

Digitalization of Logistics Processes and Comparison with Several Asian Countries Related to Logistics Information Systems: Propositions of National Logistics System Architecture

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Abstract- The purpose of this article is to find out about logistical process problems, current conditions related to the digitization of logistics processes in Indonesia, compare information systems / digitization of logistics processes between Indonesia and countries in Asia and Propose National Logistics System Architecture. This study was completed by conducting literature study activities from a number of relevant references related to digitizing the logistics process. Next is to visit the web pages of a number of parties or institutions, be it government or companies related to the logistics distribution process. The next activity is to make comparisons between the logistics digitization process in Indonesia with a number of countries in Asia. With regard to data and information verification, visits have been made to a number of government agencies and companies related to the logistics distribution process. Based on the studies that have been conducted, there have been a number of information systems related to the digitization of the logistics process, both those developed by central government agencies and by companies independently. These government agencies include the Ministry of Finance (INSW), the Ministry of Industry and Trade (DO Online), the Ministry of Transportation (InaPortNet). From the company (port service providers) there are a number of applications (either applications developed by third parties or internally) such as those owned by IPC (Indonesia Port Companies). There is no integrated logistics information system that connects interested parties (public entities, logistics node operators, logistics service providers, carriers / logistics companies, warehouses in the national logistics distribution system, goods senders / buyers, consignors / consignees, banks and other related financial companies, the Regional Transportation Service, and the Police) yet. Through this study, it is hoped that interested parties can find out and take advantage of the existing logistics process digitalization system and / application and make decisions that produce optimal solutions.

Keywords: *Logistics information system, Indonesia national single window, logistics distribution, digitization of logistics processes, information system architecture.*

Introduction

As an archipelagic country, logistics plays a role in the movement of the flow of goods domestically and abroad. It plays an important role not only to meet the basic needs of society, but also as a vehicle for delivering agricultural, mining and industrial products so that they can be used and marketed, both domestically and abroad.

Based on data from BPS (Central Bureau of Statistics) related to the amount of Export Volume by Main Destination Countries 2000-2017 (Net weight: thousand tons), during the last 10 years (2008-2017) there

has been an increase in exports from Indonesia throughout the world, namely 54%, from 355,054 thousand tons to 545,846.6 thousand tons (Source: Central Statistics Agency, accessed in August 2019).

The largest increase in export value (top 5) occurred for the following countries: (Net weight: thousand tons)

1. Myanmar, an increase of 36% per year.
2. Vietnam, an increase of 31% per year.
3. Cambodia, an increase of 21% per year.
4. Philippines, an increase of 21% per year.
5. China, an increase of 14% per year.

Of the top five countries with the highest ranking, 4 countries are included in the ASEAN (Association of Southeast Asian Nations). Attention to countries in the top five above is very important to be taken into consideration in any policy making related to logistics distribution in Indonesia.

The National Logistics System (SISLOGNAS) is a system aimed at creating an effective and efficient distribution environment for goods that will create additional strategic value for the national economy. Through Presidential Regulation No. 26 of 2012, the government has issued a blueprint document for the development of the national logistics system, which is a guide in logistics development for relevant stakeholders as well as policy coordination and development of the national logistics system. The National Logistics System is expected to help achieve Indonesia's economic mission in 2025, namely "creating an independent, advanced, just and prosperous Indonesian society". The relationship between the National Logistics System and the achievement of Indonesia's economic mission can be seen in Figure 1.

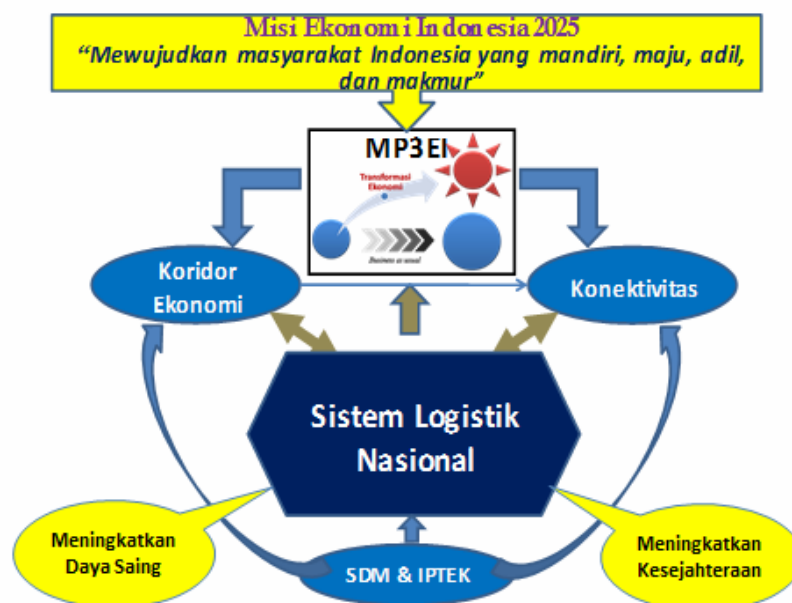


Figure 1. The Role of the National Economic System in National Economic Development
(Source: Presidential Regulation No. 26/2012)

The national logistics system is not only related to micro aspects, but also to broader (macro) aspects that are accommodated in a national order in the framework of policies and regulations in carrying out logistics activities among stakeholders in the national logistics sector.

As an archipelagic country, the role of logistics in the movement of domestic goods flows plays an important role where more than 80% of logistics movements are domestic or domestic movements to meet

the needs of all regions of Indonesia. In fact, the important role of logistics is not yet supported by an adequate national logistics system. Indonesia's logistics system has not been able to play a role as it should. This is evidenced by logistical problems that occur such as scarcity of goods in several regions, high logistics costs, price fluctuations and price disparities between regions for several types of goods.

Logistic problems are very complex in terms of several factors such as; diversity of commodities, area and geographic conditions, infrastructure conditions, and the number of parties involved in the logistics system (a number of ministries and agencies at the central level, local governments, BUMN, private companies, and others). Meanwhile, the implementation of the National Logistics System Development blueprint based on Presidential Decree No. 26/2012 has not met expectations. The logistics performance index for the world's countries is released by the World Bank every 2 years, showing Indonesia's position in 2018 is ranked 46 as shown in Figure 2.



Figure 2. Indonesia's National Logistics Performance Based on the World Bank's LPI Index
 Source: World Bank. - Business / Husin Parapat

Another problem that has arisen is the development of information technology that is very fast and has an impact on various sectors. If this is not anticipated, it will result in disruptive technology. In this regard, the digitization of the logistics process is something that is needed in an effort to support the smooth distribution of logistics. Through digitizing the logistics process, it is expected that accuracy, speed, consistency and simplification related to data/ information can be realized which in turn will have an effect on reducing overall logistics costs.

Problem Statement

Currently, the logistics process is still done manually. Logistics service companies use different manifest forms to record every movement of goods. By digitizing the logistic process, it is possible to save logistical processes and administration time, because it is enough to record transactions once.

The digitization of the logistics process needs to be widely implemented immediately. Digitalization as a starting point in standardizing logistics. There is no longer a logistic process that is done manually using paper so that all logistical processes will be paperless. Related to the above, then how is the digitalization of

the logistic process, especially those related to the logistic information system in Indonesia, the current situation? What kind of digitalization of logistics processes and information systems is applied in other Asian countries?

Methodology

This research was conducted by searching for information regarding problems faced related to the logistics distribution process in Indonesia, and how these problems are related to digitizing the logistics process. Through literature study and verification activities by visiting the official website of a number of relevant institutions, the information that has been collected is then analyzed and a comparison is made between the digitization of the logistics process in Indonesia and a number of other Asian countries, so that a national logistics information system proposition can be produced.

Digitalization of Logistic Processes in Indonesia

Indonesia National Single Window (INSW)

The digitization of international logistics documents has been accommodated in a system known as the Indonesia National Single Window (INSW). There has been a number of studies related to single Windows in relation to logistics processes. Tosevska-Trpcevska (2014) analyzes the effects of implementing the SW concept and simplified customs processes and procedures in the Republic of Macedonia. Wang (2018) uses a case study of a SW development in Korea to highlight the need for improved and institutionalized interagency coordination to promote its implementation. Niculescu and Minea (2016) present current regulations and ongoing or finalized projects related to SW systems in Europe, analyze the main differences between the Maritime SW and the Customs SW and propose the development of a National Single Window Integrated Platform.

INSW is a national system that allows single submission of data and information (single submission of data and information), synchronous processing of data and information, integration of information, and integration of business process flows between customs systems, export licensing -import, port / airport, payment, transportation of goods, and logistics, as well as other systems related to the handling of export-import goods traffic. Nizeyimana and DeWulf (2015) provides an overview of the implementation of the Rwanda electronic SW and its impact on trade facilitation and conclude that the use of the eSW has received reduced clearance times and direct and indirect costs associated with international trade.

INSW is an information system managed by the Ministry of Finance which has a mission to create an integrated public service system in handling the traffic of export and import goods. INSW carries out a national system integration which enables the submission of single data and information, single and synchronous processing of data and information, and submission of single decisions for granting customs permits and releasing goods in accordance with statutory provisions. INSW is a system that integrates the import-export service process in all Ministries/ Agencies which includes the process of licensing, customs clearance and goods release (Customs Clearance and Cargo Release).

The INSW system is an electronic system that integrates systems and/ or information related to the handling process of customs documents, quarantine documents, permit documents, port documents, airports, and other documents related to export and or import, which ensures data and information security and integrates flow and process information between internal systems automatically.

That all permits, documents (customs, quarantine, licensing, port/ airport and other documents), data and other information required in the service and supervision of export-import and distribution activities must be carried out through the Indonesia National Single Window (INSW). Bal et al. (2017) examine the concept of

international single window environment (ISWE) from a transaction cost and information asymmetry theory perspectives and argue that its full potential can be realized through integration of transport and commercial requirements improving G2G, B2G and B2B information flows.

InaPortNet

Related to this, one of the regulations that becomes the reference is the Minister of Transportation Regulation Number PM 157 of 2015 concerning the Application of INAPORTNET for Ship and Cargo Services at ports. INAPORTNET is an internet / web-based electronic single service system to integrate a standard port information system in serving ships and goods physically from all relevant agencies and stakeholders at the port. The scope of INAPORTNET is for ships and goods services which currently include:

1. Ship entry;
2. The ship moved;
3. Ship out;
4. Extension of mooring; and
5. Cancellation of service

Through digitizing the logistics process at the port, it is hoped that the port's performance will increase so that it will reduce costs or costs associated with the distribution of goods. Port efficiency relates to performance by logistics operators and customs authorities for cargo clearance and transshipment through port services rendered by the available infrastructure and logistics superstructures (Hanjra et al., 2017; Sutomo & Soemardjito, 2012; Beresford et al., 2012; Tongzon et al., 2009; Le-Griffin & Murphy, 2006; Bichou & Gray, 2004; Sanchez et al., 2003; Ki-Tae & Song, 2003).

Software application at the port

In general, the digitization of the logistic distribution process has occurred in the scope of ports, both sea ports and land ports (Dry Port). In Figure 3, it can be identified that from the ship coming to the dock for unloading the goods to the goods out, there are a number of applications that are used. The parties involved in this application ranging from: port authorities, shipping agents, customs, terminals, shipping companies, forwarder companies, place of payment, to truck companies can be accommodated properly.

Based on information from the IPC President Director (TPK Koja, 2019), the implementation of digitization of various sides at the port has been the main focus of IPC in the last two years. Digital-based service standardization on the land and sea side is implemented and optimized thoroughly from the time the goods are delivered to the port to ease of payment as well as tracking and tracing of goods. Digitalization steps on the sea side carried out by IPC include implementing the Marine Operating System (MOS), Vessel Management System (VMS) and Vessel Traffic System (VTS) which can monitor the movement of ships from the time they depart from the initial port until they arrive at Tanjung Priok Port. Meanwhile, on the land side, IPC already has a Terminal Operating System (TOS) and a Non-Container Terminal Operating System (NPKTOS) as well as Auto Tally for container calculations.

IPC also prepares Container Freight Station (CFS), Buffer Area, DO Online, Auto Gate, Car Terminal Operating System, Reception Facility and Truck Identification to identify drivers and destinations for goods delivery from all cargo carriers entering Tanjung Priok Port. There are also gates that have implemented auto gates, accompanied by e-payments, billing payments, and e-invoices, since the last few years IPC ports have been converted to lead to digitalization. For more details, the relationship between the parties involved

can be seen in Figure 3.

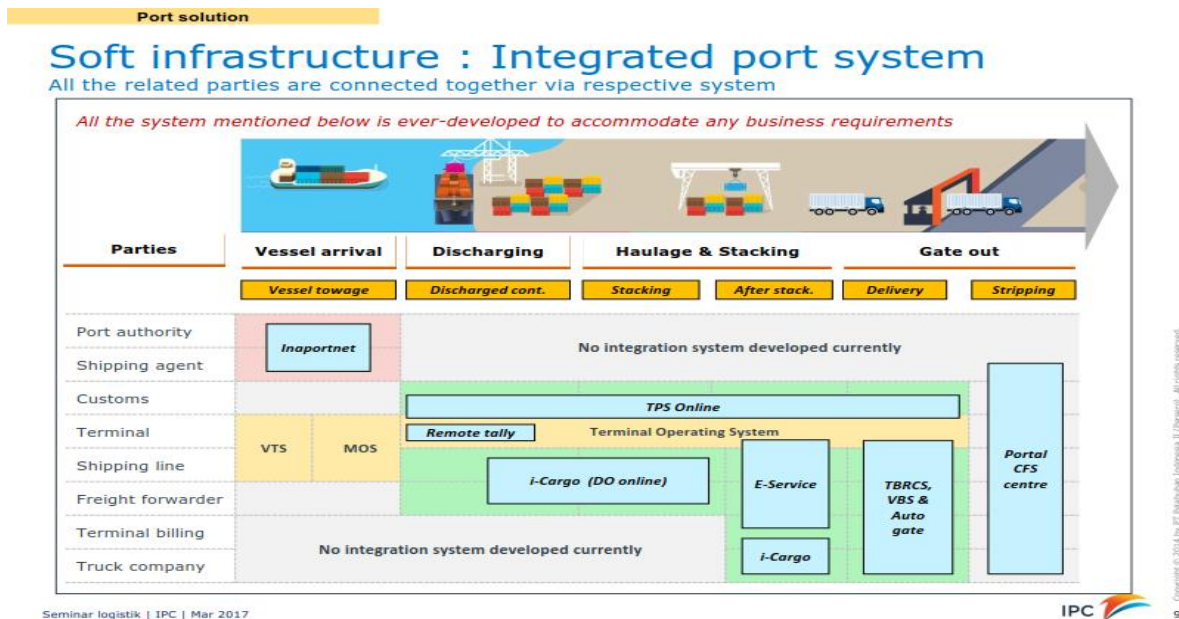


Figure 3. Applications Ranging from Berths to Containers Leaving the Port

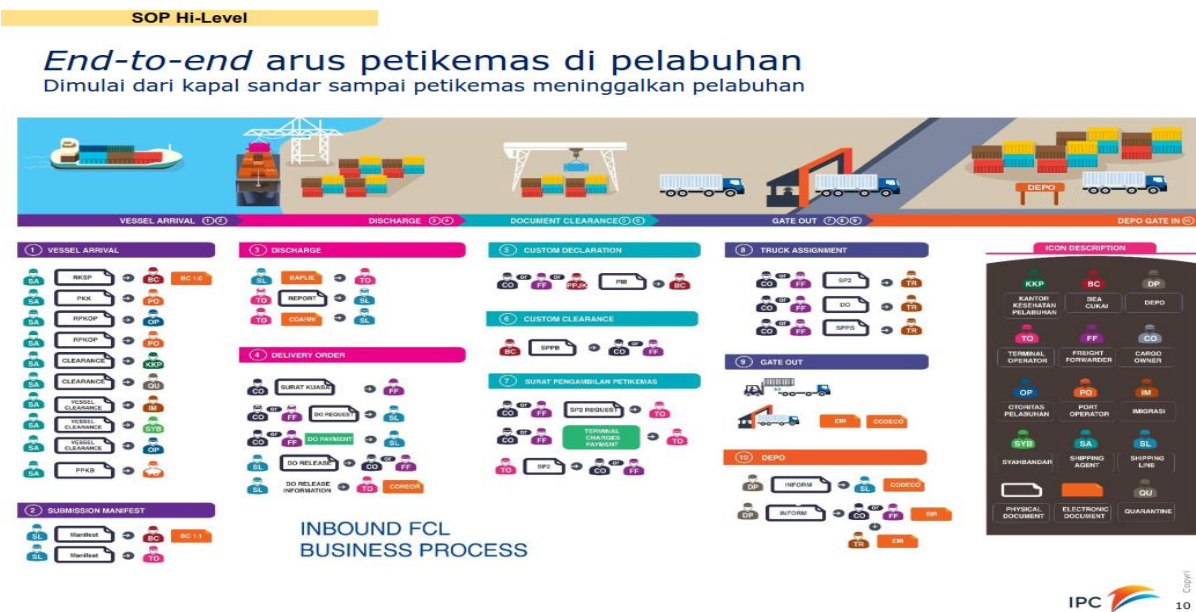


Figure 4 The Parties Involved Regarding the Flow of Containers at Ports

Digitizing Logistics Processes in Other Countries

Logistics information systems have been implemented by several other established countries such as China, South Korea, Japan and Singapore. Based on a study conducted by UNESCAP (2016), the information systems implemented in these 4 countries are shown in Table 1.

Table 1. Logistics Information Systems in Several Asian Countries

Countries	Logistics System	Information	Managing Agency

China	LOGINK	Ministry of Transportation and Regional Government of Zhejiang
	E-Port	Customs
South Korea	Port-MIS	Marine and Fisheries Ministry
	SP-IDC	
	GCTS	
	uTrade	Ministry of Economy
Japan	Colins	Ministry of Land, Infrastructure, Transportation and Tourism
	NACCS	NACCS (<i>State Own Enterprise</i>)
Singapore	PortNet	Port Authority of Singapore
	TradeNet	Cooperation between agencies
	TradeXChange	

Similar to Indonesia, logistics information systems in China tend to be developed at logistic nodes and managed by their respective management companies without considering integration between systems. As a result, information tends to be isolated in the information system of each node. LOGINK was then developed by the Ministry of Transportation in collaboration with the Zhejiang Regional Government with the main aim of facilitating information-sharing between parties related to logistics distribution as well as between information systems that have been implemented in China.

LOGINK has connected to 118 logistics nodes in China and 11 ports outside China. The data provided by LOGINK includes data from 8.3 million companies related to transportation and logistics, 13.3 million logistics vehicles, 25.4 million workers related to logistics, and real-time location data from 300 thousand trucks on a trip. Until 2008, the total data points collected in LOGINK reached 1.37 billion data points with daily data access reaching 20 million by users. LOGINK information system architecture can be seen in Figure 5.

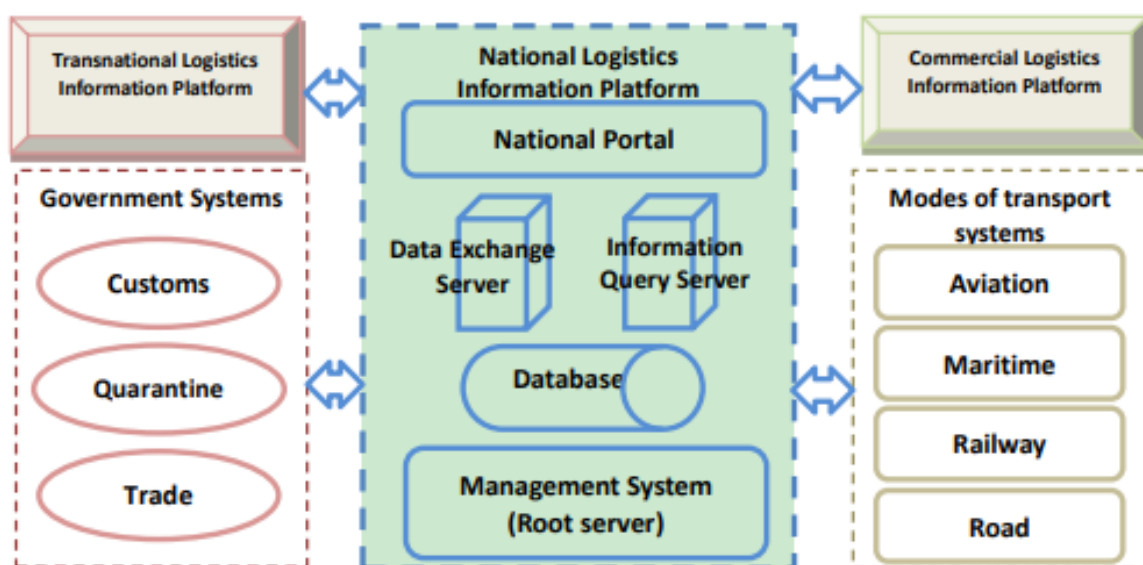


Figure 5. LOGINK Information System Architecture
(Source: UNESCAP, 2016)

LOGINK has a main component called the Basic Information Exchange Network. Government agencies

related to logistics as well as logistics companies can use the Basic Information Exchange Network to share information that is G2B, B2G, and B2B in nature. The Basic Information Exchange Network itself has 2 components, namely the data exchange component and the data query component.

Through the data exchange component, the parties involved in the information system can exchange data easily. For example, using LOGINK, a shipping company can provide dangerous goods manifest documents to its partner trucking companies in the process of transporting multimodal goods to be reported to the relevant government agencies. The manifest document only needs to be input once into the system and can be used by more than 1 party involved in the logistics distribution process. In general, the data that can be exchanged in LOGINK are as follows:

- Electronic booking;
- Schedule of transport vessels (vessel);
- Customs information;
- Inspection and quarantine information;
- Consignment;
- Status of delivery (freight / Shipment);
- Time to enter and leave the vehicle;
- Finance and insurance;
- Payment

The second component, namely data requests can serve information system users to access the data needed in LOGINK. For example, shippers can easily track the position of their goods which are in the process of being shipped by requesting location data to LOGINK. The tracking of goods location data in LOGINK is implemented based on the following 2 technologies, namely:

1. GPS (Global Positioning System) technology

In China, trucks with certain loads are required to use GPS so that they can be tracked their position. This location data is input into the National Public Supervision and Service Platform. In the first 5 months of 2019, there were 3.64 million trucks whose activities could be monitored by this platform.

2. RFID and Barcode Technology

The use of this technology is intended to update the delivery status of goods in the distribution process. The use of RFID and barcode is done to facilitate the input of the delivery status data into LOGINK.

Proposition of the National Logistics Information System

The design for digitizing the national logistics process is outlined through the national logistics information system architecture. This architecture is designed based on the recommendations of UNESCAP (United Nations Economics and Social Commissions Asia-Pacific) and a benchmark against the LOGINK information system implemented in China. The architecture and benchmarks are then used as main considerations in assessing what kind of information system is suitable for implementation in Indonesia.

Based on studies that have been carried out on existing conditions as well as benchmarks against information systems applied in developed countries, we conclude the following:

1. The current information system development at the logistics node that is implemented and developed directly by the node operator is appropriate. Apart from being able to adapt to business processes and the needs of consumers, information system development carried out at the node directly by operators is usually more effective and efficient because operators are dealing directly with problems in the field.
2. The next solution needed is the role of the Government to design a national logistics information system

that can integrate existing data in the information system at each node.

3. In addition to designing a national logistics information system, the Government also needs to determine standards regarding data at logistics nodes so that the data in these nodes can be integrated with each other to support a more comprehensive logistics information system.

This national logistics information system is designed with the needs of the government and business perspective in mind. The government's point of view requires that the information system be able to accommodate decision-making needs at the macro level and supervision of the logistics industry, while the business point of view requires that the information system be able to increase the efficiency of the logistics distribution system which has an impact on reducing logistics costs. As a general architectural reference, UNESCAP has recommended its standard architecture according to these needs.

The architecture recommended by UNESCAP is based on a review of several information systems implemented by several developed countries in Asia can be seen in Figure 6.

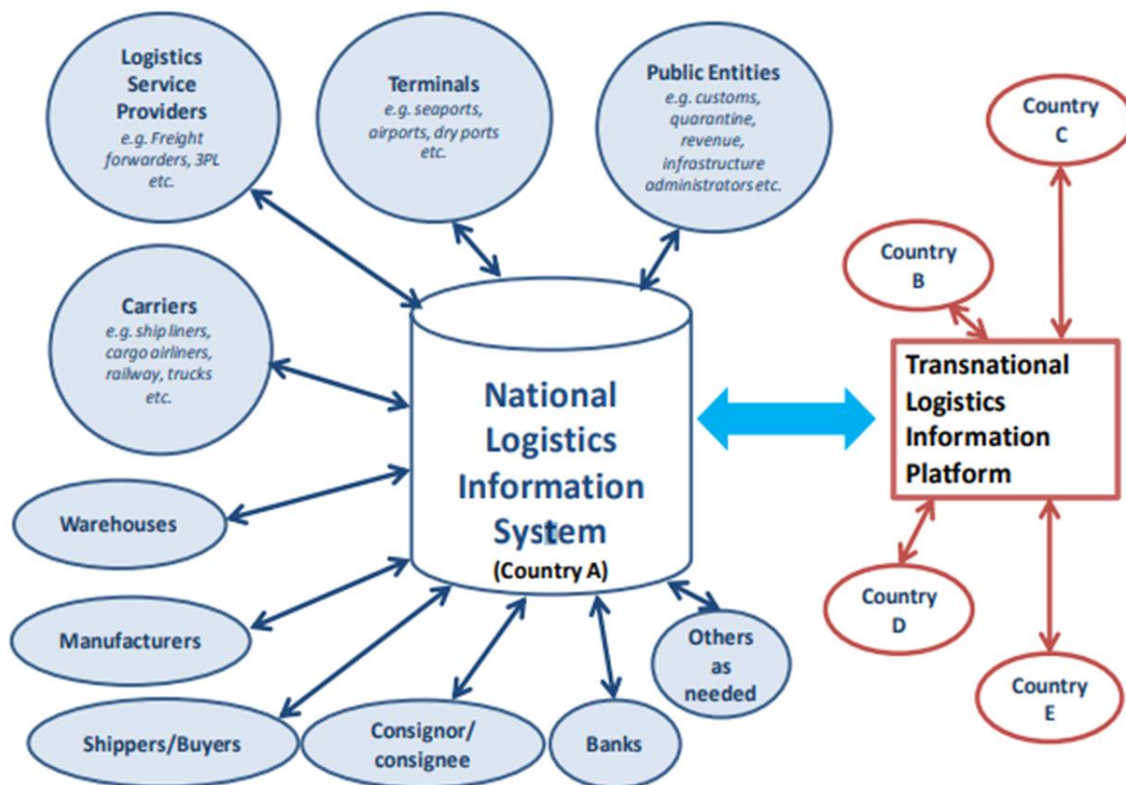


Figure 6. Recommended Logistics Information System Architecture from UNESCAP

This architecture is designed considering the interconnection of national logistics information systems with transnational logistics information systems. This architecture also considers the number of stakeholders involved in the logistics distribution system. The parties involved are as follows:

1. Public Entity (Ministry of Transportation and other related ministries, customs, and other government agencies)
2. Logistic node operator
3. Logistics service providers (freight forwarder, 3PL, etc.)
4. Carriers / logistics companies (trucking, shipping lines, etc.)
5. Warehouses in the national logistics distribution system

6. Shipper / buyer of goods
7. Consignor / Consignee
8. Banks and other related financial companies
9. Local Transportation Agency
10. Police

Based on this architecture and then adapted to the conditions of logistics distribution in Indonesia, we designed a national logistics information system architecture. The logistic architectural design arranged can be seen in Figure 7.

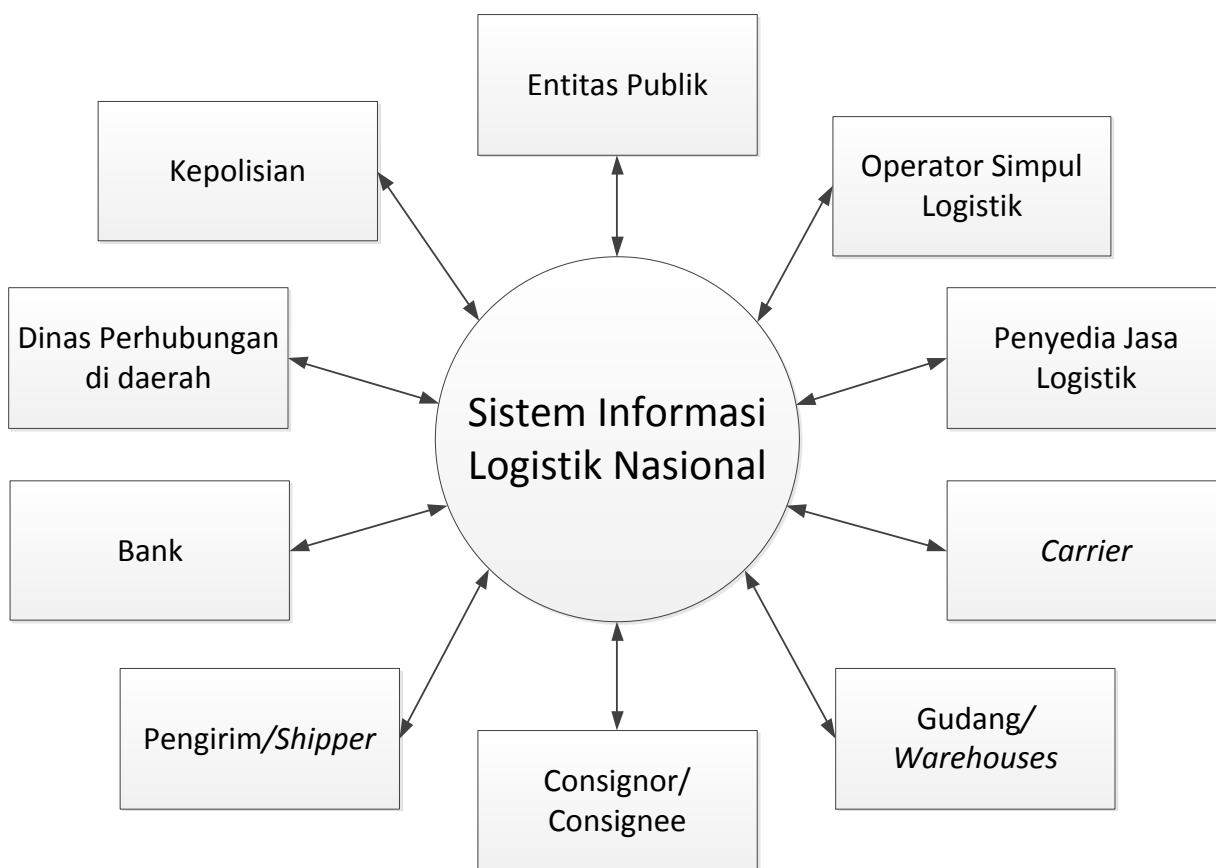


Figure 7.

Proposition of the National Logistics Information System Architecture

The main role of this logistics information system is to provide end-to-end information-sharing facilities in the distribution of national logistics by integrating information systems related to logistics that have been implemented in Indonesia. The essence of this logistics information system is to provide a means for parties related to logistics distribution to coordinate optimally with each other in distributing goods. This information system must integrate the data contained in the information system at logistic nodes which are managed by each node operator. This data must then be used in the entire national logistics distribution system and can be accessed by interested parties.

An example of the practical application of this information system is the linkage between the manifest goods in the logistics node with the data at the transportation service and the police so that both the transportation service and the police can monitor the logistics distribution process more optimally. The end-to-end feature of this national logistics information system can also facilitate tracking / tracking of goods because the

information system integrates the supply chain contained in the national logistics distribution system from shippers / shippers to consignees or consignees.

We have also reviewed some of the functions that need to be contained in this information system. These functions are as follows:

1. Data Exchange (Data exchange). Logistics related documents must be distributed to relevant parties online to streamline the information dissemination process.
2. Information queries. There are 2 information that need to be accessed by users of the national logistics information system. The first information is tracking the delivery process. The second information is information about the company directory related to the logistics distribution system. This is intended to make it easier for shippers belonging to MSMEs to access information about logistics services.
3. Information services. The national logistics information system provides information services related to regulations, laws and statistics related to the distribution process of goods in Indonesia.

Conclusion

The digitization of logistic process documents can be divided into two groups / parts, in this regard the following can be conveyed:

1. Digitization of (international) export and import logistics process documents. There is already an INSW (Indonesia National Single Window) system that has facilitated this. There are approximately 18 Ministries and Institutions (Trade, Industry, Transportation, Agriculture, Communication and Information Technology, Maritime Affairs and Fisheries, Health, Environment and Forestry, Energy and Mineral Resources, Defense, Police, Food and Drug Administration, National Energy Supervisory Agency, Nuclear, Investment Coordinating Board, Governor of Bank Indonesia) associated with the INSW system.
2. Digitization of domestic (domestic) logistics process documents. In this regard, there is no system that facilitates a domestic nature. An information system architecture has been designed as a basis for digitizing the logistics process based on the LOGINK information system. This information system is designed as an information-sharing platform that connects various stakeholders in the national logistics system. Related to logistics documents that are digitized can refer to PP. 74 of 2014 concerning Road Transportation, in article 58 and Regulation of the Minister of Transportation No.8 of 2012 concerning the Implementation and Business of Multimodal Transportation. There are 2 documents and 20 information data that can be used as data base in the national logistics information system.
3. Through digitizing documents related to the goods / logistics distribution process, a number of benefits can be obtained, such as:
 - a. Data accuracy related to:
 - i. Goods that are produced and or transacted domestically.
 - ii. Flow of types and quantities of goods from one place to another.
 - b. Ease related to control and supervision.
 - c. As a source of information in making national logistics policies.
 - d. Speed related to obtaining administrative management information.
 - e. It does not need to be done face to face, so it is hoped that the administration-related processes will be more effective and efficient.
4. Of these information systems, we recommend using the LOGINK (The National Transportation Logistics Public Information Platform) information system implemented by China as a benchmark for the design of a national logistics information system in Indonesia. The reason for choosing LOGINK is

based on the similarity of the problems at hand.

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