Advanced ERP Application for Marine Transportation Industry in the South Asia Pacific Country; a Case Study

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Abstract. Marine transportation industry is one of the most vital activities in the world. Demand to provide effective and efficient inter-regional connectivity within the marine transportation framework will be a common agenda in some areas. South Asia Pacific region has a member country of more than 14 countries. With the region's economic growth of about 5.3 percent, compared to the world average of 3.2 percent, because it is the most safe area compared to other regions (Antara, 2016). Almost 70% of total world trade takes place among countries in Asia Pacific. In this study, we try to focus on comparative analysis of IT support system to support the operation of marine transportation services in 3 countries namely Indonesia, Malaysia and USA. Some port systems in the archipelagic country particularly the South Asia Pacific region have adopted approaches such as the ERP system, but are still partial. Each part of the port management creates its own information system, and links it to every organization's website. Utilizing existing ERP systems, will be key in designing new frameworks with IOT concepts. With the development of IOT techniques and major investments in marine transportation systems in the Asia Pacific region, intelligent transportation will be able to improve the effectiveness and efficiency of marine and port transportation services processes. The technology of the Internet of Things will enable the development of transportation systems to be more intelligent, safe, harmonious, and energy efficient.

Keywords: Marine Transportation System, ERP, IoT

1. Introduction

Based on The Review of Maritime Transport 2017 published by the United Nations Conference of Trade and Development [1], the demand for world marine freight increased slightly. The increase in world trade volume by marine was 2.6 percent, up slightly from 1.8 percent in 2015, but still below the average growth in the last four decades of 3 percent. With a total volume of 10.3 billion tons, an increase of more than 260 million tons of cargo was added. In UNCTAD calculations, world trade by marine in 2017 will reach 2.8 percent, with a total volume of 10.6 billion tons. The medium-term projection also shows a tendency to increase cargo flows. Still according to UNCTAD, the sea borne trade will increase by an average of 3.2 percent between the period from 2017 to 2022. Surely the value has a profound effect on the design and operation of the marine transportation system, especially the marine port.

Several global issues related to the marine transportation system between countries in recent years have been widely discussed, especially related to marine information systems. The marine information system becomes a standard of analytical resources for public and private institutions in planning
development, managing resources, and supporting Geographic Information Systems (GIS) marine transportation management decisions. Narrey and Shi in their study has developed the concept of marine information system [2]. Marine Information System is limited to providing access to information primarily for ship owners, company ships, and port authorities. However, the information cannot be accessed by external users due to the design of marine information systems.

The development of integrated marine information system has not been fully able to work optimally if implemented in an archipelagic country region, as in several southern and southeastern pacific countries. Each archipelago has its own authority to manage its service system under the control of the local government. Particularly the marine port service system, several governments in each region tend to have their own rules and policies in decision making. Service systems that are still conventional and not yet integrated among stakeholders, also make the marine information system can not be implemented effectively and efficiently.

Some study investigated the relationship between information systems, especially ERP implementation and transportation or logistics systems (Rondinelli et al., 2000; Ince, 2013; Kandananond, 2014). As transport and logistics systems continue to integrate, their impact on the physical environment (air, water, and land resources) will become more complex. Economic globalization, agile manufacturing, fast delivery to markets, and supply chain management create greater demand for intermodal transport services and multi-modal transport infrastructure [3].

Implementation of logistics and ERP systems has revealed that logistics practices and ERP systems have a positive effect on company performance and competitive advantage [4]. On the other study that the successful implementation of ERP relies on five important factors: defining business cases, setting up systems and users, stabilizing for normal operation and maintenance, and improvement [5].

However, some previous studies have not discussed the effect of the IoT (Internet of Things) application trend on the implementation of the ERP system framework to support the marine transportation system, particularly with regard to the geographical conditions of the pacific region. Implementation of ERP and IOT as a new generation of marine port system especially in south pacific region of south pacific island most of the country become the key factor to optimize the performance of marine port.

2. Methodology

In accordance with our previous explanation, some previous studies have not discussed the influence of IoT (Internet of Things) for the implementation of the ERP system framework to support the marine transportation system. In this study, we reviewed the data qualitatively, related to the comparison of port operational systems in the USA, Malaysia and Indonesia. The process of determining the variables as the basis of data comparing the needs of ERP and IOT service users is done by interviewing some port authority authorities and related parties, as well as field observations, major ports in Port Klang Malaysia and Tanjung Perak in Indonesia. While our USA uses secondary data released by Maritime Administrator in 2017. As the basis of comparison data, especially in the pacific asia region we chose to observe the port of Klang Malaysia which has tried to implement this IoT system and has the same geographical characteristics as Indonesia as an archipelagic country.
It is also important to note that the current operating system is still conventional rather than integrated. Local government, shipping companies, and port authorities as service suppliers work individually. On the other hand, there are many additional costs without permission to facilitate the process to be paid by the customer.

As stated in the purpose of this study, it is important to develop a new system to optimize the performance of logistics systems and marine highway programs in Indonesia using the IoT approach, while only using ERP in each stakeholder system for the operating system has not been able to work optimally and fully integrated.

3. The Analysis of Marine Transportation System between Indonesia, Malaysia and USA Country

Utilization of information systems technology in several ports of the world has become one of the key solutions to optimize the performance of integrated systems. The US marine port system for example, has implemented the American Marine Highway program. The program run by the Maritime Administration (MARAD) since 2007 involves dozens of ports along the inland rivers in the United States, by implementing a highway system, diverting the cargo transportation process on land to the water sector [6]. The program has also integrated the port service information system with stakeholders to make marine transfers more effective and efficient.

In the Asia Pacific region especially in southern and southeastern parts, we take the example of archipelagic countries such as Malaysia and Indonesia. One of the main ports in Malaysia is Port Klang. The port management has even implemented the IOT concept, with the release of e-PAN for the benefit of early arrival of ships related to the ship’s security process which will be anchored. And also the e-DCFZ system, which aims to facilitate the processing of dangerous cargo documents and free zones. Implementation of e-DCFZ will help streamline the trading process in accordance with the vision of the port authority of Klang (PKA) and anticipate the government’s vision to improve the ease of doing business in Malaysia [7]. Another case in Indonesia, which recently implemented marine toll programs. The marine transportation system is trying to develop a marine toll strategy that has been done US through the American Marine Highway program.

However, the results of our observations and analysis, especially in Malaysia and Indonesia, found that the implementation of the marine information system still tends to be partial, where each field makes its own application and not yet integrated as a whole. Then also still tend to be technically focused only in certain fields only. In conclusion, not all information systems from each stakeholder can be optimally integrated, and from the user side of the port service is still not satisfied.
Table 1. Comparison of Marine Transportation Industry Conditions

| Operation and Policy of Marine Transportation Industry | Indonesian | Malaysia | USA |
|--------------------------------------------------------|------------|----------|-----|
| - There are approximately 70 major ports spread across 34 provinces. | - There are about 7 major ports of cargo. | - There are about 100 major cargo ports. |
| - Implement marine toll programs. | - Some ports are managed by private companies. | - Implement the American Marine Highway program. |
| - The main port is managed by the government as a state-owned enterprise. | | |

| ERP System Perspectives | Indonesian | Malaysia | USA |
|-------------------------|------------|----------|-----|
| - Implement marine information systems for internal port authority authorities. | - Implement marine information systems for each stakeholders. | - Each port authority has its own information system. |
| - Implementation of ERP is still not optimal, and only in some main ports only. | - Implementation of new ERP is done in some ports only. | |

| ERP and IOT Platform | Indonesian | Malaysia | USA |
|----------------------|------------|----------|-----|
| - Has not implemented integration between ERP and IOT. | - Has applied the e-PAN application for the benefit of early arrival of vessel related to vessel security process which will be anchored. | - Has not implemented integration between ERP and IOT especially for integration of all service process. |
| - Has not integrated the entire service process from each stakeholders in all major ports. | - Implementation of e-DCFZ application, which aims to facilitate processing of dangerous cargo documents and free zones. | |

3.1 Marine Transportation Industry in the South Asia Pacific Country

South Asia Pacific region has a member country of more than 14 countries. With the region's economic growth of about 5.3 percent, compared to the world average of 3.2 percent, because it is the most safe area compared to other regions [8]. Almost 70% of total world trade takes place among countries in Asia Pacific.

Based on the description in Table 1, we tried to use data logistic performance index (LPI) which was released by World Bank in 2106 to compare the growth condition of logistics performance index between Indonesia, Malaysia and USA as shown in Fig. 2 [9]. The results show significant differences from the three countries, from scale 1 to 5 the highest value of USA about 4.0, followed by Malaysia 3.4 and last Indonesia 3.0. Of course with these conditions the opportunity to improve infrastructure and service processes, especially integrated information system tools such as ERP system wide open. Countries with archipelago areas have a good opportunity, if coupled with the approach of marine toll programs such as those run by the US government.
However, before we build an integration system with ERP, it is necessary to map and clarify in advance about the business processes of each stakeholder. By understanding the existing conditions of the stakeholder business processes, it will help build the initial foundation in the ERP integrated network system later.

3.2 ERP System
The development of ERP system was initially more implemented in the manufacturing world, but along with the development of technology in the world of marine transportation system was now widely used. Especially in the marine transport system, based on our case studies on the three countries representing the Asia Pacific and American regions, the ERP system has been implemented in each country, starting with the marine transportation management information system in its region.

Overall, however, the issue of sectoral ego of each stakeholder remains a constraint in the implementation of the system. ERP system that is built is still partial which means each stakeholders create its own system for internal organization only. Has not optimally integrated ERP, also caused by each government in every archipelago or province has its own authority to manage the marine transportation system. So many policies that are made precisely complicate the process of system integration in the field.

3.3 IOT in Marine Port System
The development of IoT platform in the world of industry and especially marine transportation system has not been widely applied. If anyone has started, just an online application that works for one of the processes in a support organization of the marine port system. As we have explained in table 1, the Malaysian port authority has tried to implement an IOT platform to assist the cargoship service process that will carry out loading and unloading process in its territory. However, the application is only specialized to meet the security needs and process of dangerous cargo documents.

While in fact many opportunities that can be taken by utilizing the IOT platform, especially to integrate the entire process of service from each stakeholders of marine ports in their respective regions.

4. The New Generation of Auto Marine Transportation System
Based on our literature study, accompanied by secondary data that we obtained both observation and interviews directly with some authorized officials in Indonesia and Malaysia, there are some fundamental variables that must be met in designing the marine port system to be optimal. All stakeholders’ interests in the port service system must be effectively and efficiently selected.

The fundamental variables in the service system include, among others, the administrative process of the port authority, the shipping company service system, the local government service system including the customs inspection process, the freighter operator information system and of course access as the external service users.

The new generation design of marine transport system, all fundamental variables of each stakeholder need to be integrated in one application service. The use of IOT platforms to be one of the main
objectives at this time, to optimize the performance of marine transport service system.

5. Conclusion
With the rapid development of the pacific south Asia region, together with uneven infrastructure support throughout the region, the demands of a fast and efficient intelligent transportation system is inevitable. Information systems technology, especially in the transportation sector with the IOT concept, is required today.

However, the current perception of the marine transportation system to service users, both shipping companies, governments and some stakeholders is passive, incomplete information is partial and inaccessible, and networking and monitoring functions are not strong enough, all of which result in integration low and low intelligence levels.

Currently, the development of IOT in the early stages and key technology is still in the exploration stage, but has a very strong momentum. With the development of IOT techniques and major investments in marine transportation systems in the Asia Pacific region, intelligent transportation will be able to improve the effectiveness and efficiency of marine and port transportation services processes. The technology of the Internet of Things will enable the development of transportation systems to be more intelligent, safe, harmonious, and energy efficient.

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