

Research, Society and Development, v. 9, n.1, e76911652, 2020
(CC BY 4.0) | ISSN 2525-3409 | DOI: <http://dx.doi.org/10.33448/rsd-v9i1.1652>

**Projeto De Arquitetura Do Documento De Manifesto Eletrônico E Seus Desafios Na
Indonésia**

Architecture Design of Electronic Manifest Document and ITS Challenges in Indonesia

**Diseño De Arquitectura Del Documento De Manifiesto Electrónico Y Sus Desafíos En
Indonesia**

Recebido: 10/09/2019 | Revisado: 17/09/2019 | Aceito: 18/09/2019 | Publicado: 04/10/2019

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Resumo

O transporte tradicional costuma sofrer alguns acidentes. A maioria dos operadores de navios não preencheu os documentos do navio e não os criou para requisitos de segurança, um deles é manifesto. A ausência de manifesto dificulta o mestre do porto de realizar as inspeções. Esta pesquisa tem como objetivo discutir sobre o projeto de arquitetura do sistema eletrônico para documentos manifestos. Além disso, conhecer os desafios na natureza do transporte tradicional na Indonésia. A pesquisa utiliza o estudo de caso do transporte tradicional na província de Java Oriental, entrevistando os entrevistados. O resultado mostrou que o desenvolvimento do ITS ajuda na melhoria da segurança, embora ainda precise de ajustes na organização e nas condições existentes, mas o nível de resistência da implementação do ITS pode ser minimizado. Em conclusão, o projeto de arquitetura desenvolvido como ITS básico pode ajudar o mestre do porto a obter acesso fácil ao documento manifesto. Assim, aumentará a segurança dos navios.

Palavras-chave: embarcação tradicional, manifesto, sistema de transporte inteligente.

Abstract

Traditional shipping often experiences some accidents. Most of the ship operators did not complete the ship documents and did not create the documents for safety requirement, one of them is manifest. The absence of manifest makes the harbourmaster difficult to carry out the inspections. This research has objective to discuss on architecture design of the electronic system for manifest document. Also, to know the challenges of it in nature of traditional

shipping in Indonesia. The research uses case study of traditional shipping in the Province of East Java by interviewing the respondents. The result showed that ITS development helps the safety improvement even though it still needs adjustment on the existing organization and conditions, but the resistance level of ITS implementation could be minimized. In conclusion, architecture design which developed as the basic ITS can help the harbourmaster to get easy access to manifest document. Thus it will increase the safety of the ships.

Keywords: traditional vessel, manifest, intelligent transportation system

Resumen

El envío tradicional a menudo experimenta algunos accidentes. La mayoría de los operadores de barcos no completaron los documentos del barco y no crearon los documentos para requisitos de seguridad, uno de ellos es manifiesto. La ausencia de manifiesto hace que el capitán de puerto sea difícil de llevar a cabo las inspecciones. Esta investigación tiene el objetivo de discutir sobre el diseño de la arquitectura del sistema electrónico para el documento manifiesto. Además, para conocer sus desafíos en la naturaleza del transporte marítimo tradicional en Indonesia. La investigación utiliza el estudio de caso del transporte marítimo tradicional en la provincia de Java Oriental al entrevistar a los encuestados. El resultado mostró que el desarrollo de ITS ayuda a la mejora de la seguridad a pesar de que todavía necesita un ajuste en la organización y las condiciones existentes, pero el nivel de resistencia de la implementación de ITS podría minimizarse. En conclusión, el diseño de la arquitectura que se desarrolló como el ITS básico puede ayudar al capitán del puerto a obtener un acceso fácil al documento manifiesto. Por lo tanto, aumentará la seguridad de los barcos.

Palabras clave: buque tradicional, manifiesto, sistema de transporte inteligente.

1. Introduction

Sea and water transportation have important role for Indonesia as an archipelago country. The mobility of people and goods are very intense in interisland or inland (lake, river, and strait). On the other hand, the ratio of the availability of the modern and registered vessels is 1:11,352 (Kementerian Perhubungan, 2018), it means 1 unit of ship provide service to 11,352 people. Beside those ships, transportation needs are provided by traditional vessel that are not recorded and are not supervised by government. Those vessels are made by wood or fiberglass, and generally have size of ≤ 7 GT. The ships are operated by traditional shipping company or personal. The condition creates challenges, especially on safety.

Naturally, traditional shipping business has its own characteristics to carry out transportation in the waters by using certain size of traditional vessels. Arizal (2016) stated the business does not have any standard in management, documents, operations, technical, and maintenance as minimum requirements in shipping generally. Thus, that affects to level of safety and efficiency. In addition, Act No.17/2008 about Shipping was only managed traditional ships that have size of ≥ 35 GT. Generally, most of traditional ships have size < 35 GT.



Figure 1: Loading car on open deck traditional wood-made ship in Madura Island

This paper is discussing vessels' manifest document. According to (Trade Facilitation Implementation Guide, n.d.), manifest is a compilation of information about the goods carried on a means of transport. The document has function on administration and safety. However, the traditional shipping disregards importance of the document and no inspection from harbor master. Sample of negligence in making the document is accident of KM Sinar Bangun 4 caused by overload. The critical finding from NTSC (National Transport Safety Committee-KNKT), as focus of discussion, was the manifest and SPB (port clearance) document were not found (KNKT, 2018). In addition, it also means that harbor master does not do inspection.

The case illustrated that there was asymmetric and inconsistent information between harbormaster and the operators since it did not have an information pipeline. In conventional way, information pipeline uses paper document, however it faces challenge in time, inconsistency, and risk of data lost. Thus, it could slow down the process of decision making. Exchanging the manifest electronically allows sending the information well in advance (Trade Facilitation Implementation Guide, n.d.). The use of electronic system in the transportation industry is known as the Intelligent Transport System (ITS). The system integrates transportation infrastructure with stakeholders with one of the objectives of increasing safety in transportation.

At present, ITS projects are developing very rapidly in the world. In marine transportation, the development and implementation of ITS still focuses on modern shipping, and has not touched traditional shipping due to several challenges, such as conservative mindset, level of knowledge of the actors, and organizational structure (Arizal, 2016; Febrianto, 2017; Izza, 2016). Therefore, this research has objective to discuss on architecture design of the electronic system for manifest

document, and to know the challenges of it in nature of traditional shipping in Indonesia.

2. Methodology

The research uses case study of traditional shipping in Province of East Java, due to limitation of author in time and funds. Province of East Java is an archipelagic province in Indonesia with land areas of 47,922 km², water areas of approximately 110,000 km², and 42,030,633 people that are scattered in Java mainland and 287 small islands (BPS, 2018). According to data from Department Transformation of East Java Province in 2017, the number of traditional ships that are connected to the province is 2,636 units. In line with topic of the research, the provincial government started to empower the traditional shipping to provide transportation service on route of Surabaya – Kamal (Madura) since Suramadu Bridge being public road.

The author uses field observation to obtain who and how on traditional shipping business process, since it does not have any standard process. The author also conducted interviews with questions determined by respondents consisting of companies, and passengers randomly to get insight. Locus from observation is the area of Province of East Java (Situbondo, Ketapang, and Surabaya). In addition, the research is applying desk study with literature review of implementation of information technology in transportation industry, and also discusses the regulations related to traditional vessel safety in Indonesia.

The next stage is inventorying and reviewing the findings of the field. Thus, it continues on SWOT analysis of traditional shipping business, and the future challenges to fulfill safety standard. Then, the process continues on building a system architecture design that is adjusted to the results of the previous stage, namely organizational architecture which contains details of the organizational structure of the manifest system to minimize conflicts of interest, and technology architecture that explains technology that is in line with field conditions and technology transfer milestones to front.

3. Literature Review

3.1. Literature

3.1.1. Intelligent Transport System

McQueen and McQueen in Arizal (2016) explained Intelligent Transport System (ITS), also called telematics system transportation, including various tools and services originating from information and communication technology combined with transportation infrastructure and its users. Data information can be distributed through various information media to arrive at individuals involved in the transportation process. ITS supports the efficient planning of operations using vehicles.

The information and control technologies is the core of ITS, but human factors are important as well (Jarašūniene, 2007).

Jarašūniene described the concepts of ITS technology for optimizing:

- Information exchange and decision coordination
- Information acquisition and integration between the vehicle and the infrastructure
- Information exchange with new private-sector organizations
- Information exchange with non-transport organizations

3.1.2. ITS Architecture

A system's architecture is the set of principal design decisions made during its development and any subsequent evolution (Medvidovic & Taylor, 2010). ITS requires a framework or system architecture that covers technical and organizational matters. The framework or architecture describes integrated functional processes between organizations so that they are in accordance with the desired goals (Zulkarnaen, 2009).

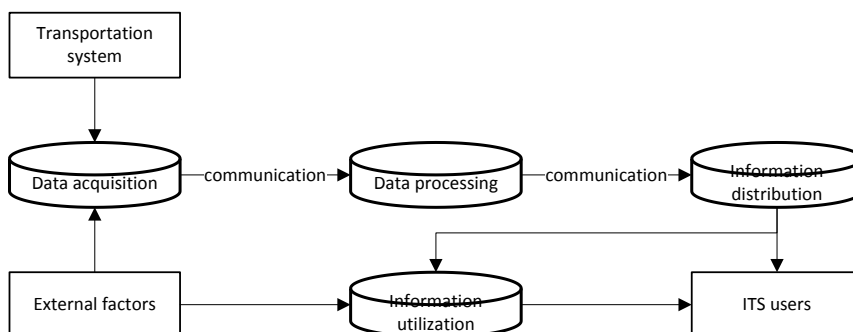


Figure 2: ITS Information Chain

3.2. Regulation

Studies on traditional shipping in Indonesia are rare and, generally, focused on ship technology, not on business processes or basic problems. Traditional shipping is divided into Pelra and non-pelra. Pelra is an organization of traditional people shipping company). The difference between Pelra and non-Pelra companies is the organization. Data of non-Pelra traditional vessel are hard to be found. However, referring to Act No. 18 of 2008 concerning on Shipping, states Pelra is "a traditional business of the people and has its own characteristics to carry out transportation in the waters using sailing vessels, motorized sailing boats, and/or simple motorized vessels with Indonesian flag with a certain size ", then all traditional vessels must be categorized as Pelra.

In the other hand, according to the Article No 126, the vessels with size of >7GT must be completed with safety equipment and certificate. Thus, the vessels with size of ≤ 7 GT are not mandatory to have safety equipment and certificate, including its process. The problem in field, as observed in research locus, the traditional vessels are commonly measured as ≤ 7 GT. The observation found that the measurement method has not been appropriate. Thus, the regulator could not implement safety standard to them. This condition urges composing of special regulation for ≤ 7 GT traditional vessels, especially related to safety standard procedures, including documents.

3.3. Observation

Traditional non-Pelra ships, so on, will be called traditional vessels, can be owned individually without a business entity and have various functions, mainly for the mobilization of people and basic necessities. Traditional ships have an important role in supporting economic activities on adjacent small islands, rivers, or crossings with services rates are smaller when compared to rates of conventional shipping services.

The most common traditional vessels are made from wood, fiberglass, or a combination of wood and steel in traditional shipyards. The fleet size varies from ≤ 7 GT to 30 GT. The method of shipbuilding is a traditional to semi-modern method. Verification of documents could not be conducted, since in no ship documents were found. Ship size ≤ 7 GT does not need to report to harbormaster if it sails in range of 12 nm from the port, but if the vessel is going to sail more than 12 nm, then it is obligatory to notify harbormaster.

The interview was conducted using sample of 22 crews. The profiles of the respondents were 18.2% aged <30 years, 40.9% aged 30-40 years, 27.3% aged >40-50 years, and 13.6% aged >50 years. In terms of work experience, the profiles of respondents were 9.1% who had working experience for <5 years, 40.9% with working experience for 5-10 years, and 50.0% of >10 years working experience. Respondents who are the owners and operators of vessels are 31.8%, and only as operators are 68.2%. In term of skills, 36.4% of respondents claimed to have SKK 30 miles, while 63.6% did not have.

The summary of interview with the predetermined question, to investigate existing business process, is the respondents do not create manifest document to obtain a port clearance since it has very simple business process and the habits of crews. The process are very quickly on the spot, very simple, and only involving passengers and crew. Passengers pay freight to the crew, then, the crew estimates the number of passengers and cargo on board based on his intuition/ habits.

Some operators take notes in a simple note, only for reports and calculation of income to the ship owner. Harbormaster or inspector do not record data and inspect the vessel and its operation. In addition, some traditional ports even do not have harbormaster or inspector. In terms of technology,

the respondents have owned and used Android based mobile phones. They use the device for personal purposes, for example, make a calling, send SMS and chat, browse information and entertainment, and sometimes find directions using online map. The connection speed using one of the 4G cellular networks at the port is in the range 2.4 ~ 4.8 Mbps for download and the range of 0.82 ~ 1.27 Mbps for upload. This speed is the average internet speed in Indonesia, and can be used for medium data transmission.

3.4. SWOT Analysis

This digital system requires an analysis to find out how far this system can be developed and implemented. Nurhayati (2009) explained to build and to evaluate some strategies could use SWOT analysis. The analysis uses the Strength-Weakness-Opportunity-Threat (SWOT) analysis method. SWOT analysis is an analysis that is commonly used to evaluate a project from internal and external sides.

The purpose of this SWOT analysis is to prepare strengths, overcome weaknesses, find opportunities, and prepare strategies for threats. Appropriate SWOT mapping supports the system obtain the objectives, i.e. increasing safety and creating databases. The SWOT matrix is as follows:

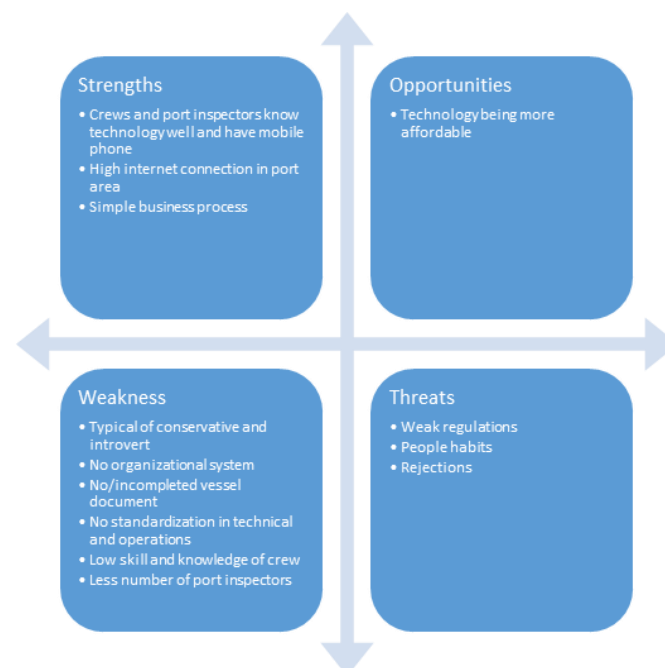


Figure 3: SWOT Matrix

4. Result and Discussion

As discussed before, the paper focuses on architecture design of implementation electronic manifest document on traditional shipping. It is important and crucial since ITS requires a framework or system architecture that covers technical and organizational matters (Medvidovic & Taylor, 2010). The milestones of ITS shown below:

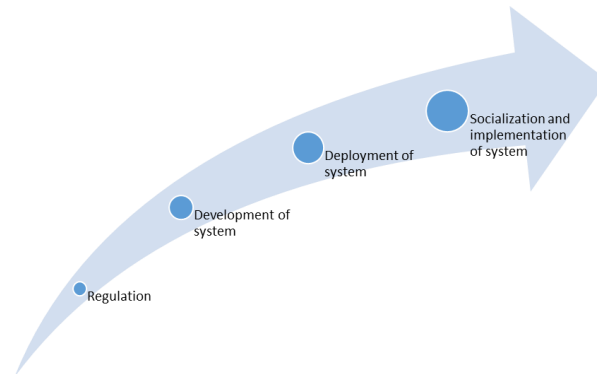


Figure 4: Milestone of system development

The stages of development of the system begin with the affirmation of regulations as the basis for implementing the system, thus, the system have law-power to be implemented since today's act does not regulate traditional vessels under 7 GT. The next stage is developing and deploying the system. The final step is implementation, socialization, and assistance until the operators and harbormasters or inspectors understand the function of the system and are able to use the system.

From technology point of view, the applications use cloud-server and online managed by harbormaster. The application consists of web-based applications and mobile-based applications. The web-based application is used for data input, managerial activities, and monitor. The android-based application records transactional activities at the port by operators. In addition, the system is being used as a database of traditional ships. The system uses SMS gateway in the beginning because it reaches all types and models of cellular phones. Furthermore, native applications are developed for mobile-based phones and run simultaneously with SMS gateway technology. This technology have to adjust to a very short loading time.

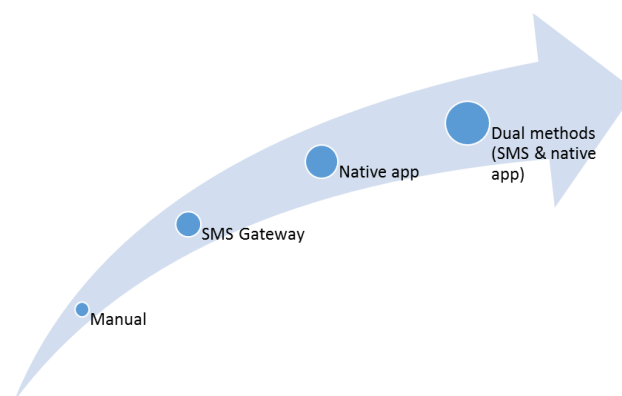


Figure 5: Milestone of technology

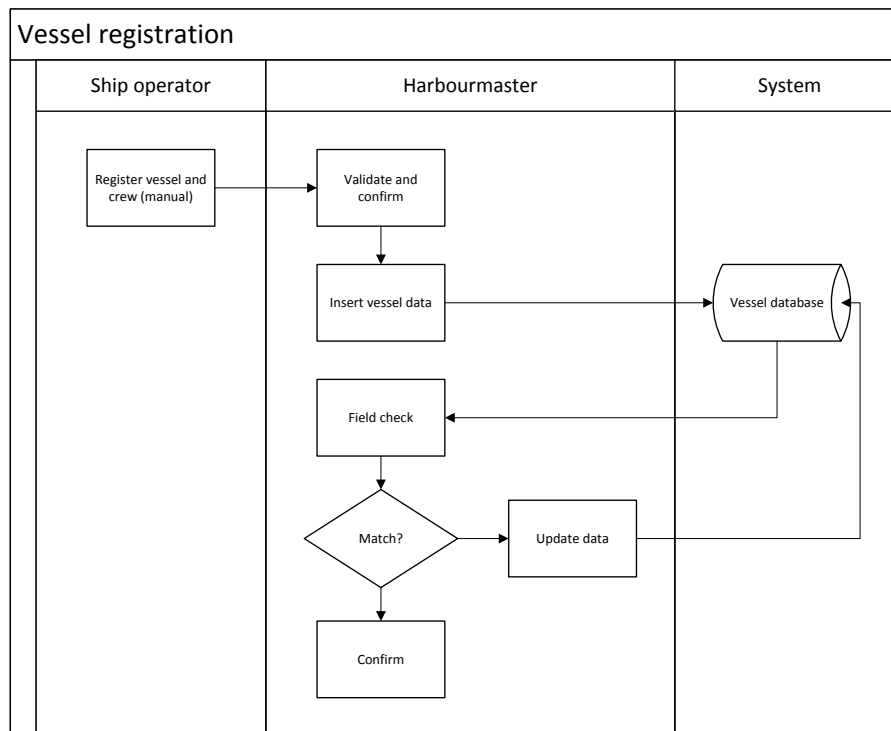


Figure 7: Architecture of vessel registration

This stage involves 2 (two) stakeholders, namely operators and harbor masters. The operators register their vessels to harbor master using paper-based form. Harbor master validates and confirms the data of the vessel as written on the form then input the data to the system. In field, the harbor master will check the vessels' data with the real condition. If it needs some revise, the officer could update the vessels' data via mobile-based application, then confirms when the data is appropriate with real condition. Thus, this stage creates traditional vessels' database. The architecture of transactional processes for daily operations could be seen as follows:

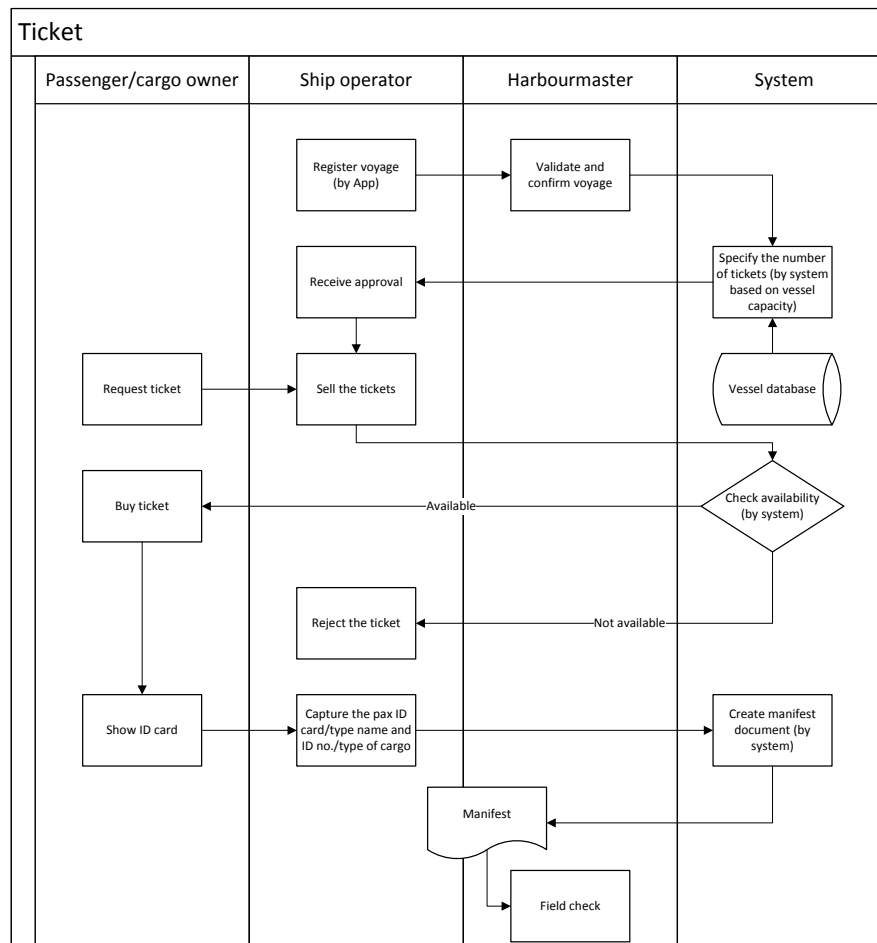


Figure 8: Architecture Transactional Process

In daily operation, the step starts on operator registering their voyage to the harbor master, including the schedule, then the harbor master validates and confirms registered voyage. Thus, this step is the authority of harbor master to monitor the voyage. The next step is the system automatically issues number of tickets as the capacity of vessel. It will prevent the excess capacity. Then, the operator sells the ticket to passenger. System will check the availability of capacity of the vessel before issuing ticket. If the capacity is full, system will automatically reject to issue ticket. The operator is mandatory to capture ID card of passenger to create manifest, and the system will create manifest document by using some algorithm to read picture. In the final, the harbor master must check the data and the reality.

5. Conclusion

Architectural design is the basis for developing a digital manifest system that consists of organization, technology, and business processes that exist, so it can be implemented and accepted by the community. This system uses cloud-server technology, making it easier to access anywhere and anytime in real-time. However, the system has obstacles, especially in the conservative and introvert

nature of the ship owner/operator, so that it will cause resistance to system implementation. The system will be considered to hinder and slow down their business.

The involved organizations in system have to carry out defined functions. Thus, the system requires strict regulation. This system increases the harbor master inspection to traditional vessels operating, then it increase safety. This digital manifest system has several functions, namely:

1. Create database of traditional vessel
2. Help the actors to create manifest document (and derivative)
3. Increase discipline of vessel operators to follow regulation and safety SOP

For further research, it is suggested to making related regulations, developing SOP (Standard Operating Procedure), and developing digital applications in web-based and android-based, making socialization materials, and implementing.

Acknowledgement

The researcher thanks the respondents in the ports of Probolinggo, Situbondo, Kalianget, Gresik, Surabaya, and all contributors.

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