Transport telematic architecture of an electronic payment system for traditional merchant shipping

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Abstract. Wooden boats operating throughout an archipelagic country play an important role in connecting in particular remote areas and small islands. Those boats are deployed by traditional merchant shipping, also known as Pelra, abbreviated from Pelayaran Rakyat meaning Pelople's Shipping. They carry nearly all types of cargoes, and usually a family business. Efforts to alleviate its role are necessary, from various aspects. The duration of shipments of cargo by using Pelra ships is long, the impacts on the cashflow of many parties are immediately afected. The growth of internet usage open a window of opportunity to improve this situation, by introducing e-Payment system. This paper outlines this effort by applying the Intelligent Transpotation System (ITS) architecture. A Pelra route Surabaya-Bima serves a case study to investigate the viability of the e-payment. The study concludes that introduction of an e-payment system is promising.

1. Introduction

Indonesia as an archipelagic country has many islands spread across the territory of this nation.The logistic connections between the islands primarily are performed by seagoing vessels. Shipping companies are the main players which deliver goods to a many islands in Indonesia. The main businesses in Indonesia are located in Java Island. Java Island has two major cities as the center of industrial, namely Jakarta and Surabaya. So the other islands and especially the small islands located very far away from the main island of industrial place rely very much upon the shipping services. There are two types of shipping company that provide services in Indonesia, i.e. modern shipping company and the traditional shipping company, called Pelra, which is abbreviated from Pelayaran Rakyat, meaning pelra [1].

The current research focuses on the traditional shipping companies in Indonesia which are also known by the name of Pelra. Pelra operates to connect main islands to small and remote islands that are not served by modern commercial vessels to distribute food, agricultural materials, building materials, and other daily necessities. At certain circumstances Pelra also transport passengers. In the past before modern shipping companies were developing, the majority of transportation was carried out by the Pelra fleet. Pelra fleet comprises of boats and vessels constructed in traditional shipyard out of wood materials having capacities ranging from 5 GT up to 500 GT, as shown in Figure 1. The earlier boats and vessels were propelled by the

sail, but since the 1970s they were also equipped with engines to reach operational speeds between 5 – 8 knots. Pelra vessels mostly operated by masters and crew with limited qualifications [2,3].

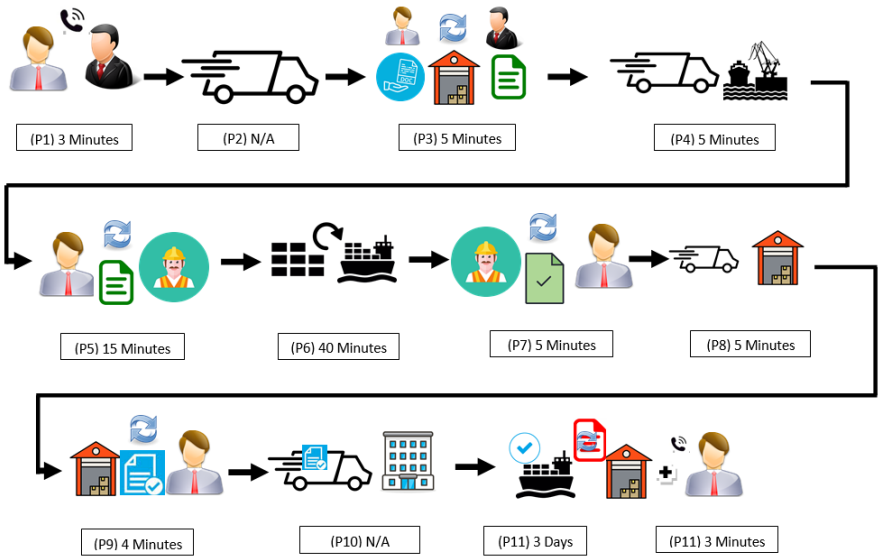

Figure 1. Activities at port of loading

The research highlights the case study of Pelra shipping route between Surabaya, the capital of East Java Province, and Bima in a small island of Sumbawa, at a distance of some 360 sea miles. The research focuses on the payment system in Pelra service. Both of operation and transaction are runs with a simple tool and method. Most of shipper or customer of pelra comes from the remote islands. They pay the invoice after they get their goods unloaded from the vessel. The customer and shipping agent doing their transaction in cash. They do it in order to satisfy the customer and the majority of their customer comes from Bima. In conjunction to this Pelra shipping employees collect the payment by visiting the customer one by one.

The cash payment does not only affect the cashflow between buyers and sellers only, but the provision of cash money it self is also another challenges. Bank Indonesia faces chalenges in distributing vcash money especially in remote areas and remote islands. Its distribution delay may disrupt transactions and economic activities in those areas, whose economy are relatively small [4,5]. Bank Indonesia declared a program called Gerakan Nasional Non Tunai (National Non-Cash Movement). The program concern to create a cashless society in Indonesia. It is intended to increase public awareness in the use of cashless instruments, so that becomes a new community who accustomed in practising cashless payment, especially in conducting businesses. The bank planned to build the payment system to be more efficient, safe and reliable in order to protect consumer security [6]. There are incidents concerning counterfeit money spead, which concerns many, particularly in Bima [7]. So, the society must be aware when doing a transaction, especially in relation with Pelra shipping, because they usually practice the payment in cash. The old fashioned way in business transaction make them less flexible to manage their payment and wasting a big deal of time to collect the payment from the costumer one by one [8,9].

The availability and implementation of ICT can help the national sea transportation system, especially Pelra shipping, to overcome the aforementioned problems [3]. In this regard a research on the implementation of ICT, which is called Intelligent Transport System (ITS) with a particular effort in the

development of telematics architecture on electronic payment system for Pelra business, is conducted and the results of which are thoroughly put forward.

2. Methodology

This study concerns with the operation of a Pelra ship between Surabaya and Bima, as its case study. The study starts with elaborating the shipment process. The identification on typcial working operation of a cargo shipment and how a Pelra ship is operated. It is investigated how cash payment of services is conducted, as a majority of the payments are conducted in cash. An investigation on how to transform the payment systems. It is investigated how the perpectives of all parties, their benefit towards the introduction a non-cash payment. System Architecture is developed. This consists of four elements, namely the identification of user needs, functional architecture, physical architecture and concluded with communication architecture. Few parts of this architecture is conducted in the preceeding identification of current payment systems.

3. Shipment Process

A shipment process in Pelra shipping is considered laborious. The shipment processes and their documentation are not standardized. The following procedure is obtained from the processes of a shipment sample surveyed. To be noted, that this process may vary from one shipping company to another. A smooth transfer between modes, for example the cargo transfer from truck to warehouse or from truck directly to ship may differ from among Pelra shipping companies and agents. The folllowing illustrates the processes of a cargo shipment.

A shipper contacts a Pelra agent in order to obtain the ship's schedule and tariff. A Pelra ship stays at the port between three and four weeks. Some 10% of this port time is spent to load and discharge cargoes [10]. In the remaining time, the lies physically idle, until the oeprator and agent obtain suficient cargoes. Obtaining the updated schedule is conducted repetitively, coded as P1, as can be seen in Figure 1. The shipper or cargo owner send the goods to the Pelra office or its agent, coded as P2. The quantity and conditions of the goods are checked and documented, coded as P3.

The goods are delivered to the ship alongside the berth, usually by using the same truck, coded as P4. Another tally check is conducted, coded P5. The goods are then loaded on to the ship, the shipper receives a Mate Receipt, coded as P6. Another tally check is conducted after the loading completed, coded as P7.

Table 1. Activities at port of loading

Activity Code	Duration (in Minutes)
P 1	3
P 2	0
P 3	5
P 4	5
P 5	15
P 6	40
P 7	5
P 8	5
P 9	4
P 10	100
P 11	4,320

The shipper returns to the office of the shipping company or its agent, coded as P8. He presents the Mate's Receipt in return of a Bill of Lading, coded as P9. The shipper awaits the departure information of the ship, coded as P10. Shipping company prepares the manifest prior the departure of the ship, P11. Table

1 presents numerical values of the durations of the processes. To be noted, that the P11 constitutes the highest. This is also considered as the most uncertain, as this activity is conducted whilst the ship is in waiting for carrgoes. The processes at the discharging port is similar, in a reversed order, as depicted in Figure 2 and 3.

Figure 2. Existing physical architecture

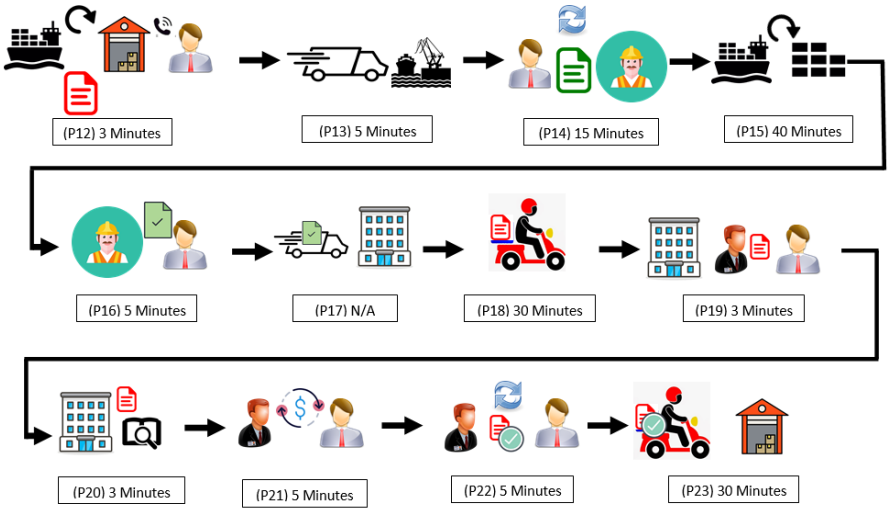

Figure 3. Activities at discharging port

4. Towards a Non-Cash Payment Process

The study investigates the viability of e-payment service providers, namely LinkAja, OVO and GoPay. The number of users of the above is huge and is still growing. Figure 4 shows the share of their users in e-payment ecosystem in Indonesia. GoPay is by far the largest one, operated by an online transport operator. Many services by GoJek could be associated with the usage of its e-money, namely GoPay.

Security aspects. The risk for counterfeit money spread still exists. Numerous traders are concerned about this, therefore they support very much the idea of introducing an e-Payment. In a wider term, a growing usage of e-payment could dramatically stop the spread of counterfeit mony wihc could jeopardize the whole economy of in particular remote areas.

The freight rates of cargo shipments are distributed equally, below IDR 1.0 million, between IDR 1.0-5.0 million and between 5.0-12.0 million. This is the range of transaction, which sould be considered by the e-payment service providers. Approximately 87% of the freight payments are executed at port of discharge, the remaining in port of loading. Some 78% of users reside in Bima and prefer to accomplish the payment there.

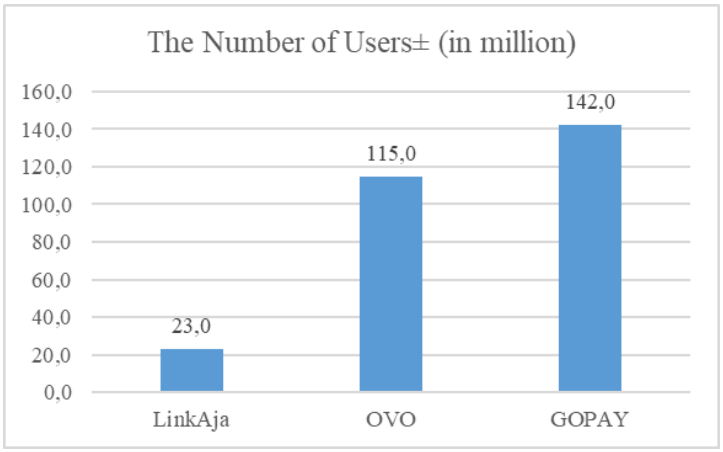

Figure 4. e-Payment users in Indonesia

E-payment increases the efficiency of a payment process. A transaction of a cargo shipment by using Pelra normally takes 76 minutes. All e-payment systems have one thing in common. An e-payment transaction could be completed within 7 minutes in average, as illustrated in Figure 5. This improved efficiency is obtained by the fact that e-payment does not require the presence of persons during the transaction. Involvement of personal presence entails the loss of transporatation costs and losss of opportunity costs of the persons involved due to this inefficient period, see Figure 5.

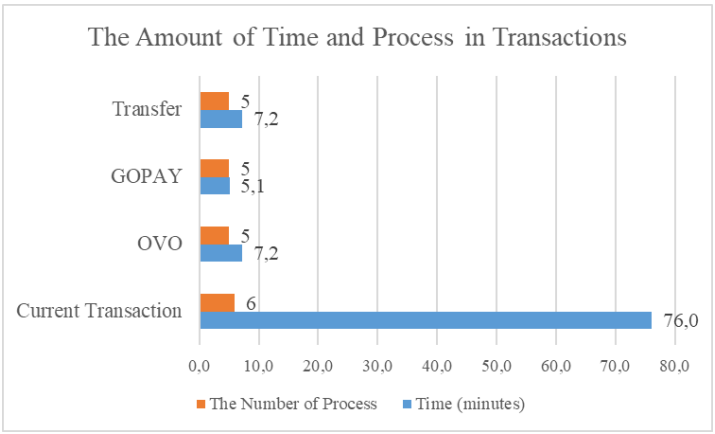

Figure 5. Duration and number of processes among payment systems

Transaction cost of e-payment is much lower compared to bank transfer, even of the same network, see Table 2. The competition between e-money and cas-payment is obvious. The fact that banks shrink their size of operations, it would impact to the presence of banking system in remote areas. This fact underlines the importance of introducing e-payment system for remote areas even more.

Table 2. Transaction costs of payment services

Payment Services	Transaction Cost
OVO	IDR 2,500.-
GoPay	IDR 2,500.-
M-Banking from State-owned to a private bank	IDR 6,500.-
M-Banking from State-owned to a state-owned banks	IDR 3,500.-

5. System Architecture

In order to plan the transformation from cash to non-cash payment, a system architecture is established. An e-payment belongs to one of growing Intelligent Transportation system (ITS) implementations. This is a framework covering a.o. the user needs, functionalities, regulations, organizations and communication, which serves as a basis for design and decisions [11,12]. By doing so, an ITS implementation can be planned in a logical manner, integrates successfully, has the desired behaviour, meets the desired performance levels, is easy to manage, is easy to maintain and is easy to extend.

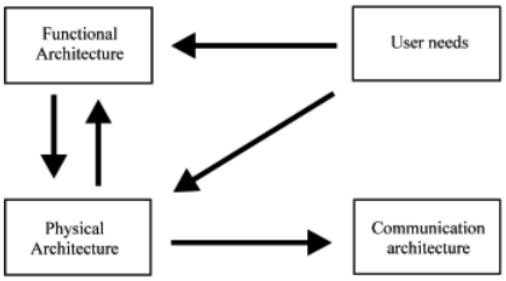

Figure 6. System architecture [10]

The system architecture starts with identifying the user needs, as already explained in Figure 6. From here the funcional architecture is derived. There are four essential parties involved:

1. Issuer. This a bank or any finantial institution which manages e-payment services. GoPay, OVO and LinkAja are selected for this study. They are three top e-payment service providers in Indonesia at present.
2. Customer/ buyer. A group of organizations or people who pay by using e-payments in return to the goods or services received. Buyers and sellers of goods in both sides, Surabaya and Bima. Buyers are usually the ones who execute the payments.
3. Merchant/ seller. A group of organizations or people who receive money by using e-payments in return to the goods or services provided by them. Pelra shipping companies and their agents provide the tarnsporattion services are those who would receive e-payent after completing their job.
4. Regulator. This the role of governmental institutions to endorse, arrange or draft regulation to enable e-payment work accordingly.

All four parties show the benefit of using e-payment. This increases the chance of success. Finally, the physical architecture. It concerns the way how a message or a document os conveyed from one part to another. The information conveyance lies on top of the telecommunication infrastructure, as visualized in Figure 7.

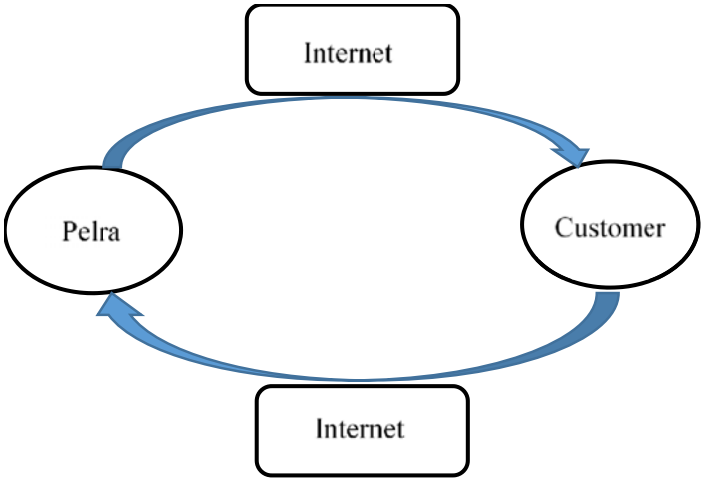

Figure 7. Future e-Payment's communication architecture [13]

Telecommunication infrastructure is an enabler of an e-payment system. The 3G infrastructure is a minimum requirement. Figure 8 shows that a town such Bima is adequately connected by a 3G signal. For many rural and remote areas, the telecommunication connectivity is inadequate. Nevertheless, a majority of Pelra consumers reside in the city areas of Bima, so the availability of internet is sufffficent. The e-payment system requires availability of internet. All parties users, Pelra and e-Payment service providers are connected by internet. Internet enables the transaction to work well.

Figure 8. 3G/4G signal distribution map [14]

6. Conclusions

A study on the transport telematic architecture of an electronic payment system for traditional merchant shipping has been conducted and bring forth some findings as follows:

1. E-Payment system could countribute in counterfeiting the spread of fake paper money, and in ecompassing the shipment of paper money in particular to remote areas.
2. Total processing time using e-payment systems could be cut by three days, from 26 days into 23 days in average.
3. The introduction of e-paymen is viewed economically feasible, by using the existing infrastructure of e-payment systems.

4. Due to its small scale of economies of remote areas, a push to endorse financial institutions to facilitate e-payment systems for Pelra and for other sectors is desired.

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