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Performance Analysis of Terminal II of The New Makassar Container Port in Supporting Logistics Distribution in South Sulawesi

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Abstract

The New Makassar Container Port serves as logistics hub that impacts local economic growth and facilitates the distribution of goods between regions. To optimise port operations, it is crucial to establish connections with the hinterland area. Terminal II is designed to handle the flow of containers. According to the current stage of development, the existing capacity and facilities should be able to handle a larger volume of containers. This study aims to evaluate the performance of the logistics system through time and service performance indicators. The research method involves both qualitative and quantitative approaches, with freight forwarders and shipping companies as the sample population. The analysis involves a descriptive analysis of the logistics system and an Importance Performance Analysis (IPA) to assess performance and satisfaction of service users. The Potential Gain in Customer Value (PGCV) method was used to determine priority areas for improvement. The results show that Terminal II of the New Makassar Container Port performs well and meets the standards set by the Director General of Sea Transportation. However, international shipping services have not been fully utilized, contributing to low container flow and underutilization of the installed capacity. Additionally, export activities remain heavily reliant on commodities instead of industrial goods. The IPA and PGCV analyses revealed that the priority areas of improvement include sustainable and customer-oriented operating processes, with a conformity rate of 79% and the highest PGCV value of 6.22. Regular evaluations of both the physical and human aspects of port operations are necessary.

1. Introduction

Globalization has fueled a massive demand for chemicals, food, and commodities to be transported from one country to another. Eighty percent of these goods are transported by sea according to the UNCTAD [1]. In a well-functioning port system, each port serves as a node in the shipping chain rather than as the final destination [2]. The quality of sea transportation infrastructure is critical to enhance the efficiency of the maritime logistics system, leading to increased economic value-add and competitiveness in international trade [3]. Adequate transportation mode is influenced by a number of factors, such as the transportation time, costs, impact on the environment, infra- structure, retention at the border crossing, etc [4]. Indonesia, as an archipelagic country, faces challenges in establishing an efficient maritime logistics system. It ranks 46th in the world for logistics performance and 4th in Southeast Asia, trailing Singapore (7th) and Thailand (32nd) [5]. The logistics system in Indonesia is rapidly evolving. Most inter-island distribution of goods takes a long time and is expensive because of inadequate infrastructure [6].

The port sector in Indonesia is complex, as the country is an archipelago with more sea area than land [7]. Recognizing the importance of maritime logistics in Indonesia, it is necessary to build a comprehensive maritime logistics system [8]. The role of ports has evolved from merely facilitating loading and unloading to being a crucial link in the larger logistics chain of a global distribution channel. One of the strategies in maritime logistics is to increase port efficiency [9]. Logistics ports are characterized by high levels of fragmentation, mobility, and complexity [10]. The port environment can drastically turn into an efficient and optimized system [11]. Each port governance reforms have an impact on port efficiency and effectiveness [12]. Ports serve as gateways for logistics supplies that influence local economic development, boosting competitiveness, and facilitating the distribution of commodities between regions. One of the efforts to improve the economic development of a region is to support the export of its primary commodities. The province of South Sulawesi is strategically located as a gateway and trans-shipment point connecting eastern Indonesia with all the other islands. Population and economic growth in the city of Makassar and eastern Indonesia will drive the demand for containers and goods [7].

In line with the National Port Master Plan [13], Makassar Port is designated as the main port in the region. State-owned port operator, PT Pelabuhan Indonesia, aims to take advantage of this opportunity to improve its performance with the construction of the New Makassar Port. A new container terminal, designated Terminal II, will be built to accommodate the increasing throughput of containers until 2050 [7]. Terminal II will be operated by Sub-holding PT Pelindo Terminal Container and offers stevedoring, haulage, dock services, receiving/delivery, stacking, and other services for loading and unloading container goods from ships to delivery to the goods' owners [14].

In order to efficiently conduct port operations, it is crucial to establish links with the hinterland, which serves as a source of export commodities. The traditional notion of hinterland refers to the economic area influenced by ports [15]. Simply put, hinterland is an area containing the majority of businesses involved in exports or imports [16]. It is important to note that hinterland can vary terms of time, distance, transport modes and commodities which highlights the support it provides to port development. In essence, port management should not only focus on providing services within the port but also on enhancing the economic capacity of the surrounding community, enabling them to produce high quality commodities [8].

According to the South Sulawesi Central Bureau of Statistics, South Sulawesi's trade balance performance shows fluctuations in commodity export growth. Table 1 shows the export value and volume of South Sulawesi [17].

Table 1. Export Value and Volume of South Sulawesi Province in 2017-2021

Year	Export Value (Million USD)	Export Volume (Tons)
2017	1,020.80	1,226.30
2018	1,164.35	2,081.51
2019	1,207.88	2,508.09
2020	1,199.36	2,115.91
2021	1,438.41	2,654.60

While the volume of exports has increase dramatically in recent years, the corresponding rise in export values was tempered by fluctuations in global commodity prices. Ports play a crucial role in facilitating international trade by serving as a gateway for the import and export of goods and commodities. Geographical conditions such as proximity to markets, access to transportation networks, and availability of resources can influence competition in the trade of goods. As such, the development of ports and their supporting infrastructure can have a significant impact on the efficiency and competitiveness of Indonesia' s trade activities. By connecting the inter-island economic chain, ports can help to facilitate the flow of goods and promote economic growth.

The Terminal II development was carried out in three phases. The completed Phase IA is currently operational with a pier length of 320m, a buildup area of 16ha and an installed capacity of 500 thousand TEUs. Phases IB and IC, which are currently under construction, involves a pier length of 1280m and an installed capacity of an additional 2 million TEUs. Over the last four years, the flow of containers at Terminal II increased significantly from 1,261 TEUs in 2018 to 185,757 in 2021. This rapid increase in throughput is supported by infrastructure and operational improvements in port logistics activities. Hinterland transport connectivity is the second most important factor driving port competitiveness after port costs [18].

According to the Port Operational Service Performance Standards at Commercially Operated Ports issued by the Director General of Sea Transportation (HK.103/2/18/DJPL-16), the primary performance indicator of the productivity of container terminal services is the growth of container flows. It is essential for every company to keep track of the performance of their logistics services and make continual advancements to fulfill customer standards [19]. Successful performance measurement in port operations is driven by a reliance on establishing accurate indicators as a basis for measurement. Performance continues to have a positive impact on port economic growth, as a support and driver that accelerates and maximizes the performance impact [20].

The increase in the export volume presents a challenge for Terminal II in terms of accommodating the expected high flow of containers into the future. With 185,757 TEUs handled in 2021 compared to the installed capacity of 500,000 TEUs for Phase IA, the terminal needs to improve its operations to serve larger loading and unloading capacities.

To address this challenge, it is crucial to analyze the logistics system at Terminal II based on operational performance. This involves evaluating the number of containers served against predetermined performance standards and analyzing the quality of logistics services provided to customers. By conducting this analysis, it will be possible to determine the effectiveness of Terminal II in supporting logistics distribution in South Sulawesi and identify areas for improvement. This study aims to determine the performance of the logistics system at Terminal II in accommodating container flows and evaluate indicators of unsatisfactory logistics service quality to develop improvement strategies.

Several studies have been conducted regarding the performance of the port logistics system and service performance. From research related to the analysis of the performance of container terminal services at the Soekarno Hatta Makassar port, it was found that there was an increase in container volume where in 2014 it was 480,878 boxes, while in 2019 it was 537,433 boxes. The flow rate of containers at the Makassar Soekarno Hatta Port is influenced by the Gross Regional Domestic Product. In addition, the service performance obtained is in the good category. There are 5 elements of assessment used, 4 elements in the good value category and 1 element in the less good category [21]. This research uses SPSS and Microsoft Excel software as tools to analyze data.

Other research related to evaluating the quality of logistics services and designing service improvements to containers at ports with case studies at PT. Terminal Teluk Lamong using the Importance Performance Analysis method to identify and analyze it as well as the House of Quality to develop recommendations for improvement. From this research, 12 out of 23 total indicators were obtained which had unsatisfactory quality and 14 attempts were obtained to overcome existing problems [19].

The difference between this research and previous research is the method of data collection and the method of analysis used. This research analyzes as a whole starting from the hinterland potential of the port, the logistics system at the port since the container goes through the in/out gate, the loading and unloading process, until the container leaves the port area. In addition, this study uses the IPA method to identify and analyze service performance and uses the PGCV for recommendations for future improvements. Thus it will become information material for company management regarding factors that influence service performance and service quality in supporting the port logistics system, provide information to the public regarding the extent of success of Terminal II in accommodating the port logistics system as well as information that can be used to other researchers as a reference for further research or in the same study.

2. Methods

The research employed both qualitative and quantitative approaches, which involved a combination of observation and data analysis methods. The qualitative aspect was descriptive in nature and aimed to analyze the performance of the logistics system service at Terminal II. The data collected included oral statements, pictures, interview notes, photographs, official and personal documents, and researcher notes. The qualitative approach was used to verify existing facts and expand knowledge through data analysis. The data collected from the observations were then analyzed using Microsoft Excel with appropriate performance calculations to obtain the results of the logistics distribution performance at the port. While the data obtained from interviews with respondents and filling out questionnaires were tested for validity and reliability, the test results were then followed by analyzing using the IPA method to obtain the level of suitability which would be mapped on a Cartesian diagram. From the Cartesian diagram, the calculation of the PGCV index value is carried out to find out the order of priority for repairs to port logistics services. The research was carried out at Terminal II of the New Makassar Container Port in Makassar City, South Sulawesi Province (as shown in Figure 1).

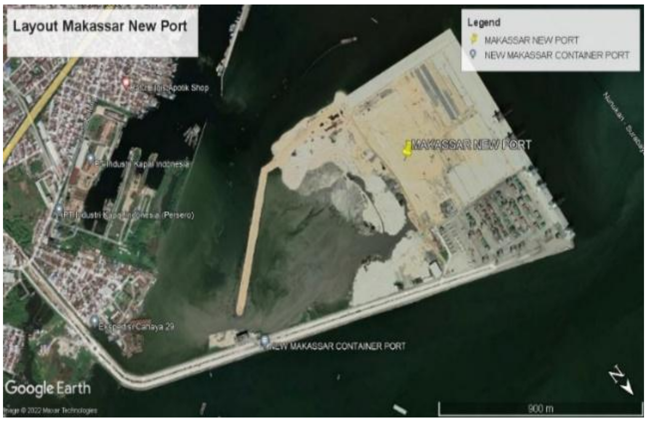

Figure 1. Research locations at Terminal II of the New Makassar Container Port in Makassar City

Terminal II is in the Pelindo Sub-holding Container Terminal with stevedoring, haulage, dock services, receiving/delivery, stacking services, other services such as quarantine, customs inspection, etc.

2.1. Data type

2.1.1 Primary data

Primary data was collected through interviews and questionnaires. This includes data obtained directly through observation during field visits to determine the condition of the logistics system at the port. The primary data collected were from (a) interviews with the port operators regarding the loading and unloading service mechanism namely in the division of engineering, operations, human resources, and field operators (b) observations of the cycle of loading and unloading activities, and (c) questionnaire surveys distributed to shipping companies and freight forwarders who specifically handle work orders with data respondents as follows:

Table 2. Respondent Data

No	Company	Position
1	PT. Salam Pacific Indonesia Lines	Operational head
2	PT. Meratus Line	Land operator & staff operational
3	PT. Tanto Intim Line	Operational head & staff marketing
4	PT. Temas Tbk	Staff marketing & staff operational
5	PT. Sinar Baru Logistik	Operational & document junior manager
6	PT. Anugrah Karunia Logistik	Sales Executive
7	PT Kintana Logistic	Staff Operational
8	PT. Eka Multi Logistik	Staff Marketing
9	PT. Quality Logistic	Staff operational

This study used 12 respondents consisting of 7 shipping companies and 5 from freight forwarders.

2.1.2 Secondary data

Secondary data was data obtained through intermediaries or parties who have previously collected the data. Secondary data collected at Terminal II were related to loading and unloading performance, loading and unloading rates, cargo origin and destination, logistics systems at the terminal, and the hinterland potential of several leading commodities.

2.2. Data analysis

Data analysis simplifies data into a more comprehensible form for easier understanding and interpretation. The following types of data analysis were utlised.

2.2.1 Descriptive analysis

The process involves the formulation and interpretation of existing data to provide a comprehensive overview of the port logistics system based on performance standards. It also explains the correlation between the level of performance and the level of customer satisfaction.

2.2.2 Tests of validity and reliability

The validity test is a step in the research process that assesses the accuracy of the questionnaire used in the study. If the validity value of each answer obtained from the questionnaire is greater than 0.3, then the item is considered valid [22]. The reliability test, on the other hand, is used to determine the reliability of the questionnaire using Cronbach's Alpha analysis. If the Cronbach Alpha coefficient is equal to or greater than 0.60, the questionnaire can be considered reliable. The formula for calculating the validity test [23] is as follows:

$$r_{xy} = \frac{n\sum XY-(\sum X)(\sum Y)}{\sqrt{\{n\sum X^2-(\sum X)^2\}\{n\sum Y^2-(\sum Y)^2\}}} \quad (1)$$

Where:

- r_{xy} : Pearson's correlation coefficient
- n : Number of respondents
- X : Score of each item on the instrument
- Y : Score of each item on the criterion
- $\sum XY$: The sum of the product of the X value and the Y value
- $\sum X$: Sum of X values
- $\sum Y$: Sum of Y values
- $\sum X^2$: The sum of the squares of the X values
- $\sum Y^2$: The sum of the squares of the Y values

On the other hand, the reliability test is defined as:

$$r_x = \left(\frac{n}{n-1}\right)\left(1-\frac{\sum \sigma_t^2}{\sigma_t^2}\right) \quad (2)$$

Where:

- r_x : Reliability sought
- n : Number of question items
- $\sum \sigma_t^2$: Total variance of each item's score
- σ_t^2 : Total variance

2.2.3 Importance Performance Analysis (IPA)

The IPA analysis measures the extent to which the customer' s perceived performance or service is related to the desired level of satisfaction. This is done by evaluating output indicators that represent service quality using a 5-point Likert scale. The analysis was conducted on the quality of port logistics services using the ROPMIS model. The ROPMIS model is a validated measurement model for exploring the concept of service quality in sea transportation and consists of six dimensions: resources, results, processes, management, reputation, and social responsibility [24]. The model includes elements related to management, reputation, and social responsibility that were not previously included in other models. The formula used to determine the suitability level is presented in equation (3). IPA analysis then categorizes these attributes into four quadrants by performing calculations to determine the boundaries for each quadrant using the formula in equation (4).

$$T_{ki} = \frac{X_i}{Y_i} \times 100\% \quad (3)$$

$$\bar{\bar{X}} = \frac{\sum \bar{X}}{K} \ dan \ \bar{\bar{Y}} = \frac{\sum \bar{Y}}{K} \quad (4)$$

The conformity level of the respondent (Tki) is obtained through a comparison between the performance appraisal score (Xi) and the interest assessment score (Yi). While the values of $\bar{\bar{X}}$ and $\bar{\bar{Y}}$ which will be the boundaries are lines that intersect perpendicularly on the Cartesian diagram and divide the diagram into 4 parts (quadrants). The value of $\bar{\bar{X}}$ is the average value of the total value of $\bar{X}$ divided by the number of service indicators while the value of $\bar{\bar{Y}}$ is the average of the total value of $\bar{Y}$ divided by the number of service indicators. K is the maximum rating score.

2.2.4 Importance Performance Analysis (IPA) Potential Gain in Customer Value (PGCV)

The PGCV index is used to further analyze the results from the IPA method and determine which areas require improvement by ranking the attributes based on the PGCV value and their level of conformity. The PGCV calculation is done through the following formulas:

$$ACV = I \times P_{achived} \quad (5)$$

$$UDCV = I \times P_{maximum} \quad (6)$$

$$PGCV = UDCV - ACV \quad (7)$$

The PGCV value is obtained from two other value factors, namely Achieve Customer Value (ACV) and Ultimately Desire Customer Value (UDCV). ACV refers to the value achieved from the opinion (performance) of service users, namely the multiplication of the average value of the importance level (I) with the performance value (P). Meanwhile, UDCV is the desired value (interest) of the service user. The UDCV value is obtained by multiplying the average value of the level of importance (I) with the maximum performance value (P) of the Likert scale on the questionnaire [25].

3. Results and Discussion

3.1. Overview of Terminal II of The New Makassar Container Port

The construction of Terminal II of the New Makassar Container Port was done in phases and as of September 30, 2022, Phases IA and IB were completed and the Phase IC stage had begun, with activities including the installation of pavement foundations, paving blocks, rehandling and dredging of rotary pools, Rubber Tyred Gantry (RTG) block work, revetment work, and drainage work. The physical progress at this stage had reached 91.17%. A diagram of the current layout of the New Makassar Container Port can be seen in Figure 2.

Figure 2. Terminal II of The New Makassar Container Port

These pictures indicate that operations at Terminal II are still in phase 1A. The facilities and equipment of a port have a significant impact on loading and unloading productivity. Terminal II, which started operating in November 2018, has seen an increase in loading and unloading throughput up until 2022, which can be seen in the summary presented in Table 3.

Table 3. Growth of container throughput at Terminal II in 2018-2022

No	**Year**	**Loading**		**Unloading**		**Total**	
		Box	**TEUs**	**Box**	**TEUs**	**Box**	TEUs
1	Nov- 2018	758	792	431	469	1,189	1,261
2	2019	49,671	56,502	40,064	41,657	89,735	98,159
3	2020	67,087	78,453	49,667	52,049	116,754	130,502
4	2021	86,782	102,601	75,164	83,156	161,946	185,757
5	January-September 2022	68,821	82,494	64,366	75,906	133,187	158,361
		Amount of loading				502,811	574,040

Compared to the installed capacity of 500,000 TEUs, the growth in loading and unloading demand has not exceeding the specified capacity. The increase in loading and unloading at the container terminal is influenced by the potential of the hinterland region as a production center for supporting export activities. The more goods produced in the hinterland, the greater the rise in containers transiting through the port.

The growth of container flows in Terminal II of the New Makassar Container Port is far different when compared to PT Terminal Teluk Lamong as a port that carries the concept of "Green Smart Port" in Indonesia with container ship traffic in 2022, namely 817,215 TEUs or an increase of 4.4% from 2021 of 780,718 TEUs. The greater the amount of goods produced in the hinterland area, the higher the growth of containers going through the port.

3.2. Hinterland Potential

The hinterland region of South Sulawesi boasts a diverse range of industries such as agriculture, fishery, livestock, mining, plantation and industry, with the highest export volume recorded in 2021 coming from salt, sulfur and lime, totaling 2.2 billion tons, exceeding the previous year's 1.7 billion tons. A summary of the volume and value of commodity exports in South Sulawesi can be found in Table 4. While these commodities originating from the Makassar Port hinterland may currently be exported through other ports in South Sulawesi, the provision of modern container facilities at Terminal II will concentrate import and export activities in support of inter-island and international trade.

3.3. Analysis of The Logistics System Service Time for Terminal II of The New Makassar Container Port

The analysis of service time in both inbound and outbound stages provides information on the efficiency and effectiveness of the port's performance in handling containers. This information can be used to identify areas that need improvement and to optimize the port's operational processes. The results of this analysis shown in Tables 5, 6 and 7, can be used as a benchmark for future performance improvements, which can help to increase customer satisfaction and the future competitiveness of Terminal II.

Table 4. The volume and value of exports by type of commodity in the province of origin of South Sulawesi, 2020 and 2021

Commodity type	Volume (Tons)		FOB (Free on Board) Value (US$)	
	2020	2021	2020	2021
Nickel	91,22	82,73	764,41	953,17
Fish and Shrimp	18,4	20,15	137,99	165,38
Seaweed and Other Algae	117,92	132,24	111,77	150,38
Iron and Steel	47,01	97,44	66,35	176,88
Cocoa/Chocolate	16,09	18,39	61,95	71,08
Shellac, Gum and Resin	14,36	14,07	60,54	62,07
Salt, sulfur and Chalk	1687,26	2248,82	56,32	74,67
Coffee, Tea and Spices	15,35	5,77	50,29	25,33
Fruits	13,79	6,96	48,28	39,72
Processed Meat and Fish	2,65	3,03	38,03	55,58
Wood and goods made of wood	49,23	38,4	36,78	46,61
Animal food processing	110,05	93,39	17,24	17,59
Furniture, home lighting	0,24	0,3	3,01	3,67
Vegetable/animal oil	3,18	2,07	2,7	3,45
Objects of stone, gypsum and cement	4,8	2,15	2,68	1,11
Other commodities	31,73	30,24	16,02	19,76

If seen from the table above, the potential for hinterland in each district of South Sulawesi has several different types of commodities. This is a factor that can increase the number of exports both domestically and internationally with various commodities. Potential commodities in the form of natural resources require transportation facilities and infrastructure so that they can be distributed further. So there is a need for connectivity between hinterland areas and container ports by integrating land and sea transportation modes to expedite logistics distribution activities.

This hinterland potential is one of the factors supporting the smooth and growing growth of containers at ports, even though only a portion of the total commodity will be exported. Thus, the hinterland potential greatly influences port performance for both export and import activities. The commodities originating from the hinterland area are distributed through Terminal II using containers with sizes of 40 ft and 20 ft which are transported using trailers through the gate and get unloading and loading services at the stacking yard with different service times. Tables 5, 6 and 7 obtain the average service time for 1 hour of operation with different activities.

Table 5. Analysis of head truck movement time

No.	Inbound		Outbound	
	Activity	Movement time	Activity	Movement time
1	Internal trucks go to the wharf to get stevedoring services	2 minutes	External trucks enter through the gate in towards the stacking yard to unload the containers	3 minutes
2	Internal trucks move from the wharf to the yard (cargodoring)	2 minutes	The external truck moves towards the gate out of the stacking yard	2 minutes
3	External trucks enter through the gate in to the stacking yard for delivery	2 minutes	Internal trucks move from the stacking yard to the wharf	2 minutes
4	The external truck moves towards the gate out of the stacking yard	2 minutes	Internal trucks go to the wharf to get stevedoring services	2 minutes

Based on these observations, the total time spent in the delivery/receiving process of containers in the stacking yard area by external trucks starting from the gate in to the stacking yard, getting the on-lift off service and leaving through the gate out is approximately 17 minutes. This is influenced by the distance traveled from the gate in to the stacking yard ± 1,2 km, reduced vehicle speed due to the large number of trucks going in and out and maneuvering activities in each intended block, as well as queues for service by RTGC devices.

External trucks enter through the gate in towards the stacking yard to unload the containers from the gate in require a slightly longer time than other activities, this is due to the scan process at the gate in which requires the driver to wait for the printed Container Movement Slip (CMS) and carry out a physical inspection of the container and truck.

Table 6. Analysis of service time and productivity of Rubber Tyred Gantry (RTG) Cranes

No	Activity	Berth Working Time (Hour/Minute/Second)	Box/crane/hour (Boxes per hour)
1	RTGC unloading service (lift off)	00:02:06	28
2	RTGC delivery service	00:02:04	29
3	RTGC receiving service	00:02:13	27
4	RTGC loading service (lift on)	00:02:14	27

Based on the average service time for RTGC equipment in Table 6 above, it is obtained a service time of ±2 minutes for each service and BCH which varies both in lift on and lift off containers. Loading and unloading productivity based on box/crane/hour is obtained from the number of containers unloaded/loaded in a period of 1 (one) hour of operation for each loading and unloading equipment used. In the RTGC service process at the stacking yard there is also idle time caused by an error in the system, there is a queue for loading and unloading activities at the stacking yard or there is a relocation order that requires the operator to communicate with the planner so that the relocation service is transferred to the reach stacker. Quite high service time usually also occurs when the operator has to ensure the position of the twist lock matches the position of the container before being lifted, adjusting the container when stacking on top of other containers to keep it balanced to prevent work accidents, and the slot spacing is far enough.

Table 7. Analysis of service time and productivity of Container Cranes (CC)

No	Activity	Berth Working Time (H/M/S)	Box/crane/hour (Bph)
1	CC unloading service (lift off)	00:02:10	27
2	CC loading service (lift on)	00:02:24	25

BCH productivity time is obtained in the lift off activity which is quite large compared to the lift on activity. The difference is caused by the service time of each container and the idle time that occurs in the field. Productivity of loading and unloading on container cranes is obtained based on the number of containers unloaded/loaded in a period of 1 (one) hour of operation on container cranes observed at the wharf.

From the analysis results for crane productivity, the RTGC tool has greater productivity. This is because the RTGC tool serves on-lift off lift activities from internal trucks and external trucks. From field observations by observing several container movements, the service process by the RTGC and CC tools is quite productive by looking at the speed at which the tools work. In addition to the condition of the equipment used, the ability of the operator is also the key to the productivity of loading and unloading equipment. However, there are several obstacles that can reduce the productivity of loading and unloading, namely there is a long idle time which is caused by an error in the system, waiting for cargo to get loading and unloading services, ship calls that are still lacking due to the length of the wharf being operated is still lacking and Container Limited cranes operating.

The latest performance data for 2021 obtained from a report by the Terminal II port operator is shown in Table 8. The data calculates loading and unloading performance as boxes/crane/hour based on the number of container boxes unloaded/loaded by one crane in an hour, and as boxes/ship/hour based on the number of containers unloaded/loaded in an hour while the ship is moored. These loading and unloading productivities are the averages over a year, specifically in 2021.

Table 8. Report on the loading and unloading performance of The Terminal II New Makassar Container Port

No	Performance indicators	Performance achievement	Performance standard regulations of the Director General of Sea Transportation
1	Effective Time:Berthing Time (ET:BT)	84.02%	80%
2	B/C/H (ET)	26.29 bph	25 bph
3	B/S/H (ET)	39.13 bph	38 bph
4	Equipment readiness	97.08%	90%

The results of these performance indicators showed significant differences with field observations. These differences may be due to variations in the methods employed for the analysis. The researchers relied on field observation to calculate the number of boxes unloaded/loaded by one crane in an hour. Meanwhile, port operator calculates its average productivity data per year based on the total number of loading and unloading activities.

Based on the loading and unloading performance reports B/C/H (box/crane/hour) of Terminal II of the New Makassar Container Port obtained, there is an increase every year. Realization of container loading and unloading speed in 2020 of 25.50 B/C/H, in 2021 of 26.29 B/C/H and January-May 2022 of 26.32. The loading and unloading performance standard and equipment operational readiness at Makassar port by the Regulation of the Director General of Sea Transportation Number HK.103/2/18/DJPL-16 is set at 25 B/C/H and the results of field observations obtained at 27.16 B/C/H, the loading and unloading speed of the plot is good. This is because the value of the craft is above the value of the operational service performance standards set and the loading and unloading service time is good, although there are still issues with the loading and unloading equipment. Port operational service performance standards are made in order to ensure the smooth flow of goods, increase the effectiveness of operational performance at ports and to determine the level of operating service performance at ports, as well as a basis for consideration in calculating port service rates. As for B/S/H (box/ship/hour) performance achievement, equipment readiness and ET:BT performance were declared good because the achievement value was above the set operational performance standard.

When compared with the performance standards at PT Terminal Teluk Lamong and Tanjung Priok port, JICT (TPK) is the port with the highest performance standard in Indonesia, which is 27 B/C/H according to the Regulation of the Director General of Sea Transportation Number: HK.103/2/18/DJPL -16, Terminal II has a fairly good level of loading and unloading operational performance on the scale seen from the average performance achievement level from January to May 2022 even though the growth of container flows through the Terminal II is still lower than PT Terminal Teluk Lamong.

From research related to the analysis of the performance of the container terminal service at the Soekarno Hatta Makassar port in 2021, a pier utilization rate of 56.4% was obtained, indicating good performance [21]. Whereas Terminal II, based on the 2021 performance report, has a BOR (Berth Occupancy Ratio) performance of 34.35% which shows good performance according to the standard recommended by UNCTAD, which is below 65%. Likewise, the YOR (Yard Occupancy Ratio) value at the Soekarno Hatta Makassar port showed good performance in 2017, which was 34.7%, while Terminal II was 38.23% in 2021.

Terminal II of the New Makassar Container Port has made continuous improvements and enhancements to port operational activities through the development of integrated internet-based technology, achieving increased performance every year, as well as through infrastructure development in stages in order to increase the flow of containers. Improvement of port infrastructure will encourage an increase in export-import activities supported by an increase in the number of commodities and industrial goods.

3.4. Logistics service quality performance analysis

3.4.1. Validity service quality performance analysis

This study was supported by 12 respondents, namely freight forwarders and shipping companies, resulting in an r_{table} value of 0.576. The results of the validity calculation using equation (1) for service indicator A1 showed an r_{count} of 0.60 which was compared to the r_{table} value. The obtained r_{count} value of 0.60 was greater than the r_{table} value of 0.576, thus the service indicator A1 was deemed valid. The same calculation was performed for the remaining service indicators A2-A24 and all indicators were declared valid based on the results of the validation test.

The reliability test was performed using the Alpha Cronbach analysis technique and the reliability coefficient was calculated using equation (2) to be 0.96, indicating that the questionnaire is reliable with a reliability coefficient greater than 0.60.

3.4.2. Importance Performance Analysis (IPA) suitability level

The IPA was conducted with non-probability sampling, specifically shipping companies and freight forwarders who were service users of Terminal II. The study participants were selected by purposive and convenience sampling techniques.

Based on a review of some of the literature, the analysis of the performance of logistics distribution services which the researchers then used was the ROPMIS method where this method has 6 dimensions with 24 indicators of the quality of logistics services. The ROPMIS method is used because the logistics service indicators contained in it are in accordance with the maritime sector, especially at ports, which are different from logistics services in general. This indicator was then distributed to respondents through questionnaires and interviews, then analyzed using the IPA method so that the level of compatibility between the level of performance and the level of importance was obtained which can be seen in Table 9.

Table 9. Results of the level of conformity (IPA) of all indicators on the ROPMIS model

Dimension	Code	Indicator	Performance appraisal score (Xi)	Interest assessment score (Yi)	Average $\bar{X}$	Average $\bar{Y}$	Suitability level (Tki)
Resources	A1	Availability of equipment and facilities	47	53	3.92	4.42	89%
	A2	Condition of facilities and equipment	44	55	3.67	4.58	80%
	A3	Facilities and infrastructure	48	54	4.00	4.50	89%
	A4	Tracing & tracking capabilities	52	55	4.33	4.58	95%
	A5	Physical infrastructure	45	53	3.75	4.42	85%
Outcomes	A6	Service performance speed	52	56	4.33	4.67	93%
	A7	Reliability of service performance	54	59	4.50	4.92	92%
	A8	Provide consistent service	51	53	4.25	4.42	96%
	A9	Delivery security	46	57	3.83	4.75	81%
	A10	Documentation reliability	50	53	4.17	4.42	94%
	A11	Competitive price	39	53	3.25	4.42	74%

Process	A12	Attitudes and behavior of staff in meeting customer needs	55	55	4.58	4.58	100%
	A13	Quick response to customer inquiries and requests	51	57	4.25	4.75	89%
	A14	Knowledge of customer needs and requirements	47	53	3.92	4.42	89%
	A15	Application of IT and EDI in customer service	55	55	4.58	4.58	100%
	A16	Application of IT and EDI in operations	51	51	4.25	4.25	100%
Management	A17	Efficiency in operations and management	50	56	4.17	4.67	89%
	A18	Management knowledge and skills	47	53	3.92	4.42	89%
	A19	Understanding customer needs	49	55	4.08	4.58	89%
	A20	Handle feedback from customers	50	55	4.17	4.58	91%
	A21	Continuous and customer-oriented operational process improvement	44	56	3.67	4.67	79%
Image	A22	Company reputation for reliability in the market	45	55	3.75	4.58	82%
Social responsibility	A23	Responsible behavior towards the environment and attention to human safety	51	57	4.25	4.75	89%
	A24	Environmentally safe operation	48	55	4.00	4.58	87%

From the results of the analysis above, various levels of conformity were obtained. The highest suitability level is in the dimension (Process) with three indicators having Tki reaching 100%, which means that the level of performance and the level of importance felt by service users is very good. Meanwhile, Tki is lowest on the dimension (Outcomes), namely on indicator A11 where the perceived performance is quite high but is considered less important by service users. The value obtained at the level of performance and the level of importance affects the level of satisfaction of service users. This then determines the position of each indicator in the Cartesian diagram. The Cartesian diagram is used to see which indicators need to be prioritized for improvement. The Cartesian diagram is divided into four parts with different priority scales.

From the average values of $\bar{X}$ and $\bar{Y}$, calculations are then carried out to obtain the values of $\bar{\bar{X}}$ and $\bar{\bar{Y}}$ which will be the boundaries, namely the lines that intersect perpendicularly on the Cartesian diagram and divide the diagram into four parts (quadrants). You can see the position of each indicator based on the level of importance and level of performance in the Cartesian diagram drawn in Micosoft Excel 2016 as shown in Figure 3 below.

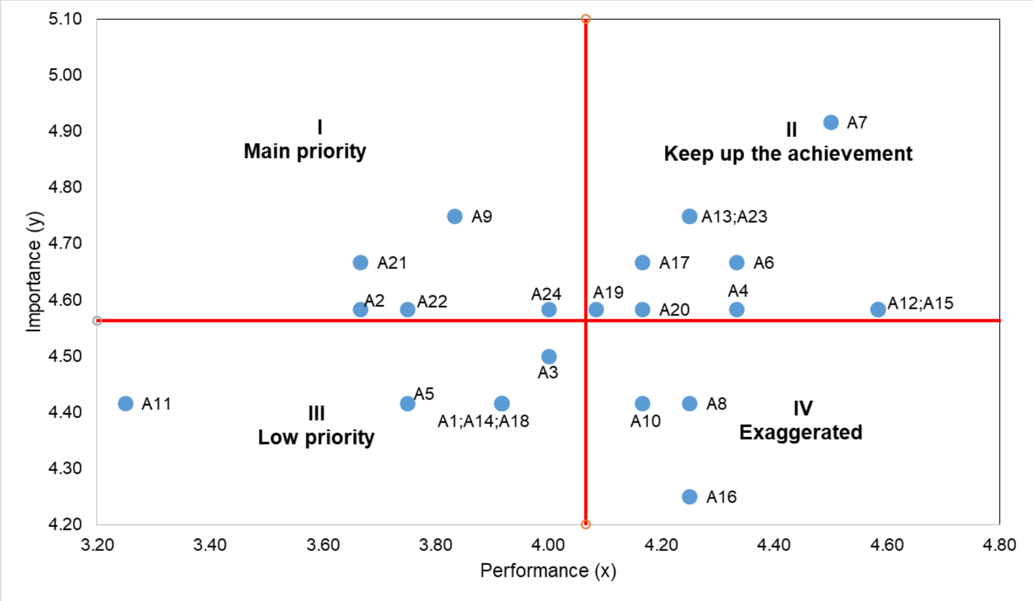

Figure 3. Cartesian diagram of logistics service quality performance

Indicators that are in quadrant I are indicators that are considered important by customer but in reality the perceived performance is not in accordance with the expectations of customer (the level of satisfaction obtained is still low). Quadrant I will be a priority for improvement by determining the order of priority. Indicators in quadrant II are considered important by service users and these indicators are in accordance with what is felt (performance level) so that the level of satisfaction is relatively higher. In quadrant III there are indicators that are considered less important by service users, and in fact the perceived performance is not too special. Increasing the indicators included in this quadrant can be reconsidered because the effect on the perceived benefits of service users is relatively small. While the indicators in quadrant IV have a fairly low level of importance but have a high level of performance so that the indicators in this quadrant may be reduced and replaced with other aspects of satisfaction.

3.4.3. Calculation of The Potential Gain in Customer Value (PGCV) Index Value

The order of improvement priorities is determined by comparing the results of the suitability level (Tki) in Quadrant I of the Cartesian diagram with the obtained PGCV index. The indicator with the highest priority is the one with the lowest conformity level and the highest PGCV index value, which represents the difference between the expected service level and the level of performance received by the customer. The priority sequence for remedial actions, based on the IPA method and PGCV index value, can be found in Table 10.

Table 10. Improvement priority order based on IPA and PGCV results

Dimension	Indicator	Tki (%)	PGCV	Priority
Resources	Condition of facilities and equipment (A2)	80	6,11	2
Outcomes	Delivery security (A9)	81	5,54	4
Management	Continuous and customer-oriented operational process improvement (A21)	79	6,22	1
Image	Company reputation for reliability in the market (A22)	82	5,73	3
Social responsibility	Environmentally safe operation (A24)	87	4,58	5

According to Table 10, it can be seen that the A21 indicator on the management dimension is a top priority because it has the highest PGCV value of 6,22 with the lowest conformity level value of 79%. The port party needs to make improvements and pay more attention to this indicator because it relates to the overall service operations which can have a direct impact on improving the quality and performance of the port. Conduct periodic evaluations on physical and human aspects as well as planning and control processes to focus on changes. The second priority is the A2 indicator on the resources dimension with a PGCV value of 6,11 and 80% Tki. The level of performance on this indicator still needs to be improved. This is because the condition of the loading and unloading equipment that operates sometimes has errors so that service queues often occur which can result in non-conducive operational activities. By paying attention to the condition of the facilities and equipment in order to extend the life of the equipment and facilities and will produce maximum work processes by upgrading the system and increasing awareness in the use of facilities and equipment.

The third priority is the A22 indicator with a PGCV value of 5,73 and Tki 82%, namely by having a reputation as a port that provides fast, consistent and responsive actions in serving service users. Based on the results of interviews with several service users, the reputation of Terminal II of the New Makassar Container Port is good but there are still obstacles that can reduce this reputation such as operational activities in the field area which are often hampered due to errors in the system when there is a density of service queues, ships that can be moored still lacking due to the limited length of the operating wharf so that it does not yet serve international shipping, as well as road access to the port which still needs attention. By maximizing services through improving services that are considered unsatisfactory through periodic evaluations, overcoming complaints from service users through conducting customer satisfaction surveys with more specific breadth measurements, as well as improving facilities and equipment to support smooth operations. The fourth priority is shipping security (A9) where based on the results of interviews with service users, some containers have experienced damage due to the inadequate condition of loading and unloading equipment, but over time this has been minimized by the port. Shipping security can be done by upgrading the container tracking system, checking container conditions through improving the quality of CCTV, OCR and others on the Terminal Operating System (TOS).

While the indicators of safe operation for the environment with a suitability level of 87% and PGCV 4.58 are in the last priority order. The obstacle in this indicator is access to the port which is of concern because it uses an access road that is not proper for container transport vehicles to pass through and can be dangerous for the surrounding community. The corrective step taken is to complete the construction of toll road access so as to reduce the negative impact on the community.

Research related to evaluating the quality of logistics services and designing service improvements to containers at ports with case studies at PT. Terminal Teluk Lamong which also uses the ROPMIS indicator in the study obtained several indicators that are the focus of improvement including on the resources dimension (indicators of availability of equipment and facilities, condition of equipment and facilities, capability of tracing & tracking containers, physical infrastructure, availability of facilities and infrastructure), dimensions of outcomes (speed of service performance, reliability of service performance, providing consistent service) process dimension (quick response to customer requests, implementation of IT and EDI in customer service) and management dimension (handling customer feedback and customer-oriented continuous improvement) [19].

When compared with the research results obtained using the same indicators with different prioritization methods, the performance of Terminal II logistics services is running well but still needs further evaluation regarding the activities taking place at the port.

4. Conclusion

The construction of Terminal II of the New Makassar Container Port has progressed into Phase IC and reached a physical progress of 91.17%. as of September 30, 2022. Phase IA, which has an installed capacity of 500,000 TEUs, has been in operation since November 2018 with an increase in container throughput every year reaching a peak of 186,000 TUEs in 2021, or 37% of its capacity. However, services for international shipping are constrained due to the limited number of container cranes and the length of the wharves, which cannot accommodate larger LOA ships. The majority of exports are commodities rather than higher value-added industrial goods.

There is tremendous potential for this container terminal to support the plantation, livestock, agriculture, mining, fishery and industrial sectors of the Makassar hinterland. In 2021, the largest export volume from South Sulawesi originates from the salt, sulfur and lime sector with a total of 2.7 trillion tons.

The realized speed of loading and unloading of containers at Terminal II of the New Makassar Container Port in 2021 was reported at 26.29 B/C/H whereas the field observations resulted in 27.16 B/C/H. When compared to the performance standard of 25 B/C/H set by the Director General of Sea Transportation, the performance of the loading and unloading of containers may be classified as good. The total time for delivery/receiving of containers in the stacking field area by external trucks, from entry through the gate at the stacking yard, obtaining lift on-lift off service and through to exit was approximately 17 minutes.

Furthermore, combining the Importance Performance Analysis (IPA) and the Potential Gain in Customer Value (PGCV) analyses, priorities for performance improvements were revealed. The indicator with the highest PGCV was for ‘continuous and customer-oriented operational process improvement’ followed by ‘condition of facilities and equipment’. The third improvement priority is the company's reputation for reliability in the market.

In this research, it is still necessary to make observations with a wider scope so that the port logistics performance and service performance measured are not limited to loading and unloading activities, and the use of respondents is not limited to port communities but also port regulators and port operators.

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