Enhancing the Digitalization in Port Activities Toward Appropriate Legal Framework

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Abstract. The shipping industry conducts the majority of global trade; therefore, it must have a safe, cost-effective, and environmentally friendly mode of commercial transportation. Statistics indicate that maritime catastrophes have steadily decreased over the past decade, even though many incidents have drawn public attention to this issue. Even the International Maritime Organization has issued resolutions in the last decade to improve the safety of the shipping industry's new regulations. Maritime incidents impact the marine environment in a variety of ways. Marine Pollution is caused by accidents and collisions, as well as human errors such as oil spillage, solid refuse, oil transfer, and bunkering. This study aims to investigate the marine pollution resulting from operational and collisions. In addition, the method is the analytical provision of the applicable marine environment law. According to the research findings, collisions between ships are becoming increasingly hazardous to the environment due to collision for all parties involved regarding human lives, the environment, and economic losses. In addition to shipping accidents, collisions, and oil leaks, ship's bilge water, ballast water, and the discharge of solid refuse into the sea cause irreversible Marine Pollution and environmental risks.

Keywords: Shipping, Supply Chain, Legal framework, Maritime law, Digitalization, Dwelling Time.

1 Introduction

The logistics industry has been revolutionized by globalization and internationalization. The fast changing process of economic globalization poses serious challenges for transportation management. (M. Coe, N: 2014). International logistics systems and global supply chains are developed as a result of worldwide economic integration and globalization of business. (Coe, N. M., & Yeung, H. W. C. (2015). In today's interconnected world, countries trade commodities and services with one another through export and import activities, forming what is known as the international mar-

M. Umiyati et al. (eds.), *Proceedings of the International Conference on "Changing of Law: Business Law, Local Wisdom and Tourism Industry" (ICCLB 2023)*, Advances in Social Science, Education and Humanities Research 804,
https://doi.org/10.2991/978-2-38476-180-7_93

ket. (Fokina-Mezentseva, K., Melnyk, T., Diatlova, V., Buhas, V., & Shatska, Z. 2020).

Global integration fosters more significant trade, financial, and technological interdependence and interconnection among nations. The World Bank, a specialized agency of the United Nations, plays a crucial role in promoting global integration through its programs and initiatives to reduce poverty and promote sustainable development. Two significant publications that offer rankings and analyses of countries' economic competitiveness in the international market are the Institute for Management Development's (IMD) World Competitiveness Yearbook and the Annual Global Competitiveness Report (GCR).

Institutions, infrastructure, the macroeconomic environment, health and primary education, higher education and training, the efficiency of the labor and goods markets, the growth of the financial markets, the state of technology, market size, business sophistication, and innovation are all factors that contribute to a country's ranking in the World Economic Forum's Global Competitiveness Report. The report offers insights into each nation's competitiveness strengths and weaknesses and can assist policymakers in determining areas for improvement.

Poor international competitiveness is a direct result of high logistical costs in those countries (Devlin & Yee, 2005). The best way for a country to get a logistical edge over its rivals is for its government to do an in-depth analysis of the existing state of its logistics system and determine which parts need to be improved through policy and initiative (Jhawar, Garg, & Khera, 2017). It is possible to conduct the study as either an in-country assessment of the logistics system or a cross-country assessment of the logistics system. When it comes to evaluating how amenable a country is to international trade and transportation, the Logistics Performance Index (LPI) created by the World Bank is the gold standard. (Mešić, A., et. All., 2022)

The LPI has considerably improved the interaction between policymakers and the business sector in determining trade and transportation facilitation goals. The World Bank has created a Logistics Performance Index (LPI) for each country. (Göçer, A., et.all (2022). Customs, infrastructure, international delivery, logistics competence, quality, tracking and tracing, and timeliness are all included in this index. Logistics can impact trade speed and security, which has implications for cost reduction (Hausman, W. H., Lee, H. L., & Subramanian, U. 2013). Lack of logistical infrastructure and operational processes may be a big barrier to global trade unification, hence the quality of logistics services may have a major impact on international trade (Devlin and Yee 2005). Due to high logistics costs, many ASEAN countries's Logistic Performance Index (LPI) ranks are low e.g. Indonesia still trailed at 55, Malaysia at 28, Vietnam at 53, Thailand at 38, not like Singapore at 1 (World Bank 2023). Since licensing and trade regulation is very complicated, the cost burden for exporters is high. Indonesian exporters need up to 5.4 days to complete export paperwork. This period is longer than Thailand's 2.3-day period, Malaysia's 1.6-day period, and Singapore's half-day period. As a result, logistics costs in Indonesia will remain at 23.5% of GDP in 2020, 13% higher than in Malaysia, 20% higher in Vietnam, 15% higher in Thailand, and 8% higher in Singapore. (World Bank, 2023)

The World Bank defines port service speed as the amount of time it takes from when a container is unloaded from a ship until it leaves the port terminal via the main door (Haerany, H. & Adisasmita, S. A., 2017) Due to the technical nature of the Dwelling Time issue and the number of involved agencies, a coordinated effort from a wide range of organizations is necessary to find a workable solution. Prolonged residence time will effect the increase of Yard Occupancy Ratio (YOR), resulting in the inability to stack containers from the berthing ship (Kusuma, L. T. W. N., & Tseng, F. S., 2019). As residence duration gets bigger, logistical expenses will also rise. Since dwell time significantly affects the port's productivity, it's important to conduct research on how to cut it down. (Bassan, S., 2007). Longer stays are caused by a number of factors, including but not limited to: inadequate port capacity and navigational aids; vessel clustering; limited cargo handling facilities; high equipment outages; low worker productivity; a lack of storage space; and a lack of storage space. (Gaete, et.all 2017) Dwelling time is also related to the equipment of terminal , including cranes and vehicles, from a technical standpoint.

In 2021, the average dwell time at ports in Indonesia was three-four days, while it is very short in other countries such as Malaysia (2 days), Australia (2 days), America (2 days), France (2 days), Hong Kong (2 days), and Singapore (1.2 days). (UNCTAD, 2021) Additionally, international comparisons are made between Indonesia's logistics performance and that of other countries. Indonesia's logistics performance has been subpar.

Many governments have to reduce logistics costs by up to 7%, and the Port can achieve a consistent dwelling time of 2 - 3 days.(Kusuma, L. T. W. N., & Tseng, F. S. (2019), . Reducing wait times for loading and unloading services at ports is influenced by a number of factors, including fees, facilities, services, information systems, and customs and government laws. The political-economic environment, operating environment, cost environment, infrastructural facilities environment, and preferential incentive environment are the five primary variables in global port logistics that the government must take into account, as stated by Yang. (Gao, T., Na, S., Dang, X., & Zhang, Y. 2018) World Bank also identified five factors—geographic limitations, labor concerns, insufficient security, corruption, and inadequate port infrastructure—that contribute to ports' poor performance. (Wahyuni, S., Taufik, A. A., & Hui, F. K. P. 2020). In addition, the paper includes six indications to boost logistics performance based on the logistics performance index. Indicators include the following: the ease with which items may be cleared, the standard of the trade and transportation network, the affordability of delivery, the quality of logistics services, the transparency of shipments, and the timeliness with which they arrive at their destination. (Sirajuddin, Sirajuddin.2020) Dwelling time has a direct effect on operational costs in ports, as it augmentation of inventory levels and uncertainty in the shipping procedure. Alternatively, dwell durations have increased been identified as a factor contributing to the competitiveness of he port and a consideration in port selection decisions (Artakusuma, A., 2012.) Moreover, from the perspective of port, reducing dweling time periods is a primary objective in the port logistics system.

2 Literature Review

The term "Container Terminal" refers to the land transportation hub where containers are unloaded from ships before being driven to the pier entrance [12]. Import containers must be removed from the ship upon its arrival at the container terminal.

The amount of cargo that can be handled by a port terminal in a given amount of time is known as the port's terminal capacity (Haerany, H. & Adisasmita, S. A., 2017 It is possible to predict the number of stacked containers depending on criteria like container dwell durations and yard storage capacity (Bassan S., 2017) The time it takes to unload containers from the moment a ship pulls into port until the moment the last one leaves is known as the "container dwell time." (Gaete, M., González-Araya, et.all., 2017)

Tentowi et al. state that poor quality and quantity of infrastructure contribute to long periods of residence. Poor adherence to export and import processing times, limited port services, insufficient capacity and service network to support national logistics service providers, infrastructure conditions that do not fully support export-import activities, and overlapping regulations all contribute to a high-cost economy. In addition, the most significant challenge to enhancing the efficiency of port logistics is the documentation of flow structuring. This is because the Port's loading and unloading procedure involves and is supported by 18 separate institutions. These establishments have not abandoned their stodgy, sectorial ways.

Five terms related to Indonesian performance were identified in the aforementioned research literature: port facility and infrastructure availability; information system integration; price and incentive strategy; service quality and deregulation; and administrative procedure regulation. Latent variables in this study's five-factor model of important techniques for decreasing port dwell times in Indonesia's Port of Indonesia. Validity, reliability, and appropriateness of the model and its impacts on lowering port living time in Indonesia are examined by connecting all of these variables using the partial least squares approach and bootstrapping testing.

Figure 1. Documents in Supply Chain Activities

Container Dwelling Time may be affected by factors such as gate operations, the availability and effectiveness of hinterland links, and customs restrictions. Figure 1 shows the most important determinants of Dwelling Time for the container terminal, depending on the research done. These include: 1) the day and month of discharge; 2) the Port of origin; 3) the size and type of container; and 4) the type of goods moved.

The entire time required for the documentation process to release the container is another factor associated with the Dwelling Time of the container. However, with the proliferation of information and the rise of paperless documentation practices, this factor is becoming less important than it once was. The container will go through a number of procedures while it is in the Port.

In general, the duration of container import stay at the Port can be separated into three distinct periods, as outlined below:

1. Pre-clearance refers to the temporal interval commencing from the moment the container is offloaded from the vessel. Simultaneously, the party responsible for importing goods sends a formal notification to the relevant Customs authority. The concept of pre-clearance the activities encompassed in this scope involve the placement of containers in temporary storage as well as the production of Import Declaration documents. During this stage, the carrier will compile supplementary documentation pertaining to import licenses that govern the aspects of security, health, distribution, and trade of the imported items. The issued documents pertain to the prohibition or restriction of the circulation of products. The actions involved encompass the application process for a Lartas license, which stands for Restriction and Prohibition. The customary procedure involves the payment of import duties and taxes through a foreign exchange bank, accompanied by the submission of a Bill of Lading (B/L) and its endorsement by a bank. Subsequently, the B/L is released to get a Delivery Order (D/O), and an L.S. (Letter of Surrender) is issued. One example of pre-clearance operations includes the unloading of goods from the ship, followed by their stacking in the container yard. Additionally, the prepa-

ration of a draft import declaration and the subsequent payment of duties and taxes are also part of these pre-clearance procedures.

2. Customs clearance refers to the duration between the receipt of a Good and the issuance of approval by Customs for the release of said goods. The process of moving containers from the stockpile to the actual inspection site is a crucial step in determining customs clearance, sometimes referred to as the "red line." The Port Authority is required to make necessary arrangements for the physical inspection of designated areas by external entities using examination containers, particularly for goods flagged under the red channel. Additionally, they are responsible for documenting the verification process conducted by Customs, which is a crucial step in obtaining approval for the Release of Goods as part of the customs clearing procedures. Customs inspection documents employ the risk management approach, thereby restricting physical inspections solely to products that are designated for Physical Inspection (Red channel) upon submission. Customs activities encompass a range of actions and processes that are undertaken in the context of international trade and commerce. Transitioning to the inspection yard, specifically the red channel; Relocating to a temporary storage facility; Presenting the necessary import declaration paperwork; Allocation of channel designation; Scrutinizing the submitted documents; Obtaining customs clearance.

Post-clearance refers to the process of releasing imported items from temporary storage, commonly known as post-customs clearance. The determining elements for post-clearance are contingent upon the importers' preparedness and proactivity in promptly terminating items. The other parties are required to assist in the timely processing of goods release, including the necessary documentation, both during regular working hours and outside of regular working hours. The post-clearance activities encompass the transportation of containers from the Port, requiring payments to be given to the port operators. Once the Document has been acquired, the subsequent steps involve the submission of a delivery order (D.O.), the settlement of fees at the transport fleet terminal, and ensuring the preparedness of the receiving warehouse. The procedure for facilitating the release of goods from the Port shall be executed. The actions pertaining to Post Clearance encompass the removal of the container, its subsequent loading onto a truck, and the finalization of payment.

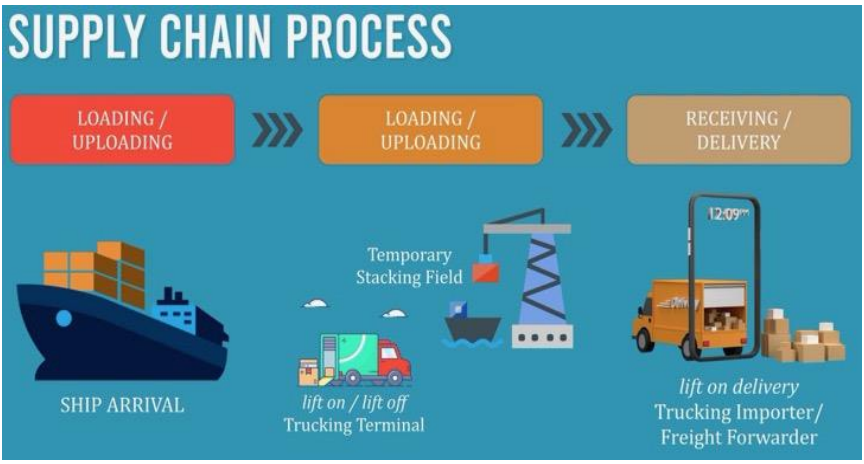

Figure 2. Depicts the flow of goods at ports

3 Discussion

3.1 Factors Cause Dwelling Time

The efficiency of port planning and operation is closely linked to the concept of dwelling time. Based on a separate study conducted to mitigate Dwelling Time, it has been observed that this phenomenon is primarily influenced by two elements: the factor attributed to the Port itself and the factors associated with other stakeholders.

Number	Finding	Causation
1	Long pre-clearance	The licensing process has not been integrated with all relevant authorities into one system of many licensing agencies. It is still not optimal, so import and quarantine permits cannot be carried out. Goods must wait for further permit approval and complete documents.
2	The process of managing documents is quite long.	Document management overlaps between departments, and coordination between departments is weak.
3	Not all parties, importers and exporters, shipping companies, banks, and related parties implement 24/7 service, which is not optimal.	Not all banks offer 24/7 port services. Importers do not pick up containers on Sundays.
4	The custom office does not	A system that is not supported in

	provide cargo manifest data received from another stakeholder	terms of both information technology and policy will make it difficult to carry out the functions of other institutions, such as the Quarantine Agency
5.	There is no smooth coordination between customs and quarantine, and not a few products have been precise but still need to be quarantined.	Lack of coordination between customs and excise risk management (tracking system) and quarantine risk management,
6.	Facilities and infrastructure are not sufficient	Many ports do not have the proper infrastructure to support import and export operations, such as container cranes, forklifts, HiCo scanners, and customs stations, and do not have appropriate quarantine,
7.	The performance of the red lane container inspection process is still not optimal	Therefore, it will increase the actual inspection time of red-line containers. This is because there are no set regulations and a system that is not yet in place. A system that is not supported in terms of information technology and policies will complicate the implementation of the functions of other institutions, such as the Quarantine Agency. Lack of coordination between customs and excise risk management (tracking system) and quarantine risk management causes pest contamination and harms national interests and stakeholders. The physical examination takes a long time because there is no 24-hour service maximum, The Inspector will move the containers to the handling place to save container owners maximum time.

This result faces various obstacles, including regulatory constraints in which the management of the four Indonesian ports is not synergistic concerning all stakehold-

ers interested in ports, not just infrastructure and human resources. Various forms of regulation and management policies stipulated by the relevant Ministries, Pelindo, and the Port Authority show great uncertainty as the agency responsible for dwelling time, which causes high logistics costs. This condition must be considered to create a synergy of public services at the port and eliminate high dwelling time.

From an operational standpoint, overlapping regulations have not been fully passed, making the airport authority a robust system. People must not only monitor but also be able to do something. Collaboration between ministries and agencies, port organizations, financial institutions/banks, and service users is a must to increase transparency, consistency, and efficiency of the import/export process. This should be a key driver for achieving good governance that is transparent and accessible. The customs process and handling of goods involve many agencies, so one of the critical factors is the availability of a portal that allows the exchange of data and information, with each institution providing and accessing the information it needs. Data exchange needs to integrate the system of every facility associated with the INSW gateway.

Export and import permits are services provided by service users issued by various government agencies. It is well known that import-export goods subject to "state restrictions" require special permits from agencies for importing and exporting goods. Prohibited and restricted goods (LARTAS) must comply with any regulation and relevant technical agency, namely the agency or central government department—the latest import and export regulations issues and submitted to the Minister of Finance for final settlement. Several bodies allow or recommend LARTAS, as follows: Ministry of Trade, POM Agency, Ministry of Agriculture (Quarantine and Phytosanitary), Ministry of Energy and Mineral Resources, Ministry of KKP, Ministry of Health, Directorate of Customs and Excise, Ministry of Information and Communication, Ministry of Forestry, Police, Navy, Ministry of Transportation, Intelligent Agent, Bank, Governors, and the Department of Industry and Trade. Import and export licenses must comply with the legal basis of the goods being exported or imported.

According to our research, various regulations should be simplified to achieve good governance and maximum constitutional compliance with public services. The rule will reduce national losses and increase the existence of the Port as a world-class port.

3.2 Strategy for Reducing Dwelling Time

Deregulation of Administrative Procedure

The deregulation of administrative procedures refers to the process of deregulating export-import functions among 18 agencies/institutions, which now exhibit overlapping and obstructive tendencies that impede the documentation process during the loading and unloading operations at the Port. As per the World Bank [2], the assessment of global logistics competitiveness incorporates a set of six indicators, one of which pertains to regulatory and policy domains. The regulatory/policy domain course highlights the key component of the supply chain, with customs being one of the principal inputs. According to Chi-Lok (7), the competitiveness of ports is influenced by customs and government rules. Similarly, Yang (6) conducted a study that

examined the influence of customs factors on operating environment variables. These factors encompassed the efficiency of local government administration, the ease of customs procedures, the efficiency of port operations and logistics, and the integration of customs information and port logistics.

The customs indicator quantifies the level of efficiency in customs and border checks, specifically pertaining to border clearance processes. Yang [6] highlights the importance of the efficiency factor of customs clearance and administration procedures in port management, particularly in the import-export process. The import-export process necessitates governmental authorization due to the prohibition and regulation of certain goods by the State, hence necessitating rigorous oversight. Nevertheless, it is anticipated that this bureaucratic procedure will not impede the movement of commodities along the green line, thereby expediting the process of container removal at the Port. An additional crucial technique entails timely submission of the goods' document (manifest) before to the Container's arrival at the Port, accompanied by the customs inspector's preparedness aligned with the inspection objectives.

Infrastructure and Port Facility

The concept of Infrastructure and Port Facility Availability pertains to the capacity of port operators to furnish efficient loading and unloading infrastructure, as well as sufficient port facilities, to facilitate the movement of products at the port. The deficiency in port infrastructure has been identified as a contributing reason to the subpar performance of ports in Indonesia, as stated by the World Bank [2]. The study conducted by Mussoa [8], titled "Seaports' competition policies: Facts and Figures," and the research conducted by Yang [6], focusing on the theme "Determinants of global logistics hub ports: Comparison of the port development policies of Taiwan, Korea, and Japan," both reached the conclusion that the infrastructure facilities environment is a significant factor influencing the development of global hub ports. According to Caldeirinha [9], the presence of sufficient infrastructure and loading and unloading equipment is a significant determinant of the quality of port services related to loading and unloading.

Integration of Information System Technology

The Integration of Information System Technology refers to the establishment of a document service system that facilitates the integration of 18 ministries/agencies responsible for the licensing process of export-import activities and the handling of commodities at the Port. The implementation of the Indonesia National Single Window (INSW) as a comprehensive information technology system is expected to expedite the licensing procedures associated with both Indonesian exports and imports. By implementing an integrated strategy through this comprehensive service, it has the potential to mitigate the sectoral ego exhibited by each ministry/agency. Furthermore, the establishment of a comprehensive network encompassing shipping lines, port operators, the Directorate General of Customs and Excise, banking institutions, and trucking services, overseen either by the government or an autonomous entity, would facilitate enhanced monitoring capabilities for exporters and importers in relation to

their merchandise. Additionally, this system offers delivery order redemption functionalities such as electronic payment, eliminating the need for cash transactions. It also includes a truck parking system to prevent queues on the highway outside the Port, an auto gate system, and interaction with Inaportnet. The implementation of this system is expected to enhance the level of service provided at the Port, hence improving its overall quality.

The integration of Information System Technology plays a crucial role in enhancing service quality and reducing dwell time at Ports. The suboptimal performance of the Indonesia National Single Window (INSW) and its integration with Inaportnet, E-payment, and other electronic information systems is the cause of this issue. The socialization and integration of systems between port operators and customs, facilitated by the use of the Integrated National Single Window (INSW), remain necessary in order to eliminate the reliance on physical export/import documents that require signatures, wet stamps, and in-person submission. The acceleration of service time is achieved by the utilization of K/L and INSW electronic technologies. The INSW platform enables business actors to conveniently submit export/import licenses using a single online access. Subsequently, the INSW system will proceed to transmit the information to the relevant K/L for subsequent processing. The business entity is obligated to submit the necessary documentation for an export/import license application only once, hence eliminating the need for redundant information across several inter-system licensing procedures within a single submission.

Based on the data given by the Transportation Ministry in 2014, the average dwell time (DT) in Indonesia is reported to be 5.98 days. In the year 2017, there was an observed increase in the average duration, which reached a value of 4 days. Subsequently, in the year 2020, the average duration further decreased to 3.98 days. The duration of stay at Tanjung Priok port is one of the most extended in the Asian region. When comparing the dwell time of other countries, it is seen that Singapore has a dwelling time of only 1.5 days, Malaysia has a dwelling time of three days, and Thailand takes four to five days for loading and unloading containers. The government has established a goal of decreasing the duration of Dwelling Time in Indonesia. Table 2 illustrates the government's endeavor to enhance container service at the container port with the objective of reducing Dwelling Time.

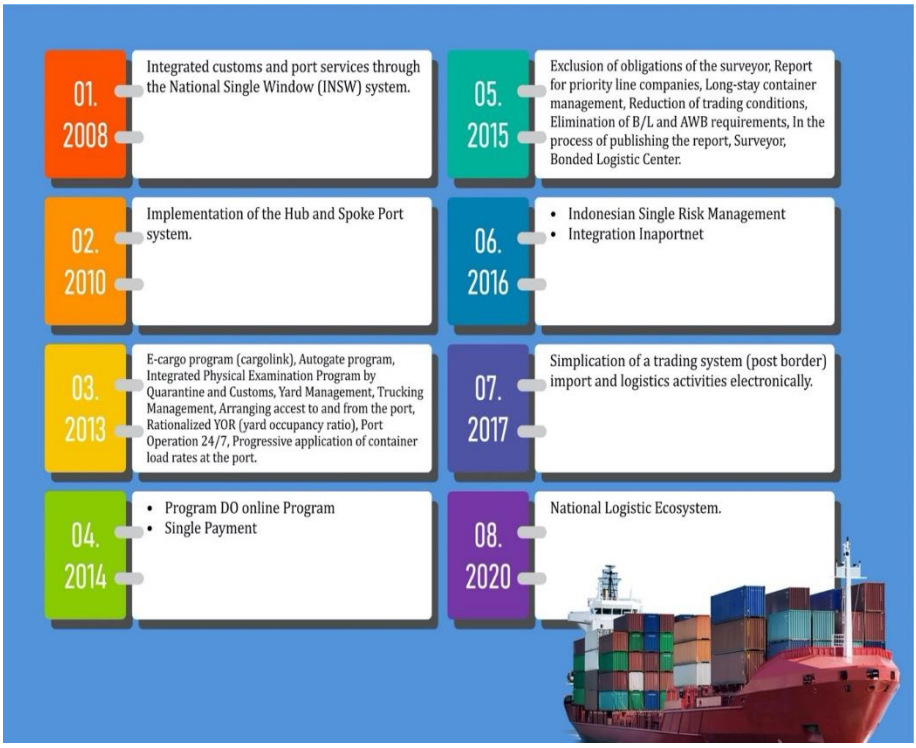

Figure 3. Roadmap Indonesian Government System to Reducing Dwelling Time

The majority of challenges encountered in the field of digital technology can be attributed to an excessive number of regulations and a protracted pre-clearance procedure. A comprehensive set of 74 pre-clearance regulations exists, of which the government has successfully transitioned 60 regulations to an online platform. The objective of the government is to reduce the duration of port dwell times in Indonesia to three days by the year 2017. This goal is based on the implementation of the Indonesian National Single Window (INSW), a system that facilitates the electronic processing of customs documents, permits, and other relevant paperwork associated with export, import, and logistical operations.

3.3 Port Digital System

The e-Document refers to a secure electronic platform that is utilized by both private and public players within the port community. According to Goldby (2013), the utilization of an electronic document system involves the utilization of a unified data entry platform. This platform enables the submission of shipping manifests and other crucial documents to a centralized site, which then automatically disseminates them to the key stakeholders within the logistics chain. The management of electronic documents at ports, namely through the Port Digital System, encompasses many tasks such

as handling manifest shipments of lesser magnitude than full cargo, obtaining authorizations from Customs, coordinating with shipping agents and shippers, ensuring terminal approval for container operations, and facilitating the identification of truck drivers for customs brokers and shippers. In contrast to the previous reliance on physical documentation, the current practice at terminal gates involves the inspection of electronic counterparts, generated by computerized systems, to authorize the departure of cargo from the port. (Cleaner, 2020).

Once payment has been made to the relevant parties and all releases have been enforced, an exit authorization notification is issued. This communication is disseminated to multiple stakeholders, including truck drivers, customs brokers/shippers, and terminals, in order to inform them that each cargo has been authorized for collection (Murray, 2016). In relation to the exportation of goods, the utilization of electronic documentation facilitates the efficient integration of various processes with both Customs authorities and terminal operations. The system employs cutting-edge security measures to effectively gather, retain, and transfer industrial data, safeguarding it against many forms and sources of security breaches (Murray, 2016).

The Port Digital System offers industry stakeholders an electronic platform for sharing information as an alternate method. Moreover, it offers notable advantages such as heightened security, enhanced productivity, decreased transportation expenses, and the advantages of circumventing travel, physical interaction, and document manipulation amongst the coronavirus pandemic. The Port Digital system has the ability to promptly respond by executing the subsequent actions. (The Cleaner, 2020)

1. The proposed approach aims to establish an appointment framework that caters to the needs of all clients, including individuals who depend on arriving goods of smaller quantities, such as barrels, rather than full containers. The implementation of an appointment system serves to mitigate customer congestion, hence facilitating the adherence to social distancing measures during the retrieval of individuals' valued personal possessions;
2. Electronic payments,
3. The submission of vessel paperwork can be done electronically. The port terminal has implemented various measures to ensure the uninterrupted flow of cargo for the shipping industry, which plays a crucial role in meeting human needs. The shipping industry demonstrates strategies for addressing the issues posed by the present crisis and the forthcoming Post-Covid age, which include embracing transformative measures, fostering innovation, and advancing collectively as a cohesive unit by utilizing a shared digital platform.

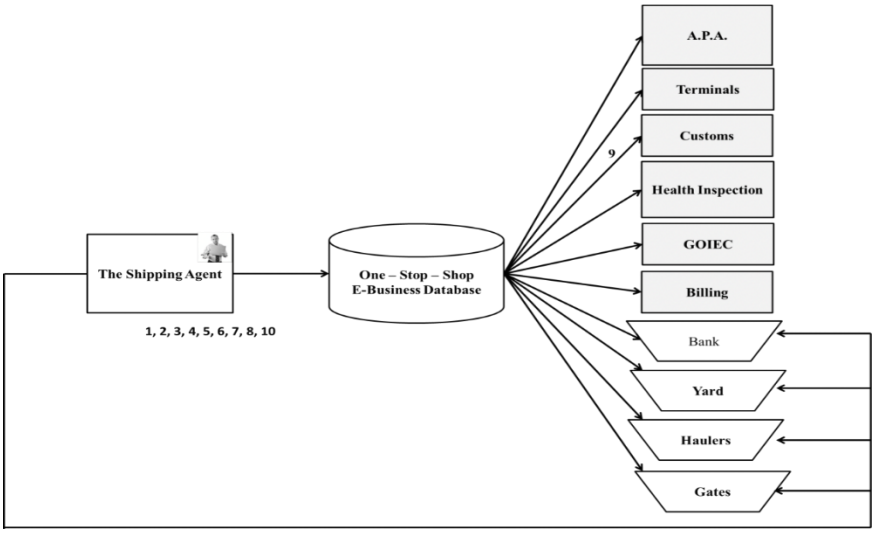

Figure 4. Shopping system diagram

The digital port system Model was applied in Indonesian Ports partially. This section examines the hypothetical scenario of applying the Model in order to explore potential outcomes. Consequently, this analysis does not include any specific values or costs.

The Port Digital System Model has the potential to facilitate hypothetical scenarios through the utilization of certain assumptions. Several of these assumptions are outlined as follows: What are the potential implications of an increasing workload in port operations? The PDS Model suggests that the system should be operated by a team that possesses a high level of skill and professionalism. Additionally, it is suggested that training courses be offered to enhance the skill set of the existing port personnel. However, the augmented workloads also raise concerns regarding the scalability of the system, namely regarding the ability of the hardware and software to effectively process and manage an expanding volume of tasks. Several other ports also face similar challenges, and outsourcing could be considered as a viable alternative for the port to address this situation.

The potential inadequacy of the e-business to meet future demand is a significant concern, as highlighted in chapters 5 and 6. This issue is particularly relevant in the context of the port, where system upgrades are necessary and may be hindered by insufficient funding allocated by the Port authority. The potential resolution to this situation could involve the pursuit of an outsourcing contract.

In order to mitigate security breaches, it is imperative to have a frequently updated security policy. One of the successful options for ensuring system security is the implementation of an intrusion detection system, which functions as a vigilant security guard for the entire system. The incorporation of risk management strategies and the evaluation of insurance coverage should be given due consideration during the preparatory and implementation stages.

The occurrence of technical issues or server failures might provide a significant challenge when attempting to apply the PDS Model. However, it is imperative to have backups, alternative power supply, and a comprehensive understanding of the company network and its objectives. The concept of synergy plays a crucial role in this particular context. However, additional research is required to assess the potential of the PDS Model and the feasibility of integrating it with other port systems in Indonesia.

Digital solutions have the potential to integrate various stakeholders, such as the vessel crew, on-shore personnel, Port, and regulatory authorities, onto a unified information platform. This enables them to conduct activities smoothly without the need to engage in several email exchanges (Goldby, 2013). The execution of tasks, such as the scheduling of maintenance activities, would be expedited and enhanced in terms of efficiency through the utilization of a unified platform that grants all relevant stakeholders access to comprehensive information.

The utilization of machine learning and extensive data can also aid ports in strategizing the logistics of cargo transfer from vessels to land and ultimately to their ultimate endpoint. Currently, containerships experience a significant amount of time, approximately 6% on average, in a state of waiting at anchor. This can be attributed to less than optimal speed profiles. Consequently, the optimal route and rate are computed, so mitigating fuel use and minimizing waiting periods. The aforementioned concept could be further extended to inland areas, with the aim of optimizing the presence of cargo trucks and other vehicles for the timely collection of cargo, precisely when required and without any unnecessary delays. Efficiencies of this nature have assumed a key role within the contemporary milieu.

The marine industry is required to adjust its business practices and reduce expenses in response to the current circumstances. The adoption of remote guiding has the potential to become commonplace in fleet management, leading to enhanced crewing efficiency. In the current era of uncertainty, this measure ensures a crucial level of stability.

4 Conclusions and further research

In Indonesia, the average duration of container Dwelling Time in 2020 was 3.98 days for containers that did not undergo customs inspection, while containers that underwent customs inspection (red channel) had an average Dwelling Time of 11.9 days. The step that consumes the greatest time is the stacking process for custom clearance, which accounts for 69.7 hours or 4.7.82% of the total container dwell time. Additional research pertaining to digital transformation (DT) in Indonesia should aim to address the overarching inquiry that arises following the complete implementation of the three-day DT regulation in the country. The initial inquiry pertains to the objective of minimizing DT, specifically examining the balance between reducing costs resulting from DT and the expenses associated with expediting DT. The subsequent question concerns the assessment of the equity of DT and its impacts on various stakeholders. In addition, it is crucial to consider the transportation of containers beyond the port gate (from the port to the end user), rather than solely focusing on internal port

movements. This aspect is closely tied to optimizing time efficiency and minimizing overall logistics expenses.

The advent of electronic documentation has prompted the supply chain industry to anticipate modifications in their business practices and mitigate dwell time. In light of recent advancements, the shipping industry has witnessed enhanced efficiency and optimization in terms of legal frameworks and vessel operations. The utilization of electronic documents presents a viable solution for achieving worldwide reach and ensuring the stability of the delivery of products and services amidst the prevailing uncertainty caused by prolonged periods of confinement.

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