Optimization of Smart Technologies in Improving Sustainable Maritime Transportation

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Abstract. The geographical constellation of Indonesia among Asia and Australia as well as among Indian and Pacific ocean has an important role in sea transportation internationally and domestically. This paper aims to elaborate the advantage of geographical constellation in relation with sea transportation, to discuss Indonesia policies on sea transportation and to challenge the smart technology for answering the challenges. The discussion began with six areas of Indonesian policies such as: competitive sea transportation, connectivity, like infrastructure, compliance on safety and security, law enforcement and integration in organizational management. The paper also gave example on how currently information technology applied on Inportnet, National Logistic Ecosystem, Sitolaut and hazardous and harmful substances management system. Further research to support each of six areas on the context of smart technology need to be developed.

1. Background
The geographical constellation of Indonesia is located between the intersection of two continents (Asia and Australia) and two oceans (Indian and Pacific Oceans) and has 3 (three) Indonesian archipelagic sea lanes (ALKI). In addition, Indonesia is also a country with the largest archipelago in the world, has 17,499 islands from Sabang to Merauke, with a total area of Indonesia is 7.81 million km2, two-thirds of its territory consists of oceans, which consists of 1.9 million km2 of land, 3.25 million km2 of ocean, and 2.7 million km2 of the Exclusive Economic Zone (EEZ). The coastline is 94,156 km long (4th largest after Canada, USA and Russia). This constellation makes Indonesia's sea area the lifeblood of world trade, a strategic trade route through which world trade ships pass through the Malacca Strait and the ALKI route, this is evident from the large volume of world trade, about 90% of the world's goods are transported by water connected by various land transfer systems, such as rail, truck and air [1]. Approximately 40% of them through Indonesian waters [2].

The geographical structure is the main reason for a country or region to determine the transportation system it uses [3]. Transportation is one of the four pillars of globalization, together with telecommunications, trade liberalization and international standardization [4]. Looking at the geographical constellation of Indonesia, sea transportation is a very convenient meanseffective and efficient as well as integrated between transportation modes, because it is expected to be able to create an effective, reliable and dynamic national distribution pattern connect one region to another and encourage regional economic growth (transport promote the trade) and support an already developed economy (trade follow the ship) [5]. The national sea transportation connectivity system is also expected to be able to realize the connectivity of freight and passenger transportation.

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The sea transportation system in an archipelagic country such as Indonesia, has become the main backbone of the movement of the distribution of goods on a large scale, therefore the development of sea transportation in the future must be able to move the wheels development Indonesia. Realizing the importance of the role of sea transportation as one of the modes of transportation that can reach all regions in Indonesia, it is necessary to organize it in an integrated national transportation system that is able to realize the provision of balanced transportation services according to needs, safe, high accessibility, integrated, sufficient capacity, orderly, smoothly and quickly, easily accessible, on time, convenient, affordable rates, orderly, safe, low pollution, and efficient. The establishment of a sea transportation system is needed to encourage Indonesia as the world’s maritime axis, one of the pillars of which is a commitment to the development of maritime infrastructure and connectivity through the construction of sea tolls, sea ports, logistics, and the shipping industry, as well as maritime tourism. Along with climate change, sustainable transportation is something that must be complied with in every transportation system policy planning, taking into account 3 (three) pillar aspects. These aspects are environmental aspects, economic aspects, and social aspects. The environmental aspect is in the form of environmental sustainability. The economic aspect affects the income from the islands that are the destination and the social aspect is a supporting aspect to increase public confidence in sea transportation services. Sustainable transportation is expected to be able to integrate intra and intermodal, connectivity between transportation infrastructure, shipping industry, human resources, integration between stakeholders, so that sea transportation can be multidimensional and not egotistical through Industry 4.0 based technological innovation.

2. Challenges
Based on background, the challenges that arise are identified in eight areas such as: in the use of the sea toll, disparity (unbalanced economic growth between the Western and Eastern regions of Indonesia), cargo is still concentrated in the Western Region of Indonesia (an area that has high economic activity) so it is necessary to balance the cargo to the Eastern Region of Indonesia in addition to supporting the improvement of port infrastructure in the Eastern Region of Indonesia, connectivity (outermost areas – border areas – undeveloped areas), integration of information systems in the enforcement of security and safety at sea, logistics costs are quite high (inadequate infrastructure – cargo imbalance), the slow procurement and improvement of marine transportation facilities and infrastructure or the very limited availability of infrastructure, delay (delay in Port (Cargo delay & Ship delay), and water pollution and air pollution.

3. Writing Purpose
The purpose of writing this paper is to see the support of smart technology in sustainable transportation that can integrate intra and intermodal, connectivity between transportation infrastructure, shipping industry, human resources, integration between stakeholders, so that sea transportation can be multidimensional and not egocentric. (three) pillar aspects, namely environmental aspects, economic aspects, and social aspects.

4. Discussion
4.1. Discussion on Policy
Nowadays, 90% of goods transportation in Indonesia is done through land / highway transportation, 7% via sea transportation and the remaining 3% by other transportation. The process of shipping goods by sea is formed in a transportation ecosystem in ports, including: port authorities, terminals, shipping lines, carriers, and storage providers. Mobility The movement of goods in an ecosystem requires measurable policies and the role of adequate technology so as not to cause a lack of accuracy and optimization. The rapid development of technology has made the transformation of business patterns develop dynamically from manual systems to digital systems with e-business. This is a
demand for stakeholders at the port to cooperate with various business partners in offering products or services competitively, so that quality control, price, and speed of service can be achieved maximally with effectiveness and efficiency in terms of time and cost.

![The Maritime Transport Ecosystem](image)

**Figure. 1 The Maritime Transport Ecosystem**

In order to improve port performance, starting from infrastructure improvements to a number of innovations that continue to be developed, then through the Regulation of the Minister of Transportation No PM 157 of 2015 concerning Amendments to the Regulation of the Minister of Transportation Number PM 157 of 2015 concerning the Implementation of Inaportnet for Ships and Goods Services at Ports, has been enacted Inaportnet as an effort to improve the effectiveness, efficiency and transparency of ship and goods services in Harbor thus lowering logistics costs by cutting operating costs. This system operates and integrates all activities, both services and licensing (clearance) from all relevant agencies (other Government Agencies) in ship service activities, cargo services and other port services, so that it will be able to improve handling performance for trading activities and goods traffic, especially encouraging the acceleration of the Port clearance process. Thus, it is possible to send standardized documents for export and import activities through a single gateway-portal that can be accessed from their location or entities connected to the Inaportnet system.

In the concept of a port information system, Inaportnet is a single authority to receive information and disseminate this information to all relevant government agencies, as well as control coordination between several agencies at the port to prevent undue obstacles in the logistics chain. This system is supported by the Internal System of the Ministry of Transportation and the existing system of the Port Business Entity (BUP). The Ministry of Transportation's Internal System includes the Traffic and Sea Transportation Information System (SIMLALA).

Digitization through Inaportnet services includes, among others, digitizing approval of ship arrivals, approval of ships entering ports, approval of loading and unloading work plans, and approval of loading and unloading of dangerous goods, determination of ship services, approval letters for ship movement, approval of crew lists. Online Ship System, Seafarer Certification Application, Port Information System and Integrated Sea Transportation Electronic System (SEHATI).

Next Policy Directorate General of Sea Transportation in the Strategic Plan of the Directorate General of Sea Transportation, continue to be carried out by design, cannot be carried out in a business as usual manner through the following programs:

4.1.1. *The realizing of cheap, easy, simple and competitive sea transportation*

Through program such as: Development of the national fleet, improvement of the domestic sea transportation service system and increase of foreign freight cargo (beyond cabotage). Through Beyond Cabotage, the transportation of goods or services between countries or exports/imports is prioritized by Indonesian-flagged vessels. The plan designed is that national ships carrying out
transportation for export/import will be given some kind of incentive. It is hoped that Beyond Cabotage can further follow up on the success of the cabotage principle in order to be able to increase the growth of national shipping.

4.1.2. Improving sea transportation connectivity

There are several programs in relation with improving sea transportation connectivity as follows:

a. Increased pioneering effectiveness. Regulation of the Minister of Transportation Minimum Service Standards for Displacement Passenger Transport No.39 of 2015, still needs evaluation in its implementation, especially pioneering sea transportation services using privately owned vessels including its facilities. Some cases of accidents on pioneer ships need attention safety and fire control plans, through the design and calculation of fire and safety control plans, and evacuation routes to protect passengers and crew. Until 2021, the government will continue to improve water transportation services on routes determined by the Government to serve areas or areas that have not been or are not served by water transportation because they have not provided commercial benefits. The data below shows an increase in pioneering routes from 2019 to 2021, as follows:

| No | Year | Description |
|----|------|-------------|
| 1  | 2019 | a. 113 Routes; b. 41 Base Port; c. 498 Stopover Port; |
| 2  | 2020 | a. 110 Routes; b. 39 Base Port; c. 464 Stopover Port; |
| 3  | 2021 | a. 118 Routes; b. 41 Base Port; c. 519 Stopover Port; |

b. Increased Sea Toll. Sea toll is the provision of a logistics distribution system using large ships that connect ports on the main route or main route. The main routes of the sea toll road are Nanggroe Aceh Darussalam, Jakarta, Surabaya, Nusa Tenggara, and Maluku, to Papua. Meanwhile, distribution to other islands uses smaller ships compared to the fleet on the main route. If the ships that pass through the main route regularly sail, then the price of necessities in Papua will not differ much more than in Java.

The issuance of Presidential Regulation Number Perpres 27/2021 which is a derivative of Presidential Regulation 70/2017 including KM.282 of 2020 (pso tariffs for freight transport) provides a sharpening to reduce the disparity in the price of goods between plus and minus regions (3T) to ensure the availability of goods, ensure continuity of service delivery. Transportation of goods to and from the 3T area. In addition to goods regulated in the Minister of Trade, other goods can be transported by sea toll ship, but will be subject to commercial tariffs. In addition to the mandate to establish a logistics center, digitalization was also sharpened and mandated the use of IT regarding cargo information and ship loading space reservations (IMR) to support logistics connectivity between modes of shipping freight transport with tariffs and routes set by the Minister of Transportation.

In this sea toll program, a logistics center is also built in our house, apart from being a distributor/consolidator/retailer, it is also expected to recruit traders (outside traders/old players) in the area/location of the Logistics Center homebase or outside the homebase/port visited by the Sea/Hinterland Highway whose implementation can coordinate with the local Government Cq the Trade Office. The center is to serve the sale of goods brought from the Java port to the 3T area at affordable prices, receive and to collect local superior commodities, to be brought and sold to outside the region (Optimization of return cargo).
Considering the vastness of the oceans in Indonesia and the vast distances between regions, the sea toll system needs to be changed, especially in relation to ship travel schedules, so as not to use looping pattern, i.e. the pattern of goods delivery tends to be repeated regardless of harvest schedule or availability commodities in a destination area.

![Figure 2. Optimization Scheme for the Program of Own House (Rumah Kita Program)](image)

The increase in the sea toll road is also carried out through the integration of connectivity for freight transport at sea (sea toll) with air transportation (air bridge) through the scenario of transporting goods from Pomako port to Mozes Kilangin airport with the aim of providing goods distribution services to areas/inland areas/mountains of Papua to ensure availability of goods and reduce price disparities in the area/region. Meanwhile, in the land sector, the concept of the sea toll road will be combined with the railway network in Sumatra, Java, Kalimantan, Sulawesi and Papua.

![Figure 3. Sea Toll Improvement Scheme Through Sea Freight Integration Connectivity.](image)

The increase in sea tolls was accelerated by the concept of Hub and SPOKE. The Concept of Hub and Spoke is a network pattern that utilizes collecting ports. The main port requests temporary cargo and delivery to other ports that act as feeders. This design uses large ships for the distribution of cargo between hubs or so-called main lines. While the ship is smaller, used to distribute goods from the Hub to Spoke, or vice versa. The concept can be the best route and also result in the most cost efficient.
This concept can reduce ship operational costs, shipping costs taking into account the cargo the ship carries, fuel prices, and container costs. Utilization of network-based information systems in the delivery of sea toll freight, needs to be controlled. Improved connectivity continues to pay attention to the arrangement of the domestic shipping network, the provision of sea transportation to support tourism, 3TP areas, KEK, KI and SKPT.

4.1.3. Provision of competitive seaport infrastructure
Through program such as: Continuation of port development/development, Development of supporting ports of national priority (KSPN, KI, DPTK and Sea Toll), Implementation of P3D, Improvement of Coastal Radio Station Facilities and Equipment. The provision of this infrastructure will be developed through the digitization of ports in order to become a smart port authority. Fulfillment of port standards, Modernization and efficiency of loading and unloading ports, Development of Green Ports and Port Information Systems. Greenport is a new concept in sustainable port development that integrates aspects of environmental sustainability, energy conservation, community development, and the economic interests of the port itself through Port Waste Management System in ports and handling air pollution, as one of the pollution caused by ship activities through the application of shore power.

According to the Greenes Major of Korean Port, there are 15 factors of environmental problems related to facilities and servicesport operations. These environmental problems include: the use of alternative fuels, providing incentives to reduce pollution, renewing the energy used, dredging and recycling, port facilities and equipment repair, development of breakwater systems for waterfront revitalization, technical development for industrial waste disposal, methods constructively to reduce noise, Renewal of resources within the Port area, Explanation of resources within the Port area, Introduction of the Port area management system, Development planning, Mode change. Introduction to environmental impact assessment and Creation of coastlines and wetlands.

4.1.4. Increasing compliance with maritime safety, security and environmental protection regulations
Through program such as: Strengthening infrastructure and improving the quality of navigation services, strengthening institutions and human resources as well as implementing international regulations, fulfilling shipping safety and security, developing shipping navigational aids (SBNP) shipping telecommunications (special telecommunications for the purposes of the shipping service which is each transmitting, sending or receiving every type of sign, picture, sound and information in any form through a wire system, optical, radio, or other electromagnetic system in the shipping-mobile service which is part of shipping safety) and increasing shipping safety & security, including:

a. Improvement of shipping safety supporting infrastructure;
b. Improvement of Equipment and Electronic Facilities Facilities in the VTS area;
c. Improvement of LRIT Facilities;
d. Improvement of GMDSS Hazard and Safety Communication Equipment by Using Terrestrial and Satellite Radio Networks;
e. Improvement of national data center (NDC) for LRIT;
f. Increasing the Quantity of Reliability and Development of Shipping Telecommunication Facilities Technology;
g. Increasing the Quantity of Reliability and Development of State Ship Technology (KPLP Patrol and Navigation);
h. Arrangement of Waterways and Locations, Implementation of VTS and Formulation and Stipulation of Provisions Related to Shipping Safety in connection with Offshore Activities;
i. Feasibility Assessment and Procurement of CCTV Security Equipment at Ports Open to Overseas Shipping and Ports designated to serve Eid and Christmas transportation;
j. Construction of Shipping Telecommunication System (Vessel Traffic Information Service, Malacca Strait VTS – Singapore, Maintenance and Replacement of Aids to Navigation in the Strait
of Malacca and Singapore, Marine Electronic Highway (MEH) Project, Ship Reporting System Project, & Maritime Telecommunications System Development Project Phase IV);

4.1.5. Increasing the effectiveness of law enforcement at sea
Through program such as: Fulfilling the needs and reliability of patrol boats, Increasing the fulfillment of human resources in the Coast Guard PLP Sector, Increasing the number of ships and faspel that have ISPS Code certificates and strengthening the Sea & Coast Guard KPLP Institution.

One way to be able to realize good management in the marine area of the archipelago, is to exchange data and information in each ministry and institution (K/L) that are directly related. The process of exchanging data and information is carried out using the latest technology called API Gateway or application programming interface gateway. API is an interpreter of communication between client and server to simplify software implementation and improvement. In addition to technology, the presence of observers on board is also important to be able to present accurate and quality data and information. The role is mainly to manage fish catch data in the capture fisheries sub-sector.

4.1.6. Improving integration in organizational management
Through program such as: Reforming bureaucratic cuts, simplifying regulations, optimizing financial management and BMN, Strengthening Marine Transportation Human Resources and Integration of sea transportation information systems. The system of integration/integration contributes to the competitiveness of sea transportation through: increasing freight transportation using the SSS / Short Sea System, increasing the operational volume of Terminals / Ports, and expanding the maritime network.

4.2. Discussion on Smart Technology
To overcome this problem, Innovation is required through digitization and automation. In reviewliteraturerecently, Fruth and Teuteberg (2017) divided the emerging literature on digitization in shipping across six areas (automation, big data, simulation and modeling, software, sustainable ocean transport, and risk). By embracing innovation and digital tools, a port can develop a smart port strategy. Ship and port automation known as smart vessel and smart port has been developed in Singapore, as one of our competitors. Smart port technology connecting the entire port ecosystem to a new smart port to connect to the global supply chain. As ports continue to digitize their processes, it aims to create an information hub for the regional transport ecosystem. The policies that have been issued by the government in principle have accommodated application technological innovation.

4.2.1. Technology for safety and security
Maritime 4.0 using new and disruptive technologies such as artificial intelligence (AI), robotics, virtual reality, and IoT devices and applications, the pace of adopting and implementing digitalization strategies is rapidly growing and sustaining, requiring harmonization and standardization of data across the maritime industry, International Maritime Organization (IMO) launched the e-Navigation initiative, which defines maritime services based on different categories of digitizing services within the group. The concept of E-Navigation is expected to open up opportunities for harmonization and digitization of the marine sector, navigation systems on ships, and connecting them with coastal support facilities. Ships are now equipped with various modern ship navigation systems, such as Automatic Identification System (AIS), Electronic Chart Display and Information System (ECDIS), Global Maritime Distress and Safety System (GMDSS) and Long Range Identification and Tracking of Ships (LRIT). The emergence of artificial intelligence has changed the maritime world and has an impact on ship navigation systems and operations such as the development of smart ships or maritime autonomous surface ships.
4.2.2. Inaportnet Development

Industry Maritime transportation has undergone tremendous changes in recent years. Currently the digital transformation in the shipping world is through the Inaportnet application in ports and ship automation in world shipping. Inaportnet is an integrated portal (one-stop service) in services and licensing (clearance) from every relevant agency/shipping industry actor (OGA) in port services, with the aim of accelerating the clearance process by simplifying document delivery through a gateway portal that is connected to the internet and can easily accessed by the trading shipping parties involved in the transaction.

In the future, it is hoped that further development of informatization in the port sector, including inaportnet as an information infrastructure related to ports in Indonesia, is expected to operate inaportnet on an ongoing basis without any service being stopped with a focus on developing the INAPORTNET system in Harborothers, adding functions to handle information on goods at ports, strengthening relations with other KEMENHUB/DJPL systems, integration with INSW. Implementing inaportnet is an important opportunity to change awareness about the informatization of the Indonesian port sector, while still paying attention to Service Level Agreements and Service Level Guarantees between stakeholders at ports.

In addition, the development of e-business at the Port illustrates the integration of systems payment port services with banks as well as the application of the concept of the Port Community System (PCS) at a further level by focusing on information exchange in the maritime shipping and freight distribution divisions on land, including several new players such as freight forwarders and trucking companies to create an information chain within the the scope of the port which includes the logistics process from the ship entering the port until the cargo carried in it enters the consolidation center in the port with real time data support supported in two-way communication, providing information on the development and progress of PCS to customers. Development smart technology that can support Inaportnet is carried out by expanding port services, namely:

4.2.3. 5G Network Strengthening

Automated Guided Vehicle (AGV) without a crew, controlled automatically by remote control through a control room supported by sophisticated information systems and technology. Only the loading and unloading of trucks, chassis and boats is in the hands of human operators and crane operators. The use of this IT system begins at the arrival of the container at the dock, arrangement at the stacking yard to exit the terminal gate and vice versa. The use of automatic unloading tools with the support of an IT system provides many benefits, firstly, activities can run more effectively and efficiently, because they do not require a lot of manpower, both operational and administrative staff. Second, it is environmentally friendly, because it does not use diesel fuel but electricity, so it can reduce air pollution (CO2, NOx, SOx), dust, vibration and sound, uses a battery that must be recharged every 8 hours. Third, productivity is more stable and can work 24/7, because it does not recognize the fatigue factor and decreased concentration as if manned by the workforce. Lastly, paperless, because all correspondence and administrative activities such as printing notes are carried out through the IT system, so as to reduce meetings with service users and minimize abuse of authority.

Part Most of the terminal operations are controlled by software. Automated Guided Vehicles (AGV) create a high degree of dependence on the computer system in use, are controlled by software and represent the connection between the gantry crane and the storage container. 5G technology will improve performance in the field to monitor daily operational activities and make terminal ports more 'smart' (effective operational performance). Then the increased connectivity and speed offered by 5G makes it able to transfer data securely in a matter of milliseconds. So it has the potential to disrupt the technological transformation of the container shipping industry, inter-port network, and logistics service companies to become the foundation of a more 'smart' supply chain network. 5G will also be the glue of Internet of Things (IoT) technology.
4.2.4. Sensor technology
Technology flexible and in large networks will be developed in tandem with IoT via mobile networks. At ports and terminals, it can be implemented so that equipment at ports is able to transmit data through sensors more independently (not dependent), automated, and operated efficiently. By implementing this innovation, for example in the form of a container tracking management system, it can use optical sensors to detect changes in conditions, including detecting when a container is opened by an unauthorized party. The equipment requires sensors to monitor the visibility, weather, location and condition of the equipment, sensors combined with engines.

![Utilization of sensors in maritime logistics](image)

**Figure 4. Utilization of sensors in maritime logistics**

To operate effectively, autonomous ships will require a large amount of environmental, performance, and location data. Sensor technology in the form of QR codes, RFID and AIS funds can be applied in transportation management services from ships to warehousing.

4.2.5. Internet of Vehicles
*Internet of Vehicles* (IoV) becomes important in supporting traffic management at ports to be more effective, so as to improve security and reduce the risk of collisions. For example installing an IoV device for track vehicles in real time so that they can help ports predict and prepare for arrivals and potential congestion at port gates. More specifically, the table below provides an overview of the types of harbours with the strategy for implementing the required technology as follows:

| Type               | Focus                        | Applicable Solutions                                      |
|--------------------|------------------------------|-----------------------------------------------------------|
| **Emerging Port**  | Ease of doing business       | 1. Port community system                                   |
|                    |                              | 2. Single-window customs                                   |
|                    |                              | 3. x-ray scanning                                          |
|                    |                              | 4. biometric access control system                         |
| **Local Trade Hub**| High productivity            | 1. Smart cargo-handling system                             |
|                    |                              | 2. Equipment management & control                          |
|                    |                              | 3. Gate automation                                         |
|                    |                              | 4. Safety management solutions                             |
| **Intermodal Gateway** | Optimized traffic across transport modes | 1. Truck appointment system                               |
|                    |                              | 2. Traffic-monitoring system                               |
|                    |                              | 3. Integrated rail & barge platform                        |
| **City-based Port**| Minimized impact on surroundings| 1. Asset health monitoring                                 |
|                    |                              | 2. Environment & energy                                    |
|                    |                              | 3. Management systems                                     |
|                    |                              | 4. Port-wide platform                                      |

Table 2. Pioneer Route Improvements
4.2.6. Digitizing the Sea Toll

Digital technology at the port in the logistics framework is known as Logistics Ecosystem (NLE) is expected to harmonize the flow of goods and international documents from the arrival of the means of transportation until the goods arrive at the warehouse. To optimize the NLE program, the port digital capabilities concept has been pursued by creating connectivity at the port digitally. Digitizing port services and in line with government steps so that in the future it is expected to attract many investors and improve the quality of human resources in all ports in Indonesia. This digital-based application is carried out to improve sea toll services, by tracking, IMRK-LCS-Phinaship, Zebrax Data Analysis, and digital vendors.

Digitization of services is carried out by facilitating the process of ordering containers in a transparent manner and being able to distribute cargo fairly to shippers in Remote, Disadvantaged, Outermost, and Border areas (3TP). The digital platform is expected to provide easier opportunities because the Indonesian people are getting used to using the application, in a Logistic Communication System (ILC) that can make it easier for the public to access information on ship schedules, ship tracking positions, availability of containers, shipping orders, manifests and shipping costs, statistical data on departing and returning cargo shipments, up to the selling price of basic and essential goods, as well as tracking export shipments of regional industrial products that can stimulate return loads.

![Figure 5. Utilization of IT Inaportnet](image)

The main thing is how to integrate between financial, trade, and transportation agencies, so as not to compete with each other. Meanwhile, the world's developed ports such as China have turned to blockchain and big data systems. China Merchant Port Group (CMP) partnered with Alibaba Group, building a blockchain platform to support more efficient ports and increase revenue.

Integration can be done through HIU (Hybrid Integration Utilities). This integration symbolizes the innovation process that will be carried out between the existing system and the system to be developed. The development of the Terminal Operating System is expected to be able to organize the Buffer Zone, speed up the Loading and Discharging traffic process, and reduce the margin of error through the following stages:
a) The first stage
development of this integrated system by adapting operational patterns, both from conditioning
data sources from manual to automatic, to developing customized resources to adapt to
digitalization of data.
b) The second stage, which is in the implementation and technology integration stage of the digital
transformation port operational system for smart ports at this port, is devoted to ports in Indonesia.

4.2.7. Green Port
Through ecoPort which utilizes the manufacture of facilities and technology Harbor which is more
friendly to the environment, including the use of digital-based technology to improve port operations
so that it is much more efficient and transparent, it is hoped that later it can be used not only for ship
facilities and port infrastructure but also for passengers and goods services. Meanwhile, the digital
system is used for a number of functions and services at the port, including Inaportnet and E-Ticketing
for passengers.

Ecoport take advantage of the port not only be preoccupied with loading and unloading activities
goods, but also very close to sports activities and marine tourism. However, to be able to combine
these various functions, ports must own and maintain a port area with a green port concept in a
sustainable manner. Coastal pollution, especially effect of loading and unloading activity, for example,
should be kept to a minimum. Likewise, the existence of green open spaces must be strived for and
maintained to the maximum level, so that conservation functions in the port area can be
maintained. Such as fulfilling all regulatory requirements in the environmental field, implementing an
environmental management system. Then, the implementation of green initiatives (green initiatives),
stakeholder involvement to support efforts to comply with regulations and implementation of green
initiatives in ports, as illustrated in the planning below:

![Figure 6. Utilization of IT Inaportnet](image)

5. Conclusion
Smart technology optimization to create sustainable technology can be done through: digitization in
shipping in six areas (automation, big data, simulation and modeling, software, sustainable ocean
transportation, and risk). The use of smart technology is expected to trigger Ecoport with 4 main
pillars such as compliance with all regulatory requirements in the environmental field, implementation
of an environmental management system. Implementation of green initiatives, and commitment and
involvement of stakeholders to support efforts to comply with regulations and implement green
initiatives at ports. Through continuous efforts and strengthening the digital era culture for all human
resources as well as strengthening appropriate budgeting, the optimization of smart technology in the marine transportation ecosystem is expected to be able to create effectiveness, efficiency and trust and profitability for the maritime industry in Indonesia. That Discussion make a two kind way as follows: firstly, policy, this is a demand for stakeholders at the port to cooperate with various business partners in offering products or services competitively, so that quality control, price, and speed of service can be achieved maximally with effectiveness and efficiency in terms of time and cost. Secondly, Smart Technology, Innovation is required through digitization and automation.

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