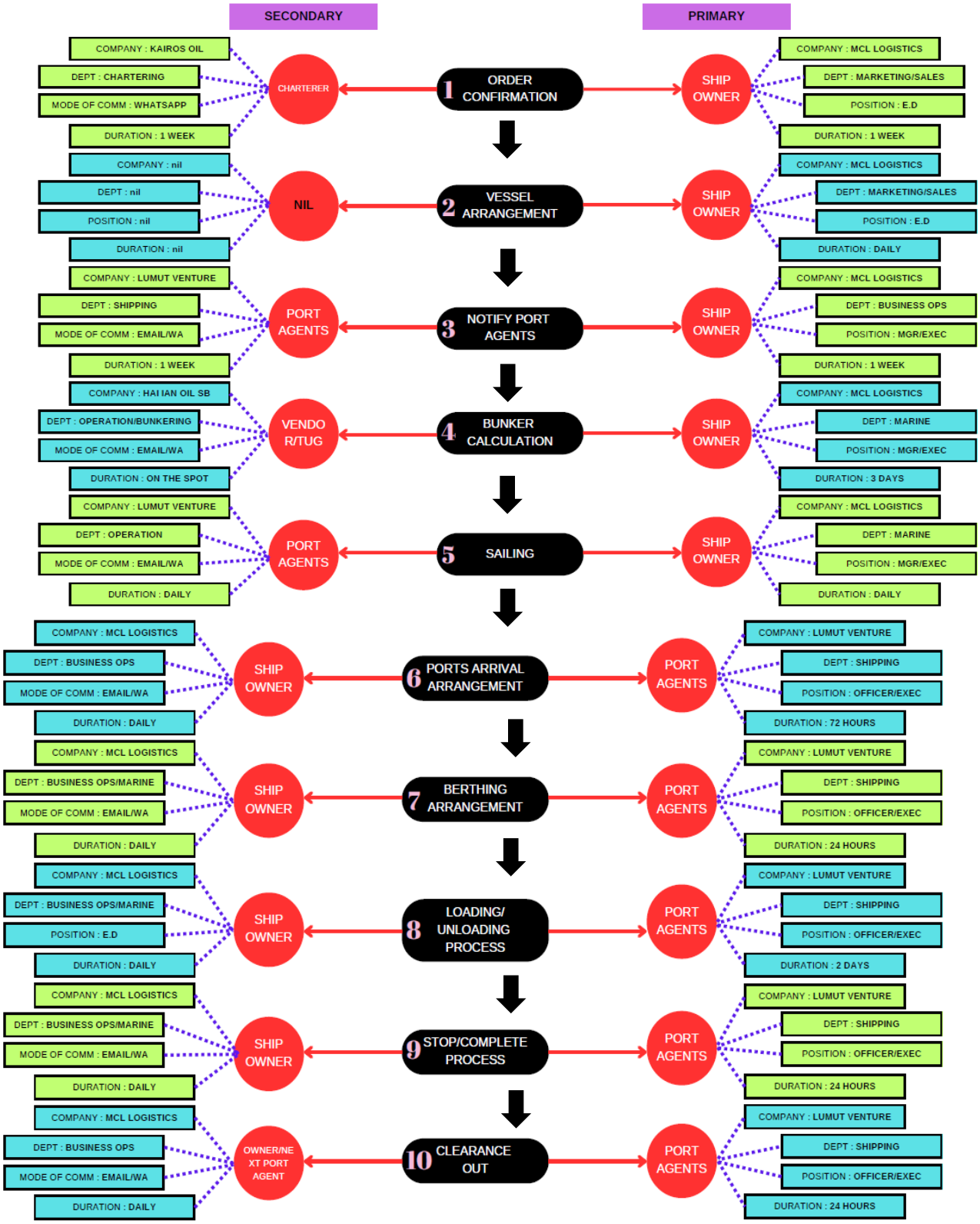


Figure 2. Business Process and documents used.

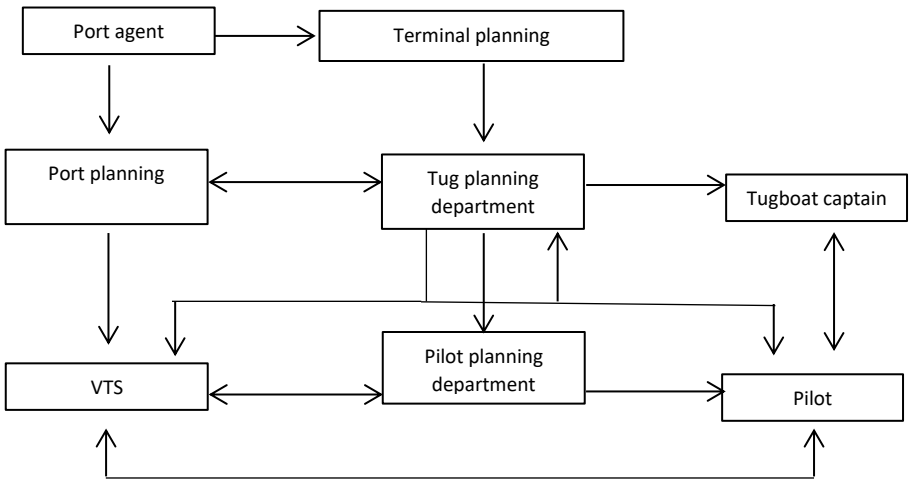


Figure 3. Information links between actors. Adopted from (Shahrzad Nikghadam K. F., 2021)

1.	**PROCESS** Order confirmation	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		**Duration**
		Ship owner	Company	MCL Logistics	Risk event	Order cancellation; change of POL; revise laycan	1 week
			Department	Marketing/Sales	Potential error	No vessel available – unable meet demands	
			Position	Exec. Director	Recovery plan	1-month prior planning	
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		Charterer	Company Name	Kairos Oil SB	Risk event	Export permit validity	2 weeks
			Department	Chartering	Potential error	Confirmation not within timeline	
			Mode of communication	WhatsApp; email	Recovery plan	Ship owner to send reminder	
2.	Vessel arrangement	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Ship owner	Company	MCL Logistics	Risk event	Vessel stops for docking	Daily
			Department	Marketing/Sales	Potential error	Wrong updated live-schedule	
			Position	Exec. Director	Recovery plan	Daily checking	
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		NA	NA	NA	NA	NA	
3.	Notify port agents	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Ship owner	Company	MCL Logistics	Risk event	Last minutes changes	1 week

			Department	Business operation	Potential error	Delay in notifying agents; outdated certificates	
			Position	Manager/Executive	Recovery plan	Assigned task reminder; monthly certificates checking	
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		Port agents	Company Name	Lumut Venture	Risk event	Missed ship owner email; last minute changes	1 week
			Department	Shipping	Potential error	Incomplete documentation; delay arrival	
			Mode of communication	Email; WhatsApp; phone calls	Recovery plan	Cross-checking email	
4.	Bunker calculation	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Ship owner	Company	MCL Logistics	Risk event	Missed task/calculation;	3 days
			Department	Marine	Potential error	High bunker rate	
			Position	Manager/executive	Recovery plan	Early/bulk purchase – block quantity with fixed rate	
			Duration				
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		Vendors & tugboat captain	Company Name	Hai Ian Oil Sdn Bhd	Risk event	Purchased not ready	Immediately
			Department	Operation/bunkering	Potential error	Last minute purchase	
			Mode of communication	Email; WhatsApp	Recovery plan	To proper manage early purchase	
5.	Sailing	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Ship owner	Company	MCL Logistics	Risk event	Weather condition – affect vessel performance	Daily
			Department	Marine/crew	Potential error	Pirates during voyage	
			Position	Manager/executive	Recovery plan	Safety precautions	
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		Port agents	Company Name	Lumut Venture	Risk event	Wrongly key-ed in vessels arrival details	Daily

			Department	Shipping	Potential error	Delay in receiving clearance documentation from last port	
			Mode of communication	WhatsApp; email	Recovery plan	Owner to provide daily status with complete documentation	
6.	Port arrival arrangement	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Port agents	Company	Lumut Venture	Risk event	Low tide – draft exceeded max water level; bad weather condition	72 hours
			Department	Shipping	Potential error	Cargo not ready; permit validity; delay payment by shipper; incomplete/wrong documentation; invalid ETA;	
			Position	Officer/executive	Recovery plan	Tide monitoring using tide table book by Jabatan Laut	
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		Ship owner	Company Name	MCL Logistics	Risk event	Delay arrival; navy check	Daily
			Department	Business operation	Potential error	Delay information received from agents; incomplete documentation from shipper/cnee	
			Mode of communication	Email; WhatsApp	Recovery plan	Build good relationship with agents; seek help from shipper to expedite immediate process	
7.	Berthing arrangement	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Port agents	Company	Lumut Venture	Risk event	Port congestion; bad weather; Unforeseen incident while waiting	24 hours

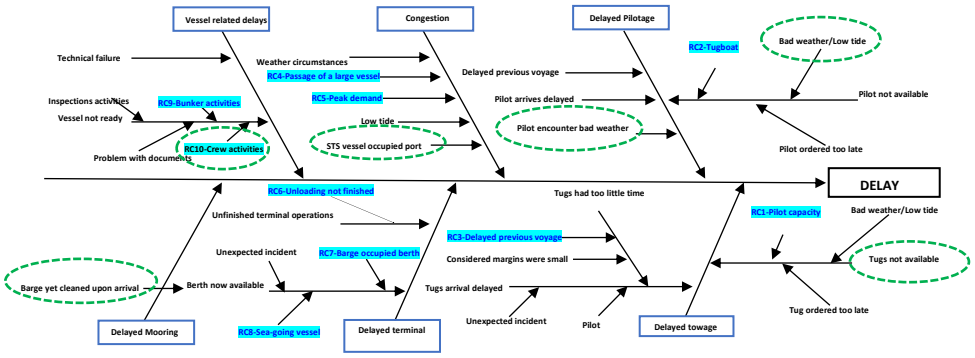
			Department	Shipping	Potential error	Delay information from port/terminal	
			Position	Officer/executive	Recovery plan	Crew to be ready 24/7; agents to request line-up from port planning	
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		Ship owner	Company Name	MCL Logistics	Risk event	Payment delay by shipper which hold any further process	Daily
			Department	Business operation; marine	Potential error	Delay in information received from agents; crew not in standby mode	
			Mode of communication	Email; WhatsApp; phone calls	Recovery plan	Provide training for crew on-board – strengthen the awareness	
8.	Loading/ unloading process	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Port agents	Company	Lumut Venture	Risk event	Bad weather condition; slow process arrangement	2 days
			Department	Shipping	Potential error	Stockpile distance; trucks availability	
			Position	Officer/executive	Recovery plan	To urged port planner to provide more trucks for speeding the process; hire more on the ground worker	
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		Ship owner	Company Name	MCL Logistics	Risk event	Poor vessel maintenance leads to broken parts during on-going process; tank-top; unforeseen incident	Daily
			Department	Business operation & marine	Potential error	Delay information by	

						port agents on current status	
			Mode of communication	Email; WhatsApp; phone calls	Recovery plan	To establish proper channel of communication and proper escalation channel; crew to take turn monitoring the process	
9.	Stop/ complete process	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Port agents	Company	Lumut Venture	Risk event	Pilot/surveyor unavailability	24 hours
			Department	Shipping	Potential error	Wrong quantity load due to unclear communication; insufficient cargo	
			Position	Officer/executive	Recovery plan	Agent to communicate to both shipper and owner for clear information	
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		
		Ship owner	Company Name	MCL Logistics	Risk event	Low tide – barge grounded; insufficient canvas	Daily
			Department	Business operation & marine	Potential error	Delay in notifying next port agent – human error	
			Mode of communication	Email; WhatsApp; phone calls	Recovery plan	Establish proper checklist/shipment tracking	
	Stop/ complete process	**PRIMARY**	**ACTORS INFO**		**DELAY FACTORS**		
		Port agents	Company	Lumut Venture	Risk event	Process ended during weekend; delay clearance readiness	24 hours
			Department	Shipping	Potential error	Delay departure due to low tide	
			Position	Officer/executive	Recovery plan	Early request for officer OT	
			Duration				
		SECONDARY	**ACTORS INFO**		**DELAY FACTORS**		

		Ship owner/next port agent	Company Name	MCL Logistics	Risk event	Fresh water level/bunker/delay payment	Daily
			Department	Business operation & marine	Potential error	Information not tally; poor speed performance	
			Mode of communication	Email; WhatsApp; phone calls	Recovery plan	Daily monitoring; provide proper training; early planning and reminder to crew on-board	

Figure 4. BP and delay factors

It was discovered that there are 35 root causes, which were plotted into a cause-and-effect analysis; the findings are shown in Figure 5. Benchmarking against the work of Nikghadam (2021), it was found that most of the recurrent causes were similar. However, six specific items differed: bad weather and low tide, crew activities, pilots encountering bad weather and choosing not to board, tugs not being available at the requested time, and barges not being cleaned upon arrival. From the perspective of respondents in this study, the most frequent delay factor requiring further investigation is root cause no 10, which pertains to crew activities related to loading and unloading cargo, maintenance work, and shift changes, all of which contribute to delays in port communication.



:*Additional factors from the ship owner perspective*

Figure 5. Cause-and-effect diagram of delay analysis.

Table 1
Root causes and impacts

No	Root of causes	Impact
1	**Pilotage Delays Caused by a Shortage of Available Pilots**	leading to increased waiting times for vessels and potential disruptions in port schedules.
2	**Towage Delays Caused by a Shortage of Available Tugboats**	resulting in interruptions to the maneuvering of ships and potential delays in port operations.
3	**Tugboat Arrival to an Assignment Was Delayed Due to Delay from Previous Voyage**	causing cascading delays for subsequent operations.
4	**Fairway Congestion Caused by the Passage of a Large Vessel**	leading to delays and reduced navigability.
5	**Fairway Congestion Caused by Peak Demand**	causing delays and extended waiting times.
6	**Terminal Delays Caused by Unfinished Loading Activities**	leading to interruptions in the vessel's departure schedule and overall port efficiency.
7	**Delayed Terminal Operations Caused by a Barge Occupying the Berth**	preventing other vessels from docking and disrupting cargo handling schedules.
8	**Delayed Terminal Operations Caused by Sea-Going Vessel Occupying the Berth:**	causing disruptions in planned docking sequences and cargo operations.
9	**Vessel's Delayed Departure Caused by Unfinished Bunker Activities:**	affecting the vessel's schedule and subsequent operations.
10	crew activities related to loading and unloading cargo, maintenance work, and shift changes	disrupt may the coordination and timing of port operations.

Discussion

The key findings from the case study are the following: Firstly, every node in the business process is very prone to communication failures. The primary cause of delays stems from heightened demands on ports and the excessive use of port resources. Maritime business process disruptions induce problems through the transportation process, which cause delays and financial losses to maritime organizations and shippers (Yang and Hsu, 2018). Thus, effectively managing this pressure necessitates meticulous planning of port resources. This involves ensuring the timely arrival of ships based on the availability of the port's resources. This departure from the current approach, characterized by highly inaccurate estimated time of arrivals (ETAs), time windows determined solely by terminal planning, and the inability to plan port resources until vessels reach the port, is essential for efficient resource management. Planners and decision-makers must arrange a schedule that aligns with the needs of the terminal (Leon, 2022).

Secondly, information-sharing links exhibit interdependence and extend across organizational boundaries. The entity transmitting information typically receives data from a preceding source and frequently needs additional input from multiple senders to make

informed decisions. This interdependency introduces intricacies in determining both the source of information and the subsequent recipients. The existence of inter-organizational links further compounds the challenges associated with information sharing. To enhance information sharing, ports must develop operational guidelines tailored to their specific context. Companies should craft compelling change narratives that outline the organization's digital vision, along with the objectives and significance of the ongoing changes (Raza, 2022).

Thirdly, addressing the impact of crew activities on port communication is important. Enhancing information sharing among stakeholder can help alleviate delays attributed to individual actors. Research by Smith & Johnson (2018) found that crew activities, during the loading and unloading cargo, shift changes, and maintenance work, can lead to delays in port communication, by which these activities require coordination and communication between the crew members, port authorities, and other relevant stakeholders. This is supported by study findings that certain crew activities, such as equipment breakdown or unexpected maintenance issues, can result in communication delays (Li, 2021). Consequently, these communication delays can lead to disruptions in the supply chain, increased waiting times for vessels, and additional costs for shipping company. In addition, a report by the International Maritime Organization (IMO) emphasized the need for effective communication protocols in ports to ensure safety and security.

Conclusion

This study adapts a three-step method for examining information sharing across maritime business operations, aiming to identify business processes and factors of delay. This method helps identify essential information that needs to be shared and determine the appropriate recipients and the findings offer valuable insights into operational delays along with their significance in the context of information sharing. To proactively address delays and prevent their escalation, specific information-sharing links were identified as essential for this study. Significant findings to the delay factors from ship owners' perspectives are the port resources allocation during vessels processes. Thus, it is essential for port authorities and stakeholders to recognize the potential challenges posed by delayed terminal operations and implement strategies to mitigate factors affecting communication delays. This leads us to suggest future directions for extending our work that may include improved coordination, the use of advanced communication technologies, and clear protocols for addressing communication disruptions caused by crew activities. Further research and practical interventions are necessary to address this issue and enhance overall port efficiency and safety.

Acknowledgement

This research has been funded by Postgraduate Studens Grant, UiTM

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