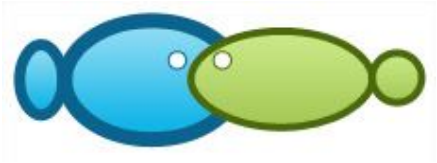

Modelling traditional shipping business integration strategy into the marine toll system: engagement of digital technology in logistic handling

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Abstract. Integration of traditional shipping into marine toll system has been planned to encourage the continuity of logistic distribution system. Unfortunately, traditional shipping sector is unprepared for such integration. This research aimed to identify the discrepancy of traditional shipping activity with marine toll system, to synthesize the integration strategy of traditional shipping activity into marine toll system and to develop a software prototype for traditional shipping service. The research was carried out through a case study in Tanjung Emas Port Semarang. Field survey and literature study were carried out to obtain appropriate information related to current practice of traditional shipping. The research found that there are some differences in shipping practice between marine toll system and traditional shipping, including the schedule, cargo type, capacity, shipping routes, ports linking and service management. Adjustment of business model is needed in traditional shipping practice to improve its compatibility with marine toll system, such as scheduling and routes arrangement. Integration of information and communication technologies (ICT) is also crucial to support the accessibility of information and service of traditional shipping.
Key Words: alignment, continuity, discrepancy, integration, maritime, service.

Introduction. Indonesia is a maritime country which nearly 70% of the territory consists of waters (Tarigan 2018). However, as a maritime country, the development of maritime transportation sector was underconcerned (Suseto et al 2018), including that of the transportation sector (Raga et al 2014; Frazila & Zukhruf 2015). Maritime transportation gained less attention in terms of infrastructure and business management (Fahmiasari & Parikesit 2017). Thus, there is a missing role of maritime transportation in maintaining the interconnectivity between regions. Further impact is shown by the low reliance of logistic distribution through marine transportation, causing disparity in prices of goods among regions (Kadarisman et al 2016; Ratnawati et al 2021).

Currently, maritime transportation as an alternative transportation mean in Indonesia is underdeveloped (Raga et al 2014). Maritime transportation becomes a crucial sector in an archipelagic country like Indonesia where islands are separated by seas (Rochwulaningsih et al 2019). Since most islands are distant each other and the development of inter-island connectivity through land lanes is impossible, maritime transportation should be designed as the main transportation mean (Wahyono et al 2016). Therefore, connectivity between regions could be established through sea lanes. Development of maritime connectivity becomes an important strategy in strengthening supply chain system, especially to support logistic distribution (Amin et al 2021).

Considering the importance of the maritime logistic system, since 2016 the government of Indonesia began the realization of marine toll program (Ratnawati et al 2021). It is expected to support logistic distribution to the remote areas such as small

islands and hinterlands. However, marine toll only connects hub ports, leaving any other ports unreached by marine toll vessels. Therefore, integration of traditional shipping is needed to establish a connection between hub ports and feeder ports (Lazuardy et al 2018). In the other side, integration of traditional shipping into logistic distribution system becomes an empowerment strategy that should be able to maintain its sustainability (Ardhi et al 2018).

Traditional shipping has been existed since centuries ago and is a native transportation mean of archipelagic community (Sunaryo et al 2020). Those ships transport goods from and to a designed location. However, the operation of traditional shipping is typically based on customers' demand (Alnaggar et al 2021). Thus, changes of shipping routes may occur due to the changing market demand.

Traditional shipping in Indonesia consists of various types and sizes of vessels. Typically, traditional ship vessels are built from woods (Malisan et al 2013). However, traditional shipping vessels are developed without certain standard and most likely depend on local community's wisdom (Malisan & Sekar Puriningsih 2015). Typically, traditional ships operate in the domestic area. Regarding the safety and security, traditional shipping vessels should follow the standard provided by the Ministry of Transportation through the Non-Convention Vessel Standard (NCVS).

According to the Government Regulation No. 82/1999 (Government of Indonesia 1999), traditional ships consist of three main categories, including sailboat, motorized sailboat and motorboats with limited size. However, the Presidential Regulation no. 74/2021 (Government of Indonesia 2021) noted that there is limitation of boat size that are integrated in marine toll system. According to the decree, the size for sailboat is not limited, the maximum size of motorized sailboat is 500 GT and the limit of motorboat size is between 7 and 174 GT.

Traditional shipping sector is one that could potentially support the maritime connectivity. However, rapid development in transportation sector has caused a degradation to traditional shipping business (Lazuardy et al 2018). Typically, traditional shipping service performance is lower than other shipping service (Wicaksono et al 2017). Moreover, newly built vessels are equipped with better equipment to ensure its safety and security (Karana 2003). This causes traditional shipping sector unable to compete with the new ship vessels.

Nowadays, technology integration has become a new breath of the community (Rabie 2013). Technology advancement has been driving the development of many industrial fields, including transportation (Din et al 2019; Humayun et al 2020). Integration if ICT is proven to support business performance by improving its effectiveness and efficiency (Cuevas-Vargas et al 2016). ICT integration has been applied in maritime transportation sector. Some softwares and information portals have been developed to support the marine toll system, such as SITOLAUT, Simlala, and Inaportnet (Priadi 2022). Unfortunately, ICT integration has not reached traditional shipping business. Therefore, traditional shipping business is hardly keeping up with the advancement in shipping industry.

Integration of ICT is an important strategy to support the shipping business performance, not to mention the traditional shipping sector. It is needed to improve management and service performance (Nadeem et al 2018; Moldabekova et al 2021). Implementation of ICT integration in the logistic system could be varied, such as the provision of information, booking service, scheduling and tracking (Priadi 2022). Thus, consumers are ensured by professionalism of traditional shipping service providers and therefore alter their trust to make use of the service in their cargo transportation.

Integration of traditional shipping into marine toll program is aimed to accelerate the connectivity of Indonesian islands by empowering the existing activities. Unfortunately, current business model applied in traditional shipping still needs improvements, such as the engagement of ICT to improve its performance. The research aimed to identify the discrepancy of traditional shipping activity with marine toll system, to synthesize the integration strategy of traditional shipping activity into marine toll system and to develop software prototype for traditional shipping service.

Material and Method. The research was carried out in July 2020 as a case study. The research was carried out in Tanjung Emas Port Semarang, in three phases, including: identification of activity model of marine toll and traditional shipping; formulation of strategic integration model for traditional shipping activities into marine toll; and the development of software prototype that promotes the accessibility of traditional shipping activities.

Data collection was carried out through survey and literature study. Survey was carried out through interviews with the traditional shipping crews. The interview was focused on the model of traditional shipping service existed in Tanjung Emas Port Semarang. The indicators included vessel size, type of cargo, shipping routes and scheduling. Literature study was carried out to explore the implementation of marine toll system. The documents used in the study included journals, books, reports, master plans, and regulations.

Framework analysis was carried out to identify the discrepancy between traditional shipping practice and marine toll system. Further, a synthesis was carried out to formulate the integration strategy as well as the adjustments needed by traditional shipping sector to improve its compatibility with marine toll system. To support the performance of traditional shipping in regard to the marine toll system, a software prototype was developed. The software includes information related with traditional shipping activity. Therefore, traditional shipping stakeholders could also adapt to the advancement of technology and be prepared for further advancements in the future.

Results

Business model of traditional shipping vs marine toll. Traditional shipping business in Tanjung Emas Port Semarang consists of various ship sizes, ranging from 116 to 360 GT. Based on the interview data, most of the ships were cruising to Kalimantan. There are various goods transported through traditional shipping. However, the most dominant cargo were groceries, fertilizers and animal foods. Typically, the ships depart from the original port when the ship is full of cargo. Therefore, there is no exact schedule of when the ships would depart.

The shipping routes are typically fixed. However, each ship may have more than one destination port in the same course. The destination ports were including feeder and local ports. On the other side, consumer should directly contact the traditional shipping service provider. Reffering to the model of traditional shipping business, its difference with marine toll vessels could be distinguished as shown in Table 1.

Table 1

Differences of activity model between marine toll and traditional shipping

No.	*Shipping aspect*	*Marine toll system*	*Traditional shipping*
1.	Schedule	Scheduled	Unscheduled
2.	Cargo type	Logistic	Logistic + human
3.	Cargo capacity	Huge	Medium, small
4.	Cruising area	International, domestic	Domestic
5.	Shipping routes	Fixed	Fixed + flexible
6.	Ports	Hub ports	Hub ports, collector ports, feeder ports, traditional ports
7.	Operational management	ICT support available (SITOLAUT, IMRK, Inaportnet, Simlala)	ICT support unavailable

Strategic improvement of traditional shipping. Refering to Table 1, there are differences in the business practice between traditional shipping and marine toll system. These differences may cause compatibility issues, ineffectiveness and inefficiency of traditional shipping integration. Therefore, adjustments are needed to improve the compatibility. Table 2 shows the suggested adjustments for traditional shipping practice.

Table 2

Adjustment of traditional shipping business model

No.	*Marine toll activity*	*Needed integration*	*Integration strategy of traditional shipping*
1.	Schedule	Regular shipping is needed to ensure the integration of logistic distribution	Synchronization of traditional shipping activity to marine toll schedule
2.	Cargo type	Prioritization of goods transportation	Specialization of traditional shipping business in cargo handling service
3.	Cargo capacity	Cargo capacity that meets the market demand	Allocation of appropriate ships in terms of capacity and numbers
4.	Shipping routes	Flexible routes that could provide shipping services on demand	Implementation of routes prioritization and ship allocation decision making system based on market demand
5.	Ports	Shipping lines that connect hub ports to collector ports, feeder ports and local ports	Development of integrated shipping lines to ensure connectivity and continuity of transportation from hub ports to local ports
6.	Operational management	Improvement of information and service accessibility	Development of ICT-based software

Software development. Development of software prototype is purposed to improve the accessibility of traditional shipping service. Thus, consumer could easily access the information they need and arrange their shipping plan. Software development was carried out to overcome some issues related with traditional shipping activity, including:

- customers' disinformation of traditional ships availability, including routes, schedule, cargo capacity and rate;
- customers' difficulties in choosing shipping service provider for their cargo;
- customers' difficulties in relaying order for cargo shipping;
- ineficiency and ineffectiveness of cargo handling management.

Therefore, the software was developed to:

- provide information to the customers regarding traditional shipping service availability, including the routes, schedule, capacity and rate;
- help customers to choose appropriate shipping service;
- facilitate customers to relay orders for their cargo shipping.

Discussion. Logistic integration system in marine toll is purposed to improve the connectivity and continuity of logistic supply chain (Barata 2021). Marine toll system is mainly purposed to promote the distribution of logistic to the remote areas (Ratnawati et al 2021). However, the other function of marine toll system is to collect products from the remote areas to be distributed to other areas (Rochwulaningsih et al 2019). Thus, exchange of products could occur through marine toll system.

Integration of traditional shipping into marine toll activity holds an important role in ensuring the connectivity and continuity of logistic distribution (Lazuardy et al 2018). However, there are various aspects that need to be adjusted to improve its compatibility with marine toll system, including the schedule, cargo type, cargo capacity, shipping routes, ports and operational management. Typically, marine toll vessels operate in a regular cycle to the designed ports (Ratnawati 2019). Therefore, the timing of ship arrival and departure could be estimated. Unfortunately, traditional shipping doesn't have the same service system. Thus, adjustment of shipping schedule is needed to improve its connectivity and continuity of logistic system. Having a synchronous schedule is important to improve the effectiveness and efficiency of logistic distribution. Through a

synchronous schedule, the operational cost and time could be reduced (Liu & Ceder 2017). As the result goods quality could be maintained and additional damage could be avoided.

Typically, marine toll cargo consists of various goods. However, the kind of logistic that could be transported through marine toll is limited as mentioned in the Presidential Regulation no. 71/2015 (Government of Indonesia 2015) and the Minister of Commerce Regulation no. 38/2018 (Ministry of Commerce 2018), including groceries, construction materials, gas and fertilizers (Mubarak et al 2019). Some of the cargos need certain treatment to maintain its quality. Therefore, appropriate cargo handling is needed. Fortunately, traditional shipping activity is mostly related to cargo handling. This shows that current practice of traditional shipping business fits the need of marine toll system.

The integration of traditional shipping into marine toll system is expected to succeed the logistic distribution to the remote areas through lower-level ports (Triantoro & Nurcahyo 2016). This guarantees that appropriate transportation means are available. Since marine toll vessels only stop by hub ports, there is a need for interconnected vessels to transport the logistic to various locations (Wahyono et al 2016). However, the designated shipping destination may have different demand of cargo volumes. Therefore, allocation of appropriate ship sizes and numbers is needed in order to optimize cost and time efficiency.

Optimization of shipping route is needed to support the logistic distribution system. In the integration to marine toll system, traditional shipping plays a major role in the extension of delivery to the areas that are inaccessible by other transportation means. Thus, in order to improve the effectiveness and efficiency of delivery operations, optimized arrangement of shipping routes is needed.

Marine toll vessels are designed to only stop by at designated port, that is hub port. However, the logistics carried by marine toll vessels need to be transported to further location, including the small islands and hinterland at most. Therefore, traditional shipping sector is needed to handle the logistic transportation. Traditional shipping sector includes various types of vessels and operational area. Traditional shipping could facilitate the connectivity between hub ports and collector ports, collector ports and feeder ports, and feeder ports and local ports, or even bypass among port levels. However, in terms of its integration to marine toll system, a proper arrangement is needed to optimize the operational of traditional shipping vessels. What is more important is the interconnectivity between lines. Therefore, traditional shipping vessels need to be distributed accordingly to ensure the continuity of logistic transportation from hub ports to the local ports.

The last thing needed in the integration of traditional shipping sector into marine toll system is operational management. Currently, marine toll service has been equipped with information and communication systems such as SITOLAUT, IMRK, Inaportnet and Simlala (Priadi 2022). Unfortunately, similar systems are still absent in the traditional shipping business. Thus, there is an emergence need of ICT integration to support service provision of traditional shipping business. Engagement of ICT in transportation business is important to handle data management and to support decision making process. Through ICT integration, information concerning traditional shipping activities will be more accessible and will ease communication between customers and service providers.

The integration of ICT in the traditional shipping business needs to be accompanied with the improvement of human resource quality. Implementation of a new system may cause confusion to the stakeholders. Therefore, introduction is needed to the stakeholders, especially service providers so that they would be familiar with the application and could utilize it properly.

Conclusions. The finding of this research suggests that traditional shipping sector needs various improvements to attain conformity with marine toll system. Generally, most of the traditional shipping practices are different from that of the marine toll system. Thus, a great effort is needed to attain the targeted business model. Misalignment between marine toll system and traditional shipping business model was found in the shipping schedule. Some aspects need adjustment to encourage the continuity of logistic

distribution, such as cargo handling and ports linking. Aside from those aspects, integration of ICT into traditional shipping practice is in emergence need, especially in the current digital era, to improve the accessibility of traditional shipping service.

Conflict of interest. The authors declare that there is no conflict of interest.

References

Alnaggar A., Gzara F., Bookbinder J. H., 2021 Crowdsourced delivery: a review of platforms and academic literature. Omega 98:102139.

Amin C., Mulyati H., Anggraini E., Kusumastanto T., 2021 Impact of maritime logistics on archipelagic economic development in eastern Indonesia. The Asian Journal of Shipping and Logistics 37(2):157-164.

Ardhi E. W., Buana I. G. N. S., Ruci D. F. N., 2018 Design architecture cargo acquisition for traditional shipping. In: Proceedings of the 3rd International Conference on Marine Technology, Scitepress, pp. 139-144.

Barata F. A., 2021 The implementation sea toll and supply chain in Indonesia development as maritime country. Jurnal Mantik 4(4):2622-2628.

Cuevas-Vargas H., Estrada S., Larios-Gómez E., 2016 The effects of ICTs as innovation facilitators for a greater business performance. Evidence from Mexico. Procedia Computer Science 91:47-56.

Din S., Paul A., Rehman A., 2019 5G-enabled hierarchical architecture for software-defined intelligent transportation system. Computer Networks 150:81-89.

Fahmiasari H., Parikesit D., 2017 Container shipping network efficiency comparison in Indonesia: Nusantara pendulum and sea tollway. The Asian Journal of Shipping and Logistics 33(2):79-84.

Frazila R. B., Zukhruf F., 2015 Measuring connectivity for domestic maritime transport network. Journal of the Eastern Asia Society for Transportation Studies 11:2363-2376.

Government of Indonesia, 1999 Government Regulation No. 82 year 1999 concerning Transportation in Waters. Jakarta.

Government of Indonesia, 2015 Presidential Regulation No. 71 year 2015 concerning The Determination and Storage of Goods with Fundamental Necessities and Important Goods. Jakarta.

Government of Indonesia, 2021 Presidential Regulation No. 74 year 2021 concerning the Empowerment of Traditional Shipping Maritime Transportation. Jakarta.

Humayun M., Jhanjhi N. Z., Hamid B., Ahmed G., 2020 Emerging smart logistics and transportation using IoT and blockchain. IEEE Internet of Things Magazine 3(2):58-62.

Kadarisman M., Yuliantini, Majid S. A., 2016 Formulasi kebijakan sistem transportasi laut. Jurnal Manajemen Transportasi & Logistik 3(2):161-183. [in Indonesian]

Karana S., 2003 Armada pelayaran rakyat sebagai sarana transportasi angkutan antar pulau dalam era pasar bebas. Alami 8(3):50-56. [in Indonesian]

Lazuardy A., Helmi M., Haryanto E., 2018 The possibility and acceptability of Indonesian traditional shipping as feeder services. In: Proceeding of Marine Safety and Maritime Installation, pp. 13-23.

Liu T., Ceder A., 2017 Integrated public transport timetable synchronization and vehicle scheduling with demand assignment: a bi-objective bi-level model using deficit function approach. Transportation Research Procedia 23:341-361.

Malisan J., Jinca M. I., Parung H., Saleng A., 2013 Traditional shipping transport safety case study: Phinisi fleet (a study on stability, strength and human resources). International Refereed Journal of Engineering and Science 2(2):1-10.

Malisan J., Sekar Puriningsih F., 2015 Pemberdayaan pelayaran rakyat untuk angkutan antar pulau dalam rangka pengembangan wilayah kepulauan di Kawasan Timur Indonesia. Warta Penelitian Perhubungan 27(1):1-10. [in Indonesian]

Ministry of Commerce of Indonesia. 2018. Minister of Commerce Regulation No. 38 year 2018 concerning The Determination of the Types of Goods Transported in the Public Services Program for the Transportation of Goods from and to Underdeveloped, Remote, Outermost and Border Areas. Jakarta.

Moldabekova A., Philipp R., Reimers H. E., Alikozhayev B., 2021 Digital technologies for improving logistics performance of countries. Transport and Telecommunication 22(2):207-216.
Mubarak M., Nuralamsyah, Hanif M. R., 2019 Analisa kebijakan tol laut dan pengaruhnya pada efektivitas to laut. Seminar Sains dan Teknologi Kelautan 2(1):153-157. [in Indonesian]
Nadeem S., Ul-Hameed W., Alvi A. K., Iqbal J., 2018 Performance indicators of e-logistic system with mediating role of information and communication technology (ICT). Journal of Applied Economics & Business Research 8(4):217-228.
Priadi A. A., 2022 Optimalization of smart technologies in improving sustainable maritime transportation. IOP Conference Series: Earth and Environmental Science 972(1): 012084.
Rabie M., 2013 Global economic and cultural transformation: the making of world history. New York: Palgrave Macmillan, 227 pp.
Raga P., Jinca M. I., Pallu S., Sitepu G., 2014 Container transport network analysis of investment region and port transhipment for Sulawesi economic corridor. International Refereed Journal of Engineering and Science 3(4):1-7.
Ratnawati E., 2019 Sea toll as means to increase the effectiveness of goods and services to the eastern of Indonesia. Awang Long Law Review 1(2):120-130.
Ratnawati E., Adiasih N., Sihombing J. S. P., Towadi M., 2021 Sea toll to support the flow of goods: a case study of East Indonesia. BiLD Law Journal 6(2):10-18.
Rochwulaningsih Y., Sulistiyono S. T., Masruroh N. M., Maulany N. M., 2019 Marine policy basis of Indonesia as a maritime state: the importance of integrated economy. Marine Policy 108:103602.
Sunaryo, Lubis A., Ramadhan M. B., 2020 Increasing the safety of traditional shipping using formal safety assessment approach. In: AIP Conference Proceedings 2227: 030004.
Suseto B., Othman Z., Razalli F. M., 2018 The need to reform Indonesia's maritime strategy: a review. Indonesian Journal of Geography 50(2):145-153.
Tarigan M. I., 2018 Implementation of countermeasures effort of illegal fishing in Indonesia (case study on sinking the FV Viking vessel). Journal of Indonesian Legal Studies 3(1):131-146.
Triantoro W., Nurcahyo R., 2016 Feasibility analysis of Indonesian traditional shipping industry to strengthen domestic maritime logistic system. In: 6th International Conference on Industrial Engineering and Operations Management. Kuala Lumpur, Malaysia: IEEE, pp. 1060-1069.
Wahyono E., Tangkilisan Y. B., Marihandono D., 2016 Development of inter-island shipping as a bridge to Indonesian archipelago. Journal of Maritime Research 13(3):29-38.
Wicaksono Y. W., Nugroho S., Yunianto I. T., 2017 Analisis kinerja operasional pelayanan pelayaran rakyat. Jurnal Teknik ITS 6(2):60-65. [in Indonesian]

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