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Implementation of Electronic Seal Cargo at Cikarang Dry Port to Support National Logistics System

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Abstrak

Penelitian ini membahas penerapan Electronic Seal (E-Seal) Cargo di Cikarang Dry Port sebagai upaya mendukung keamanan kargo peti kemas pada Sistem Logistik Nasional (Sislognas) Indonesia. Penelitian ini juga mengkaji peran Cikarang Dry Port sebagai infrastruktur logistik utama dalam memfasilitasi masuknya barang kargo internasional ke Indonesia, dengan penerapan E-Seal pada armadanya sebagai langkah mendukung pencapaian target Sislognas. Metode penelitian artikel ini menggunakan metode deskriptif kualitatif. Data yang diperoleh digunakan untuk memahami bagaimana implementasi penggunaan e-seal di dry port cikarang. Hasil dari penelitian ini adalah gambaran jenis alat e-seal yang digunakan, alur penggunaan e-seal di dry port cikarang dan analisis tingkat kerusakan alat e-seal.

Kata Kunci: Segel Elektronik; Pelabuhan Kering Cikarang; Sistem Logistik Nasional.

Abstract

This study discusses the implementation of Electronic Seal (E-Seal) Cargo at Cikarang Dry Port as an effort to support container cargo security in Indonesia's Sistem Logistik Nasional (Sislognas). This research also examines the role of Cikarang Dry Port as a key logistics infrastructure in facilitating the entry of international cargo goods into Indonesia, with the implementation of E-Seal on their fleet as a step to support the achievement of *Sislognas* targets. The research method of this article uses a descriptive qualitative method. The data obtained is used to understand how the implementation of the use of e-seal at cikarang dry port. The results of this study are a description of the types of e-seal devices used, the flow of e-seal use at cikarang dry port and an analysis of the level of damage to E-seal devices.

Keyword: Electronic Seal; Cikarang Dry Port; National Logistics System.

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1. Intruduction

At the end of May 2011, the government issued the Masterplan for the Acceleration and Expansion of Indonesia's Economic Development (MP3EI), which was stipulated by Presidential Regulation (Perpres) Number 32 of 2011. MP3EI aims to form an integrated development plan based on the government's optimistic view of Indonesia's international position. This masterplan is also intended to encourage Indonesia's vision of becoming the world's 10th largest country by 2025. MP3EI has three main strategies, namely: (1) Increasing Regional Economic Potential through Economic Corridors, (2) Strengthening National Connectivity, and (3) Strengthening National Human Resources (HR) and Science and Technology (IPTEK) Capabilities.

In Sislognas, it is also stated that to carry out logistics activities, logistics infrastructure is needed, consisting of logistics nodes and logistics links that function to move goods from the point of origin to the point of destination. Logistics nodes can be logistics actors, as well as consumers, while logistics links include distribution networks, transportation networks, information networks, and financial networks. One of the strategies of the National Logistics System (Sislognas) is the Information and Communication Technology Strategy, namely by building a National e-Logistics (INALOG) that is reliable, safe, and operates efficiently and is connected to the Association of Southeast Asia Nations (ASEAN) logistics network and the global logistics network online. To support this strategy, a capable technology is needed in logistics deposits to support fast information exchange and support security. One of the technologies used to support the national logistics system is the use of E-Seal. E-seal itself is useful as a monitoring and detection tool for goods carried by cargo containers from the threat of damage, break-in, monitoring trucking routes and as a means of detecting the condition of cargo goods.

The Indonesian government has stipulated E-seal as a condition for the transfer of imported goods storage location for TPS in 2016. The obligation is an implementation of the Minister of Finance Regulation (PMK) No. 23/2015 on Customs Zone and Temporary Stockpile and Minister of Transportation Regulation No. 117/2015. Cikarang dry port as logistics infrastructure in Indonesia with port code IDJBK port and under the auspices of PT Cikarang Inland Port, plays an important role in the entry of international cargo goods into Indonesia. Cikarang dry port acts as a spoke (feeder port) from the Hub (main port) of Tanjung Priok to carry out port activities on land and reach the hinterland and industrial areas in the Cikarang and Karawang areas. Cikarang Dry Port also supports the target of achieving sislognas by implementing E-seal on their entire fleet that transports export and import cargo to be transported to the hub (main port) of Tanjung Priok. Based on the description above, the authors are interested in studying more deeply and expressing in the form of a study with the title "Implementation of Electronic Seal Cargo at Cikarang Dry Port to Support Container Cargo Security in the National Logistics System (Sislognas)".

2. Methods

The research method in writing this article uses a descriptive qualitative method. The purpose of this article is to find out the implementation conditions for the use of electronic seals at Cikarang Dry Port. Based on the research methods and objectives that have been determined, the authors need sources that are directly related to the object of research, namely IT Presales & Technical PT. Proteksi Usaha Indonesia as a subsidiary of Cikarang Inland Port which is authorized and plays a role in the use of E-Seal at Cikarang Inland Port. The results of interviews and observations are data to understand how the implementation of the use of e-seal at cikarang dry port is presented in the form of descriptive data.

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3. Result and Discussion

Cikarang dry port with port code IDJBK port and under the auspices of PT Cikarang Inland Port plays an important role in the entry of international cargo goods into Indonesia. Cikarang dry port acts as a spoke (feeder port) from the Hub (main port) of Tanjung Priok to carry out port activities on land and reach the hinterland and industrial areas in the Cikarang and Karawang areas. Cikarang Dry Port implements The SAFE Framework of the World Customs Organization and International standards to increase international trade and return value to supply chain entrepreneurs both in Indonesia and abroad. Cikarang Dry Port is designed as an Integrated Service Port Area. With this one-stop service, documentation and inspection processes related to Customs, Animal Quarantine and Plant Quarantine are completed here. Supported by Indonesia National Single Window (INSW), these integrated services and facilities will provide convenience, service certainty and increase productivity.

As a logistics infrastructure in Indonesia, cikarang dry port plays a role in the smooth flow of logistics, especially in channeling shipments of goods to hinterland areas. Cikarang dry port also supports the running of the national logistics system by installing e-seals on their entire fleet that transports export and import cargo to be transported to the hub (main port) under the auspices of PT Proteksi Usaha Indonesia. An e-seal container is a sealing device with an RFID chip inside that can be read by an enabled device through a fixed reader, portable reader, or other modes. Each e-seal has a unique number associated with the container number and can be used to ensure the security and integrity of the container during shipment. E-seals work with RFID technology at ultra-high frequency (UHF) and ISO 18000 protocols. E-seals are used to replace mechanical seals that are commonly used by the shipping industry. E-seal can record and transmit information about the integrity of the sealed container at predefined intervals. Information can also be recorded when the container passes through a fixed reader or when read by a portable reader (Marpaung, 2019). E-seals can also be used as proof that the container has been accepted and delivered by an authorized party, as well as ensuring the safety and integrity of the container during shipment.

3.1 Electronic seal standards

E-seals are programmed with a set of standardized data with the following coded information (Jiang et al., 2017):

1) E-Seal ID number
2) Manufacturer ID number for the E-Seal
3) Time indication of when the seal has been closed and when the seal has been opened
4) Information indicating any tampering with the seal.

Currently ISO-18185 consists of the following parts:

1) ISO 18185-1, Freight containers - Electronic seals -Part 1: Communication protocol
2) ISO 18185-2, Freight containers - Electronic seals -Part 2: Application requirements
3) ISO 18185-3, Freight containers-Electronic seals -Part 3: Environmental characteristics
4) ISO 18185-4, Freight containers - Electronic seals -Part 4: Data protection
5) ISO 18185-6, Freight containers - Electronic seals -Part 6: Message sets for transfer between seal reader and host computer
6) ISO 18185-7, Freight containers - Electronic seals -Part 7: Physical layer The ISO 18185 system consists of three different components, namely the E-seal, LF transmitter, and reader. The main feature of the system is dual frequency operation (Harmon, n.d.).

3.2 Types of Electronic Cargo Seals

There are 4 types of electronic cargo seals, namely (Mosby, 2023):

a) RFID seals: passive and active
b) Infrared (IR) seals

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c) Contact Seals
d) Remote Reporting Seals.

The difference between the four is in the technical and functional aspects used by the seal device and reader to communicate with each other. Of the four types, the most suitable to be applied to cargo e-seals are e-seals equipped with Active RFID. This is because active RFID e-seal technology has benefits in improving supply chain security and efficiency, especially in terms of real-time monitoring, location tracking, and reporting of events that occur in the container. Whereas passive RFID does not provide adequate data storage or data search capabilities for trucking containerized cargo through e-seal.

Active RFID has more advanced capabilities and high cost. Active RFID is equipped with batteries and power that enable longer range and greater functionality. Active RFID can detect tampering as it occurs and add it to the time record of the event. If equipped or connected with GPS, active seals can also record location. In addition, some seals can provide live "mayday" tamper reports as events occur, mostly within specially equipped terminals. The term 'active RFID' generally implies the use of an installed power source, which in many cases gives electronic seals the following capabilities:

1) Continuous remote monitoring of seal integrity
2) Capturing and recording timing data when the seal recognizes an event or integrity damage
3) Multi-directional communication
4) Longer communication range than found in passive RFID electronic seals
5) Real-time tamper reports

3.3 E-Seal Implementation at Cikarang Dry Port

Cikarang Dry Port, in carrying out its role as a spoke (feeder port) of the Hub (main port) of Tanjung Priok has a high commitment and integrity to service quality standards and security of goods (Santoso, 2020). Cikarang Dry Port also supports the implementation of one of the strategies of the National Logistics System (Sislognas), namely the Information and Communication Technology Strategy through the use of E-Seal in trucking activities, moving containers and tracking export and import cargo. The location of Cikarang Dry Port, which is affiliated with customs, makes the security of international cargo tighter because it is related to checking cargo containers so that incoming goods become legal. One of the efforts to monitor goods in shipping goods from the main port to Cikarang dry port is by installing e-seal technology on the container.

E-seal at Cikarang dry port uses a type of e-seal that is equipped with active RFID. In addition, E-seal at Cikarang dry port is also equipped with geofencing technology. Geofencing is a technology used to monitor moving objects such as smartphones, vehicles and others using the Global Positioning System (GPS) satellite network (Muhammad Dawamul Mughni & Putri Aisyiyah Rakhma Devi, 2023). Cikarang dry port uses 3 types of e seals with the types iSPOT - iSensor, iSPOT - iScout Mini and iSPOT- In-Vehicle Management (IVM). All types of E-seals installed on cargo containers can be monitored through the Electronic Container Tracking System (ECTS) application from Ascent solutions (Electronic Cargo Tracking & Security Devices|Ascent Solutions, n.d.). The following are the specifications of the three types of E-seals.

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Table 1. Key Features of E-seal at Cikarang Dry Port

IVM	iSpot-iScout mini	iSpot – iScout
		
a) Able to monitor iSpot-iSensor & iSpot temp b) Multiple analogue and digital I/Os c) High input voltage range (8v-30v) d) MIL-STD-810F compliant e) Satellite failover (optional)	a) Compact size b) IP66 dust and water proof c) Intellegent power management d) Real time tamper detection e) MIL-STD-810F compliant f) Rechargeable battery	a) Able to monitor iSpot-iSensor & iSpot temp b) IP66 dust and water proof c) Intellegent power management d) Real time tamper detection e) Rechargeable battery

From 2016-2023, there were 789 e- seal units from the accumulation of the three types with the following specifications.

Table 2. Number of E-Seal Devices Cikarang Dry Port Based on Year of Procurement Goods

Device Procurement Year	Types of E-Seal		
	I-Scout	I-Sensor	IVM
2016		71	63
2017	35	98	102
2019	89	85	87
2021	29		
2022	80		
2023	50		

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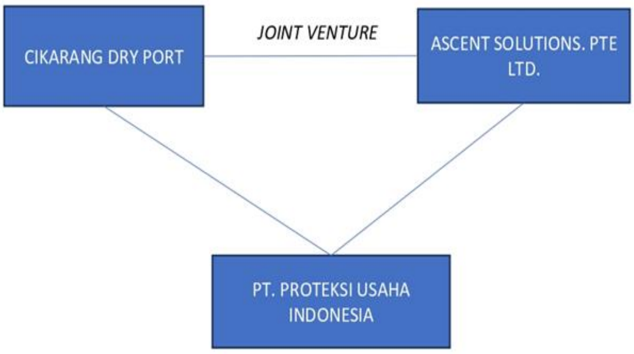
Subtotal	283	254	252
Total		789	

Cikarang dry port cooperates with PT Proteksi Usaha Indonesia (PUI) as a subsidiary to manage the E-seal used in cikarang dry port. Reporting from the PT Proteksi Usaha Indonesia page (http://www.proteksiui.com/), (*Proteksi Usaha Indonesia*, n.d.) PT Proteksi Usaha Indonesia is a joint venture company between PT Cikarang Inland Port and Ascent Solutions Pte Ltd. PT Cikarang Inland Port manages and operates Cikarang Dry Port, an integrated port and logistics facility in Cikarang, Indonesia. Ascent Solutions is a Singapore-based IoT company specializing in cargo security and track & trace for smart logistics. Both companies have more than 8 years of experience in developing smart logistics solutions at Cikarang Dry Port for the development of terminal operations and bonded logistics centers (*Proteksi Usaha Indonesia*, n.d.). PUI acts as e-seal vendor and supplier in the implementation and use of E-seal at Cikarang Dry Port. PT PUI has the task of supplying e-seal devices, repairing e-seals and claiming e-seal damage. All applications for the use of e-seal devices, repairs and purchases are made under the auspices of PT Proteksi Usaha Indonesia (PUI).



Picture 1. Business Structure

3.4 Flow of E-seal Usage at Cikarang Dry Port

The flow of e-seal use at Cikarang Dry Port involves the Cikarang Dry Port operational department as a user and PT PUI as a vendor or provider of e-seal devices. The use of this e-seal aims to ensure the safety and smoothness of the goods transfer process. In addition, e-seals are also used to monitor and secure cargo using both trucking and train modes. The following is the flow of E-seal usage at Cikarang Dry Port.

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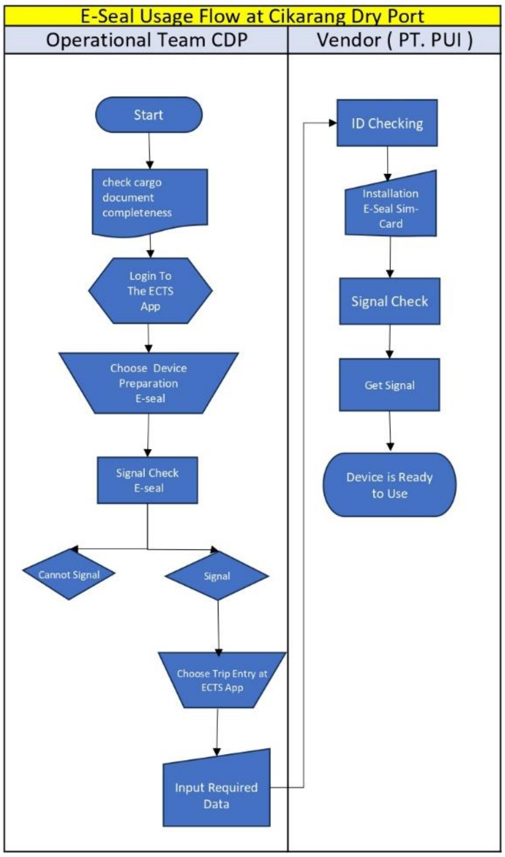

Picture 2. E-Seal Usage Flow at Cikarang Dry Port

3.5 E-Seal Device Damage

The recording of the number of devices damaged by e-seal devices is based on the results of accumulation and recording that refers to the year of procurement of e-seal devices, not the current year. This means that the data included in the e-seal device defect analysis reflects the monitoring results from the years since its procurement, not from the specific year of the defect. This approach provides a more holistic perspective and allows us to more effectively understand defect trends over time, aiding the identification of patterns and designing more proactive maintenance strategies. The following data is the result of monitoring the condition of the device based on the year of procurement of e-seal goods (e-seal purchases in 2016, 2017, 2019, 2020, 2021, 2022) from 2016-2023. The type of damage to the e-seal consists of 2 types, namely:

1) Damaged
   This type of damage occurs when the e-seal device suffers physical damage as a result of several factors, including improper physical contact, prolonged use of the device, and high intensity of use. For example, an e-seal device may crack, break, or have other physical components damaged due to impact or excessive pressure. Physical damage can significantly affect the performance of the device and hinder the desired security and tracking functions.
2) Malfunction
   This type of damage is related to glitches or failures in the software that operates the e-seal. This could include system failure, software unresponsiveness, or a mismatch between the hardware and the software. Malfunctions can be caused by various factors, such as bugs in the software, version incompatibility, or failure of the software update process. Software malfunctions can

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have a serious impact on e-seal functionality, including difficulties in obtaining and processing data, inaccurate tracking, and potential failure to perform mandated security tasks.

Table 3. Type IVM E-seal Device Damage Data Based on Procurement Year

Device Procurement Year	Type Of Damaged	Quantity
2016	Malfunction	5
2017	Malfunction	4
2019	Malfunction	6

The data is the result of monitoring carried out on 2023 on e-seal devices procured in 2016, 2017 and 2019. In the 2023 monitoring of type IVM e-seal devices at Cikarang Dry Port, the damage data shows that there is only a malfunction damage type category. This means that the recorded malfunctions are caused by glitches or failures in the software that operates the e-seal, while physical malfunctions are not detected in type IVM. Interestingly, the number of malfunctioning devices is relatively small, with less than 10 malfunctioning devices. This suggests that despite the malfunctions, the reliability of IVM devices is relatively high.

Table 4. Type I-Sensor E-seal Device Damage Data Based on Procurement Year

Device Procurement Year	Type Of Damaged	Quantity
2016	Damaged	67
2017	Damaged	14
2019	Damaged	15

In the 2023 monitoring of the e-seal type I Sensor device at Cikarang Dry Port, the monitoring results show that the damage that occurs on the device is only physical or damaged. This means that the devices were damaged due to reasons such as physical impact or prolonged use. What is interesting to note is that there was a significant increase in the number of damages in the 2016 procurement year, where 64 devices were damaged. This caused by due to the high intensity of use or the age of the devices. However, there was a decrease in the number of defects in the following years, with 2017 seeing only 14 defective devices, and 2019 seeing a relatively low number of defects. It is important to note that the spike in the number of defects in the 2019 procurement year is most likely due to the high intensity of use and the increase in the number of devices acquired that year.

Table 5. Type I-Scout E-seal Device Damage Data Based on Procurement Year

Device Procurement Year	Type Of Damaged	Quantity
2017	Malfunction	5
	Damaged	35
2019	Malfunction	25
	Damaged	57

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2021	Malfunction	9
	Damaged	10

In the 2023 monitoring of type I Scout e-seal devices at Cikarang Dry Port, two types of damage were recorded, namely malfunction and damaged. Data analysis shows a comparison of damage in the device procurement years 2017, 2019, and 2021. In 2017, there were 5 malfunction cases and 35 damaged cases. This indicates that most of the defects in that procurement year were related to physical damage (damaged) rather than software damage (malfunction). However, in 2019, there was a significant increase. There were 25 malfunction cases and 57 damaged cases. The increase in malfunctions may indicate a problem in the software that operates the Type I Scout e-seal. Meanwhile, the number of damaged remains high, indicating that there are still problems with the physical aspects of the device. In 2021, there was an overall decrease in the number of damages. There were 9 cases of malfunction and 10 cases of damaged. This decrease was influenced by the new condition of the device.

4. Conclusion

In wrapping up, Indonesia's Masterplan for Economic Development (MP3EI), initiated in 2011, underscores the nation's ambitious goals for global economic stature. The strategies laid out in MP3EI, focusing on regional development, enhanced connectivity, and investment in human resources and technology, form the cornerstone of Indonesia's economic vision. Integral to the success of the National Logistics System (Sislognas) is the strategic implementation of Electronic Seals (E-Seals). Cikarang Dry Port, a pivotal player in managing international cargo flow, has adeptly incorporated E-Seals, particularly those equipped with Active RFID technology. This integration ensures not only the secure transportation of goods but also adherence to international standards outlined in ISO 18185.

Over the period from 2016 to 2023, a total of 789 E-Seals have been procured and managed by PT Proteksi Usaha Indonesia (PUI), a subsidiary of Cikarang Inland Port. The collaborative efforts between Cikarang Dry Port's operational department and PT PUI have been instrumental in facilitating secure and efficient goods transfer. A crucial aspect of this system involves vigilant monitoring to identify and address both physical damages, such as wear and tear, and software-related issues. This proactive approach ensures the continued effectiveness of the E-Seal system. In essence, the strategic use of E-Seals at Cikarang Dry Port stands as a testament to Indonesia's commitment to leveraging technology for bolstering security and efficiency in national logistics. This not only aligns with the broader economic objectives but also highlights the pivotal role of technology in shaping modern and robust logistics systems.

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has made a significant contribution in providing data and information related to security aspects that are highly relevant to the scope of this research. Your support has not only enriched the content of this journal but also provided a more holistic perspective. All of this is not just a collaboration, but a synergy between the academic world and industry practitioners. As such, the results of this research are expected to make a positive contribution in developing our understanding of current issues in the industry.

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