The object of this study is the performance of port operational services, and formulate priority strategies to improve the performance of asphalt distribution services. It is focuses on Nambo Port, which has an important role in the distribution of Buton asphalt to various regions. The study aims to improve the operational efficiency and quality of asphalt delivery services at Nambo Port. Previous studies mentioned that the performance of asphalt loading and unloading at Nambo Port is not good. Therefore, to overcome the problem, this study tries to complement the previous study by applying the Kano model to evaluate and improve the service quality of Buton asphalt distribution at Nambo Port. The main findings show that the ratio of effective loading and unloading time and mooring time of ships reached 63,75 %, which are at least 70 %. In addition, the unloading rate of asphalt is 37,26 tons/hour, which are at least 100 tons/hour. These results show that ships spend a lot of time loading and unloading asphalt at the dock. Through the prioritized strategies generated from the Kano model, it is possible to address the identified problems. The resulting strategies emphasize the efficiency of loading and unloading operations, heavy equipment readiness, expedition fleet readiness, fast and transparent administrative processes, and management of port facility infrastructure such as lighting, road conditions, and security. The proposed strategy can be applied in practice with infrastructure development, effective coordination between stakeholders, and monitoring of operations to ensure sustainability of improvements. Thus, the implementation of these strategies is expected to improve the performance of efficient

Keywords: asphalt distribution, dry bulk port, service performance, user satisfaction, service priority

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DEVELOPMENT OF STRATEGIES FOR IMPROVING BUTON ASPHALT DELIVERY SERVICES AT THE NAMBO PORT BUTON REGENCY

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1. Introduction

Sea transport has a crucial role as the main mode of transporting goods between islands in Indonesia [1]. Its significance is not only limited to local economic growth, but also in facilitating inter island to international trade [2]. Ports, as logistics distribution centers, are becoming an important element in the ever-evolving trade system [3]. One of the main challenges in supporting trade is port operational efficiency which includes the development of operational management as well as adequate infrastructure [4, 5]. Port operational inefficiencies can have a direct impact on reduced service quality and reduced customer satisfaction [6]. Therefore, improving port service quality is an urgent need to ensure optimization of port functions and support the growing market [7].

In Indonesia, a potential natural resource to support infrastructure development is natural asphalt found in Buton Island, Southeast Sulawesi. Buton asphalt has been an important construction material since its discovery in 1920 [8]. Although Indonesia has abundant asphalt reserves in Buton, the national asphalt demand still relies heavily on imports [9], accounting for up to 75 % of the total demand [10]. The Indonesian government has committed to reducing dependence on asphalt imports, even encouraging wider utilization of Buton asphalt to meet national infrastructure needs [11]. This effort has a positive impact on the regional economy, but also poses challenges in the Buton asphalt distribution system [12]. To ensure distribution efficiency, Nambo Port plays an important role as the main gateway for transporting Buton asphalt from the mine site to various regions. As logistics centers, ports play a strategic role in the distribution of goods [13, 14], including Buton asphalt, a local resource that has the potential to replace imports [8]. The quality of port operational services greatly affects productivity, logistics efficiency, and customer satisfaction [15] and includes loading and unloading activities for determining the performance of ship and goods services [16].

Although Nambo Port plays a strategic role in the distribution of Buton asphalt, there are several operational constraints that hamper service efficiency. Data for 2023 shows that the ratio of effective time when loading and unloading asphalt falls into the category that does not meet the standard of 64,20 %, which is a minimum of 70 %. Another indicator that does not meet the standard is the loading and unloading of asphalt at 30,28 tons/hour which is a minimum of 100 tons/hour [10]. This shows that an in-depth analysis of the factors causing inefficiency is needed to improve the productivity of the port. Thus, study on the operational development of Nambo Port is very important. This is needed to understand the unresolved issues in the Buton asphalt distribution system and to develop solutions that can improve the operational efficiency of the port.

Therefore, the relevance of these studies lies in the importance of developing Nambo Port as a logistics distribution center that supports the optimal and sustainable utilization of Buton asphalt [10]. These studies are a strategic step to ensure that the port logistics system can function efficiently, support national infrastructure development, and strengthen the regional economy [17, 18].

2. Literature review and problem statement

The study [1] states that the operation of Tenau Port in Kupang City has low service quality. Importance Performance Analysis (IPA) and Quality Function Deployment (QFD) and Customer Services Index (CSI) methods were used. Indicating, that strategies in improving port services are routine maintenance of equipment, readiness of trucks and workers, optimal utilization of tugboats, preparation of additional stacking yards, worker certification, and additional training for operators, it is recommended to improve port operational services. However, it is only analysis of port facility services. The aspects of ship services, loading and unloading services and facility services will be developed to evaluate and improve the service quality of Nambo Port by considering another method, which is Kano model.

[10] states that in the previous study Nambo Port has strengths and opportunities as the main port/main node of Buton asphalt distribution by supporting an aggressive growth policy or growth-oriented strategy by utilizing existing opportunities and internal strengths. The results of this is use of the SWOT (Strengths, Weaknesses, Opportunities, and Threats) method. The results showed that loading and unloading productivity is still not good. That is, it will be developed regarding aspects of ship services, loading and unloading services and facility services in evaluating and improving the quality of Nambo Port services by considering other methods – the Kano model.

The study [15] states that the effect of ship and goods services on loading and unloading productivity at Sunda Kelapa Port requires improvement. The results of this is using of descriptive methods. It is shown that the main problem in service is less efficient and effective in its implementation, which results in weak port competitiveness at the national level. The results show that ship services did not meet the predetermined standards, because there was still a lot of unproductive time. So that the hours when the ship is idle at the port are very large when compared to its effective hours, and have an impact on ship productivity is not linear with relatively quite a lot of ship visits. However, this is only analyses ship services. That is, it will be developed regarding aspects of ship services, loading and unloading services and facility services in evaluating and improving the quality of Nambo Port services by considering other methods – the Kano model.

The study [19] states that the Gresik Public Port has the quality of loading and unloading service time that has not reached the specified standard. Importance Performance Analysis (IPA) and Quality Function Deployment (QFD) methods were used. It is shown the strategy in improving the quality of loading and unloading service time by ensuring cargo readiness, using warehouses, ensuring the readiness of loading and unloading equipment, providing fresh gang for loading and unloading personnel to operate 24 hours, expanding the stacking field, and accelerating the transportation of goods in the stacking field. However, this is only analyses port loading and unloading services. The aspects of ship services, loading and unloading services and facility services will be developed to evaluate and improve the service quality of Nambo Port by considering other methods – the Kano model.

The study [20] states that Tenau Port has loading and unloading services that do not meet the standards. It is used linear regression analysis method. It is shown that the factors that need to be considered are the condition of loading and unloading equipment, and the capacity of the stacking field. The results stated that in 2028 the port needs to expand and increase the number of docks. However, this is only analyses loading and unloading services and port facilities. That is, it will be developed regarding aspects of ship services, loading and unloading services and facility services in evaluating and improving the quality of Nambo Port services by considering other method – the Kano model.

The study [21] stated that Makassar Port as a collector center and distributor of goods to eastern Indonesia has unsatisfactory ship services. Importance Performance Analysis (IPA) and SWOT (Strengths, Weaknesses, Opportunities, and Threats) methods were used. It is shown that the waiting time to dock is much longer than the time to sail. The results stated that improvement strategies such as the construction of a new pier, structuring the operational patterns of ships and goods, reconfiguring the landside layout, and optimizing equipment. However, this is only analyses ship services and port facilities. The aspects of ship services, loading and unloading services and facility services will be developed to evaluate and improve the service quality of Nambo Port by considering other method – the Kano model.

The study [22] states that Tanjung Perak Port has a ship service that does not meet the standards. SWOT (Strengths, Weaknesses, Opportunities, and Threats) method was used. It is shown that the waiting time of the ship when moored is much longer than the time to sail. The results of this is stated that to deepen the harbor pool due to the increase in ship visits at the dock when loading and unloading. However, this is only analyzed ship services. That is, it will be developed regarding aspects of ship services, loading and unloading services and facility services in evaluating and improving the service quality of Nambo Port by considering another method – the Kano model.

These studies [19–22] present the results on the performance of port operational services, showing that the timeliness of serving ship flows, loading and unloading productivity, and facility utilization still need to be improved. There are several unresolved issues related to idle time, including speed in the loading and unloading process, truck readiness, stacking field capacity, cleanliness of the port area, lighting in the port [19], waiting time for anchorage is much longer than the time to sail, availability of tugs/guides [22], availability of loading and unloading equipment, and administrative services [21].

Ways to overcome these difficulties can be in the form of port priority improvement strategies, such as ensuring the readiness of cargo to be loaded, ensuring the readiness of loading and unloading equipment, expanding the stacking yard, accelerating the transportation of goods in the stacking yard, ships that will be loading and unloading must determine transportation management services with a sufficient number of trucks, increase lighting, and improve the cleanliness of the port area [19], structuring the operational pattern of ships and goods [6], optimizing loading and unloading auxiliary equipment, and facilitating administrative services [21].

These approaches show that time wasted during loading and unloading can have a negative impact on port operational efficiency [22] Therefore, it is important to evaluate loading

and unloading performance and improve port service management [2]. In addition, it is necessary to conduct an in-depth analysis of the factors that cause idle time in order to increase port productivity and support economic growth in the surrounding area [23]. Based on these studies [1, 10, 15, 19–22] no one has tried to consider the Kano model. Therefore, this study will try to complement previous study to conduct development on priority strategies for improving port services in supporting the Buton asphalt distribution system at Nambo Port.

Fig. 1. Location of Nambo Port in Buton regency

3. The aim and objectives of the study

The aim of the study is improving the operational efficiency and service quality of asphalt delivery at Nambo Port. This will make it possible to create innovative solutions to make Nambo Port a superior and competitive asphalt distribution center, while supporting national infrastructure growth.

To achieve this aim, the following objectives are accomplished:

– to analyze the performance of port operational services that refer to the decision of the directorate general of sea transportation concerning port operational services performance standards;

– to formulate priority strategies for improving the performance of asphalt delivery services using the Kano model.

4. Materials and methods

The object of this study is the performance of operational services, and formulation of priority strategies to improve the quality of Buton asphalt distribution at Nambo Port. The proposed hypothesis states that the application of the Kano model in the formulation of priority strategies can be a development that has not been carried out at various ports, especially Nambo Port. This assumes the importance of improving operational services at Nambo Port to support the distribution of Buton asphalt through the development of variables that include indicators of ship services, asphalt loading and unloading productivity, and utilization of port facilities. The main focus of this is to improve the efficiency of Buton asphalt loading and unloading operations, given the current problem of poor performance of asphalt loading and unloading at Nambo Port [10]. Thus, the simplicity of this is expected to provide a solution to the problem of the low ratio of effective time of loading and unloading asphalt, so as to improve the overall performance of port services.

Nambo Port is located in Buton Regency, Southeast Sulawesi Province. Based on Buton Regency Regional Regulation No. 8 of 2021 concerning the Buton Regency Industry Development Plan for 2021–2041, the Nambo Port is classified as a local feeder port with a special type of terminal that serves the distribution of dry Buton asphalt mining bulk distribution in Lasalimu District [24]. The location of Nambo Port is shown in Fig. 1.

The data collection method in this study is to retrieve data from the Baubau Port Office and Class II Port Authority, in the form of Nambo Port Layout, ship visiting data, asphalt loading and unloading data, jetty use data, warehouse use data and stacking pages, as well as data on the operation of asphalt loading and concession equipment. Then the second data collection was carried out by distributing questionnaires and interviews, namely by asking a list of questions to users of asphalt delivery services at Nambo Port and direct interviews with the Nambo Port Administrator Office staff.

In the performance of port operational services, this study is analyzed the data of asphalt delivery activities that have been collected, containing performance indicators related to ship services, loading and unloading, and facility utilities. Operational performance obtained from existing data processing was analyzed with performance standards based on the decision of the Directorate General of Sea Transportation [25] concerning Port Operational Service Performance Standards that have been determined by port performance with the following standards are indicated here:

1) ship service flow, including the ship waiting time (Waiting time) maximum is 1 hour, the time of the service (Approach time), the maximum is 2 hours; and the effective time in loading and unloading (Effective time) when the ship is mooring (Berth time) minimum is 70 %;

2) productivity of asphalt loading and loading and unloading services (Dry bulk) of at least 100 tons/hour;

3) utilization of port facilities and equipment, including the use of a jetty (Berth occupancy ratio) maximum of 70 %, the maximum use of warehouse (Shed occupancy ratio).

This study method is a Kano model developed by Noriaki Kano, which aims to categorize product and service attributes based on how well the product/service is able to satisfy customer needs. There are three types of products or services desired and can affect customer satisfaction [26] shown in Fig. 2.

This sample study uses a non-probability sampling method with a type of purposive sampling, where the determination is based on the appropriate consideration of the researcher and is considered representative. So that the sample used is only in Buton Regency (Lasalimu regency, Pasarwajo, and Wolowa) with a total of 30 companies with each company consisting of 3 respondents consisting of Buton asphalt logistics coordinators, Buton asphalt loading and unloading workers, and the Section of Sea Asphalt Transport Expeditions totaling 90 people, because the Nambo Port is in Buton Regency. Factors that

influence the performance of asphalt shipping operational services are carried out by the Kano model by distributing questionnaires to gather information about perceptions about the delivery of Buton asphalt at the Nambo Port.

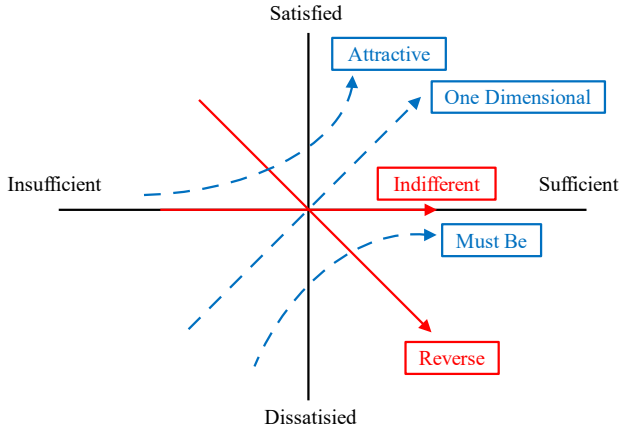

Fig. 2. The Kano model

First, literature studies and field observations are conducted to determine the variables to be analyzed by the Kano method. In the aspect of ship service, there are 8 variables; in aspects of asphalt loading and unloading productivity, there are 8 variables; and in aspects of the facility utility, there are 12 variables. The validity and reliability test use the SPSS software. Validity is tested with Product Moment, by comparing *r count* with *r table*; if *r count*>*r table*, then the variable is declared valid. Conversely, if *r count*<*r table*, then the variable is declared invalid. As for Reliability tested with Cronbach Alpha; if the value is >0.600, then the variable is declared reliable. Conversely, if the value is <0.600, then the variable is declared unreliable [27].

In determining the service attributes in the Kano method, the next step is determining the overall answers to the respondent questionnaire based on the grouping of functional and dysfunctional questions (Fig. 2). Let's describe the Kano model. The vertical axis measures the level of satisfaction, while the horizontal axis measures the presence or absence of quality, and the two axis is determined based on the relationship between satisfaction and quality [28]. This can be seen in Table 1.

Table 1

Kano model attribute classification

Customer requirement		Dysfunctional				
		Like	Expect	Neutral	No problem	Dislike
Functional	Like	Q	A	A	A	O
	Expect	R	I	I	I	M
	Neutral	R	I	I	I	M
	No problem	R	I	I	I	M
	Dislike	R	R	R	R	Q

Notes: M – must be; O – one dimensional; A – attractive; I – indifferent; R – reverse; Q – questionable.

Let's determine the category of Kano using the Blauth Formula [29] that is (one dimensional+attractive+must be)>(indifferent+reverse+questionable), then the grade is obtained from the maximum of one dimensional, attractive, must be, the second if (one dimensional+attractive+must be)<(indifferent+reverse+questionable), then the grade is obtained from the maximum of indifferent, reverse, questionable, and third if (one dimensional+attractive+must be)=(indifferent+reverse+questionable), then the grade is obtained from the maximum of one dimensional, attractive, must be, indifferent, reverse, questionable.

After each attribute's category is known, the calculation is done to find the value of Customer Satisfaction (CS) using the CS-coefficient formula. The CS values show which attributes are the most influential or dominant to customer satisfaction. There is formula to calculate the Customer Satisfaction (CS) value:

$$CS=(\text{attractive}+\text{one dimensional})\div(\text{Attractive}+\text{+One Dimensional+Must Be+Indifferent}).$$

The CS value approaching 1 indicates that the facility significantly affects service user satisfaction and vice versa. If it approaches 0, it does not have any effect.

5. Results of performance analysis and prioritization of Buton asphalt distribution services at Nambo Port

5. 1. Performance of Buton asphalt delivery services at Nambo Port

The performance of the operational services for sending Buton asphalt at the Nambo Port results from measurable work achieved at the port in carrying out ship services, loading and unloading Buton asphalt, and facility utilities. The following (Table 2) is delivery data for Buton asphalt in 2024 at the Nambo Port [30].

The data above will be identified regarding the performance of asphalt delivery operational services in the Nambo Port in accordance with the Directorate General of Sea Transportation [31] concerning Guidelines for Calculation of Port Operational Services Performance and Decree of the Directorate General of Sea Transportation [25] concerning Port Operational Service Performance Standards that have been set at port performance limits with indicators of ship service performance, the performance of loading and unloading service, and the performance of port and port equipment. This can be seen in Fig. 3–6 and Table 3.

The waiting time of the ship at the Nambo Port shows the average waiting time of the ship including a good performance. However, 6 ships indicate the waiting time is above 1 hour, so it is classified as not meeting the performance standards of ship service (not good). The maximum waiting time of the ship is 1 hour. The average result obtained is 0.98 hours or 59 minutes, showing that the ship's waiting time at the Nambo Port is still classified as good. This can be seen in Fig. 3.

The time of shipbuilding service at the Nambo Port shows the average time of shipping services, including a pretty good performance. However, 14 ships show a waiting time of over 2 hours, so it does not meet the performance standards of ship service (not good). The maximum approach time of service is 2 hours. The average results obtained are 2.06 hours or 124 minutes, thus indicating the time of shipping service at the Nambo Port is still quite good. This can be seen in Fig. 4.

Effective time in loading and unloading asphalt in the Nambo Port shows the average effective time in carrying out asphalt loading and loading and unloading including not meeting performance standards (not good), which is as many as 26 ships. Ships that meet the performance standards (good)

are only 13 ships that indicate the wait is equal to or above 70 % (effective time) in making loading and loading and unloading when the ship's time is blocked *(*berth time*)* at least 70 %. The average results obtained are 63.75 %, thus showing effective time in loading and unloading Buton asphalt when the time the ship is blocked in the Nambo Port is classified as not meeting the performance standards of ship service (not good). This can be seen in Fig. 5.

Table 2

Buton asphalt delivery data in 2024

No.	Ship Name	Arrives		Exit		Asphalt (Tons)
		Time Arrives	From	Exit Time	Destination	
1	Klm. Surya Putra	03/01/2024 10.00	Kaledupa	05/01/2024 13.30	Belang Belang	300
2	Klm. Harapan Maju 04	05/01/2024 09.35	Kaledupa	10/01/2024 10.00	Paotere	200
3	Klm. Harapan Maju 04	18/02/2024 10.11	Ba'a	21/02/2024 13.35	Paotere	200
4	Tb. Johan Jaya 119	21/03/2024 13.00	Molawe	27/03/2024 12.40	Probolinggo	500
5	Bg. Indo Darma	21/03/2024 12.00	Molawe	27/03/2024 15.35	Probolinggo	5200
6	Tb. Grace	01/04/2024 15.30	Wawatu	06/04/2024 10.40	Probolinggo	500
7	Tk. Parta Jaya	01/04/2024 09.40	Wawatu	06/04/2024 11.20	Probolinggo	5025
8	Klm. Cahaya Nur Linar 02	28/03/2024 04.00	Siompu	30/03/2024 13.00	Paotere	128
9	Klm. Lima Tujuh Tujuh E	14/04/2024 11.00	Biringgasi	17/04/2024 11.00	Belang-Belang	300
10	Klm. Poleang Indah	18/04/2024 21.00	Binongko	20/04/2024 10.00	Pomala	250
11	Klm. Lima Tujuh Tujuh E	19/04/2024 10.15	Sikeli	22/04/2024 13.12	Paotere	200
12	Cb. 108	06/05/2024 11.20	Lapuko	12/05/2024 08.40	Palu	500
13	Tk. Bina Marine	06/05/2024 12.00	Lapuko	12/05/2024 10.15	Palu	4200
14	Klm. Harapan Maju 04	21/05/2024 08.00	Lakara	28/05/2024 13.14	Paotere	200
15	Bg. Yohanna 3	27/05/2024 08.00	Rangga Ilung	30/05/2024 08.00	Rangga Ilung	3600
16	Tb. Ryhman 02	02/06/2024 13.30	Wanci	07/06/2024 12.40	Lapuko	500
17	Bg. Ryhman Dua Empat	02/06/2024 12.45	Wanci	03/06/2024 17.15	Lapuko	3500
18	Klm. Lima Tujuh Ujuh E	10/06/2024 14.00	Kasipute	12/06/2024 13.50	Paotere	200
19	Klm. Bintang Seroja I	20/06/2024 14.35	Binonko	23/06/2024 14.12	Belangbelang	400
20	Tb. Threes	17/06/2024 10.45	Rangga Ilung	28/06/2024 15.00	Balik Papan	2000
21	Bg. Yohanna 6	17/06/2024 11.00	Rangga Ilung	28/06/2024 14.35	Balik Papan	4200
22	Tb. Bima Sakti	25/06/2024 13.00	Wanci	07/07/2024 13.15	Lapuko	600
23	Tk. Hm 2301	25/06/2024 13.30	Wanci	07/07/2024 12.45	Lapuko	4100
24	Klm. Cahaya Nurlina 02	05/08/2024 10.30	Binongko	07/08/2024 13.40	Paotere	250
25	Tb. Sabang 67	15/08/2024 11.20	Raha	17/08/2024 09.50	Makassar	300
26	Bg. Sumber Jaya 2520	15/08/2024 13.24	Raha	17/08/2024 10.38	Makassar	3250
27	Bg.Marina Line	15/08/2024 07.00	Bahodopi	19/08/2024 20.00	Probolinggo	3000
28	Tk. Beslink.9911	04/09/2024 16.30	Kendari	06/09/2024 23.00	Moramo	2100
29	Km. Nigata	08/09/2024 17.00	Gotontalo	16/09/2024 14.30	Tj. Perak	700
30	Bg.Ll 2301	12/09/2024 10.30	Kendari	14/09/2024 06.00	Kendari	3700
31	Klm.Poleang Indah	25/09/2024 22.00	Kasipute	29/09/2024 21.00	Paili	200
32	Klm. Lima Tujuh Tujuh E	10/10/2024 09.12	Kasipute	14/10/2024 11.00	Belopa	400
33	Tb. Fortuna Samudra	25/10/2024 08.50	Bungku	29/10/2024 13.00	Palu	500
34	Bg. Zulkifli 03	25/10/2024 09.40	Bungku	29/10/2024 15.20	Palu	4100
35	Klm. Lima Tujuh Tujuh E	07/11/2024 08.52	Belopa	09/11/2024 12.40	Banabungi	60
36	Klm. Bintang Seroja I	06/11/2024 10.15	Liana Baggai	15/11/2024 13.40	Belang Belang	350
37	Bpm 05	23/11/2024 13.12	Banabungi	25/11/2024 10.50	Lapuko	1500
38	Bg. Fery	23/11/2024 12.48	Banabungi	25/11/2024 11.12	Lapuko	5100
39	Km. Arista	02/12/2024 21.00	Kendari	08/12/2024 23.30	Pasar Wajo	500

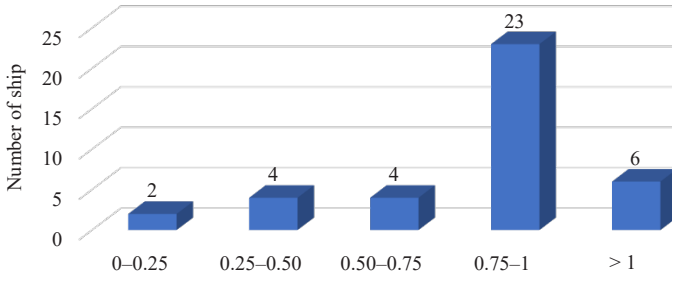

Fig. 3. Graph of waiting time for the ship at the Nambo Port

Asphalt loading and unloading productivity at the Nambo Port shows the average productivity of asphalt loading and loading and unloading including not meeting loading and unloading performance standards (not good), which is as many as 35 ships. Ships that meet the performance standards (good) are only 4 ships that show the productivity of loading and unloading Buton asphalt equal to or exceeding 100 tons/hour. Asphalt loading and unloading work productivity shows an average result of 37.26 tons/hour which is standard on loading and unloading productivity for asphalt (dry bulk) of at least 100 tons/hour, so it is classified as not meeting the performance standards of the Buton asphalt loading and unloading productivity in Nambo Port (not good). This can be seen in Fig. 6.

The use of the jetty (berth occupancy ratio) is obtained at 48.65 %, so the performance of the use of the jetty (BOR) is still classified as good (Maximum 70 %). Meanwhile, the maximum use of a buildup (yard occupancy ratio) is 70 %. Dimensions of the Nambo Port accumulation field measuring 100×50 meters or with an area of 5.000 m^2, and the effective capacity of the buildup of Buton asphalt in the Nambo Port is 5.500 tons. The results of the analysis of the use of the buildup field are based on obtained use of a buildup field (YOR) of 28.16 %, so the performance of the use of the buildup field is still classified as good (Maximum 70 %). Recapitulation results of the identification of asphalt distribution service performance at Nambo Port can be seen in Table 3.

They use a warehouse (Shed Occupancy Ratio). The maximum is 65 %. However, the results of the existing analysis of the use of warehouses in the Nambo Port are not used, so there is no data use because the Buton asphalt will be distributed at the buildup field. As for the asphalt that is stored in sacks is not stored in the Nambo Port storage warehouse, the company immediately brings it to the ship. Then, for the equipment operations, the minimum is 80 %. The existing analysis results, namely in the Nambo Port, did not prepare supporting equipment for distributing Buton asphalt, such as excavators, loaders, and trucks. But the one who prepared was the company that would distribute the Buton asphalt in the Nambo Port.

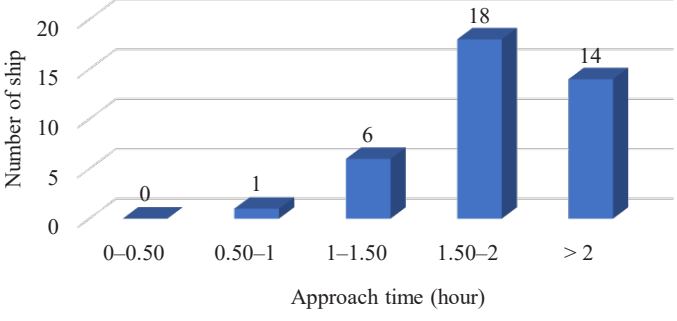

Fig. 4. Graph of ship service time at Nambo Port

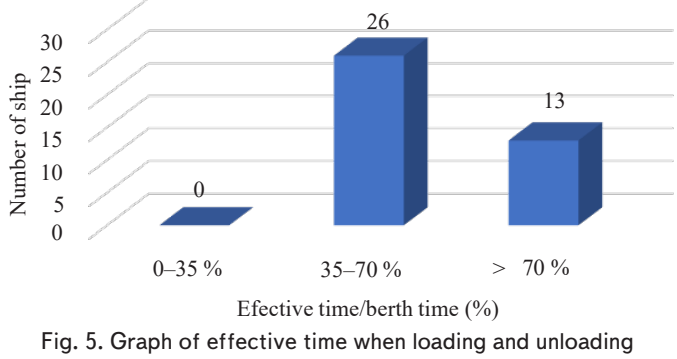

Fig. 5. Graph of effective time when loading and unloading Buton asphalt

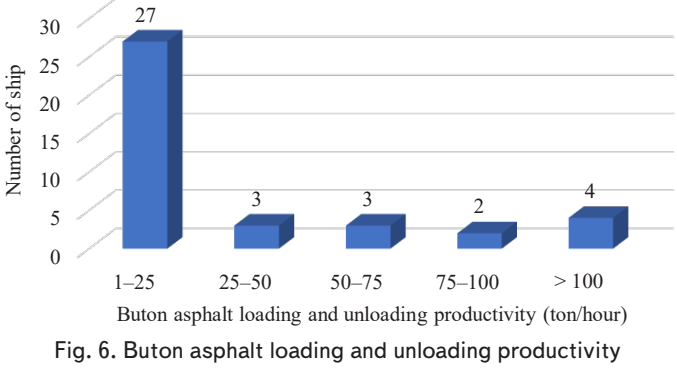

Fig. 6. Buton asphalt loading and unloading productivity at Nambo Port

Table 3

Identification of asphalt distribution service performance at Nambo Port

No.	Aspect	Service	Standard	Unit	Results	Description
1	Ship service	Waiting time (WT)	Max. 1	Hour	0.98	Good
		Approach time (AT)	Max. 2	Hour	2.06	Quite Good
		Effective time (ET)/berth time (BT)	Min. 70	%	63.75	Not Good
2	Loading and unloading productivity	Dry bulk (Buton asphalt)	Min. 100	Ton/hour	37.26	Not Good
3	Facilities and equipment utilities	Berth occupancy ratio (BOR)	Max. 70	%	48.65	Good
		Yard occupancy ratio (YOR)	Max. 70	%	28.16	Good

5. 2. Priority improvement of the performance of operational services for delivery of Buton asphalt in the Nambo Port

The results of the distribution of questionnaires allow to determine the priority of improving the performance of the operational services of Buton asphalt in the Nambo Port using the Kano model, the characteristics of the respondent as a sample in this study were the user of the Buton asphalt shipping service at the Nambo Port. Basic information about respondents' identities, namely gender, age, last education, and long time to become users of Buton asphalt distribution services can be seen in Table 4.

Based on Table 4, the characteristics of male respondents were 88 people (98 %), and those who were female were 2 people (2 %). Most of the respondents are male; this shows conformity during direct observation in the field. Second, the age characteristics of respondents aged 21–30 years were 36 people (40 %), 31–40 years were 31 people (34 %), 41–50 years were 18 people (20 %), >50 years were five people (6 %), and no one was under 20 years old (0 %). Most of the respondents were aged 21–30 years, and this result was reinforced during direct observation in the field that company workers are dominated by people who are in the productive period. Third, the educational characteristics of respondents with the latest high school education totaled 28 people (31 %), D3 education totaled 7 people (8 %), S1 education totaled 55 people (61 %), and no one had the last education below high school and S2/S3 (0 %). Most respondents have the last education S1. Finally, the characteristics of the length of time being a user of Buton asphalt shipping services are at Nambo Port with users <1 year numbered 3 people (3 %), 1–5 years numbered 15 people (17 %), 5–10 years numbered 26 people (29 %), and service users above 10 years numbered 46 people (51 %). Most respondents are companies that have been users of Buton asphalt shipping services at Nambo Port for more than 10 years.

Determination of the variables are analyzed by the Kano model. In the aspect of ship service, there are 8 variables; in aspects of asphalt loading and unloading productivity, there are 8 variables; and in aspects of the facility utility, there are 12 variables. After the validity and reliability test using the SPSS software, the *r* table value is 0.207 which is obtained from the product moment value on the number of variables of 90 with a significant level of 5 %, so that if *r* count > *r* table, the variable is declared valid. Conversely, if *r* count<*r* table, then the variable is declared invalid. While the Cronbach's alpha limit value is 0,600, so that if the value is >0.600, the variable is declared reliable. Conversely, if the value is <0.600, then the variable is declared unreliable [27]. The results of the analysis of all variables were declared valid and reliable. This can be seen in Table 5.

The results of the Kano model, after the answers to the respondents were analyzed with the classification table (Table 1), are shown the results in the form of category and ranking for each variable, this can be seen in Table 6.

Table 4

Respondent characteristics

Sample	Category	Number	Percentage (%)
Gender	Male	88	98
	Female	22	2
Age	<20	0	0
	21–30	36	40
	31–40	31	34
	41–50	18	20
	>50	5	6
Education	<SLTA	0	0
	SLTA	28	31
	D3	7	8
	S1	55	61
	S2/S3	0	0
Long time user	<1	3	3
	1–5	15	17
	5–10	26	29
	>10	46	10

Table 5

Variable validity and reliable test

Aspect	Functional				Dysfunctional			
	Variable	*r* count	Alpha Cronbach	Description	Variable	*r* count	Alpha Cronbach	Description
Ship service	*X*1	0.280	0.723	Valid and reliable	*Y*1	0.556	0.648	Valid and reliable
	*X*2	0.618	0.654		*Y*2	0.580	0.643	
	*X*3	0.512	0.691		*Y*3	0.491	0.659	
	*X*4	0.519	0.671		*Y*4	0.657	0.624	
	*X*5	0.734	0.614		*Y*5	0.611	0.637	
	*X*6	0.586	0.657		*Y*6	0.655	0.622	
	*X*7	0.653	0.648		*Y*7	0.470	0.668	
	*X*8	0.598	0.654		*Y*8	0.355	0.680	
Loading and unloading productivity	*X*1	0.397	0.734	Valid and reliable	*Y*1	0.471	0.685	Valid and reliable
	*X*2	0.232	0.731		*Y*2	0.683	0.623	
	*X*3	0.821	0.604		*Y*3	0.530	0.663	
	*X*4	0.415	0.744		*Y*4	0.592	0.661	
	*X*5	0.788	0.607		*Y*5	0.572	0.661	
	*X*6	0.793	0.613		*Y*6	0.589	0.656	
	*X*7	0.522	0.69		*Y*7	0.496	0.671	
	*X*8	0.721	0.634		*Y*8	0.569	0.653	
Facilities and equipment utilities	*X*1	0.237	0.736	Valid and reliable	*Y*1	0.271	0.685	Valid and reliable
	*X*2	0.632	0.702		*Y*2	0.503	0.651	
	*X*3	0.221	0.744		*Y*3	0.594	0.638	
	*X*4	0.393	0.728		*Y*4	0.547	0.645	
	*X*5	0.217	0.754		*Y*5	0.474	0.666	
	*X*6	0.499	0.711		*Y*6	0.472	0.655	
	*X*7	0.561	0.708		*Y*7	0.219	0.693	
	*X*8	0.650	0.69		*Y*8	0.289	0.676	
	*X*9	0.587	0.700		*Y*9	0.248	0.692	
	*X*10	0.657	0.689		*Y*10	0.597	0.637	
	*X*11	0.684	0.683		*Y*11	0.567	0.640	
	*X*12	0.683	0.686		*Y*12	0.713	0.606	

Table 6

Kano model category results

Aspect	No.	Variable	Q	R	I	A	O	M	Category	CS	Ranking
Ship service	1	The ship is waiting at the jetty and immediately carried out the asphalt loading and unloading process	1	0	20	23	25	21	O	0.539	1
	2	The ship is waiting at the jetty because of bad weather	1	4	22	24	20	19	A	0.518	2
	3	The ship is waiting at the jetty because of heavy equipment failure	0	2	53	11	4	20	I	0.170	8
	4	The ship is waiting at the jetty for asphalt cargo	3	3	40	17	4	23	I	0.250	7
	5	The ship is waiting at the jetty because of to work accident	0	0	28	12	13	37	M	0.278	4
	6	Guiding ships in port waters is carried out properly and on time by Port Officers	1	6	26	17	6	34	M	0.277	5
	7	Fast, safe, and free from extortion administration of ship documents	2	3	23	16	19	27	M	0.412	3
	8	Adequate fuel oil bunker services for the ships	2	5	40	17	7	19	I	0.289	6
Asphalt loading and unloading productivity	1	Loading and unloading of asphalt at the port jetty is carried out relatively quickly without any breaks	0	2	32	11	6	39	M	0.193	5
	2	Asphalt loading and unloading labor is accommodated and disciplined	6	26	25	6	5	22	R	0.190	6
	3	Heavy equipment, such as loaders and excavators, are always present and ready to use at the Port	3	14	13	28	18	14	A	0.630	1
	4	Asphalt loading and unloading workers work at the port without resting	11	23	24	5	5	22	I	0.179	8
	5	The absence of delays in loading and unloading asphalt occurred due to a lack of adequate equipment and manpower.	2	5	29	10	30	14	O	0.482	3
	6	Information about the loading and unloading asphalt at the port is clearly coordinated	2	4	15	31	8	30	A	0.464	4
	7	Security of cargo at port	5	26	25	5	6	23	R	0.186	7
	8	Readiness of the sea freight expedition fleet / truck	0	8	21	17	25	19	O	0.512	2
Facilities and equipment utilities	1	Use of adequate jetty according to the dimensions of the ship being moored	3	10	16	17	20	24	M	0.481	6
	2	Asphalt stacking fields are in accordance with the amount of asphalt being stacked	2	3	29	12	30	14	O	0.494	4
	3	Warehouse usage is used as an asphalt stacking facility	7	24	23	8	9	19	R	0.288	11
	4	Ship loading and unloading equipment is available and still suitable for use	10	13	25	10	9	23	I	0.284	12
	5	Road conditions at the port are adequate (asphalt/concrete)	4	5	29	30	12	10	A	0.519	2
	6	Accessibility of the jetty with organized and smooth stacking yard/warehouse	0	6	25	27	14	18	A	0.488	5
	7	Capacity of the vehicle parking lot at the port is large and sufficient	10	12	24	10	10	23	I	0.299	10
	8	The fenders on the jetty are still adequate	1	6	28	15	11	29	M	0.313	7
	9	Cleanliness of the port area	6	13	28	11	11	21	I	0.310	8
	10	Port lighting (night)	5	13	12	25	18	17	A	0.597	1
	11	Friendliness and fast-acting port staff services to service user complaints	9	16	25	11	9	20	I	0.308	9
	12	Security in the port environment with the presence of guard posts	0	5	29	11	32	13	O	0.506	3

In the aspect of service, the obtained results on variable 1 (the ship waiting at the jetty by directly carrying out the asphalt loading and loading and unloading process) is one dimensional (O), with the value of customer satisfaction (CS) values is 0.539. The results of the recapitulation of the Kano model can be seen in Table 6.

6. Discussion of results for prioritization of Buton asphalt distribution services at Nambo Port

The operational service performance of Buton asphalt delivery at Nambo Port in terms of ship service, namely ship waiting time (WT) of 0.98 hours or 59 minutes is classified as good

which is a maximum 1 hour (Fig. 3), ship pilotage time (AT) of 2.06 hours or 124 minutes is classified as quite good which is a maximum 2 hours (Fig. 4), and effective time when loading and unloading asphalt (ET/BT) of 63.75 % is classified as poor which is a minimum 70 % (Fig. 5). In terms of productivity, the loading and unloading of Buton asphalt at Nambo Port of 37.26 tons/hour is classified as poor which is a minimum 100 tons/hour (Fig. 6). In terms of facility and equipment utilities, namely, the use of the jetty (BOR) of 48.65 % is classified as good, which is a maximum 70 % (Table 3), the use of the stacking yard (YOR) of 28.16 % is classified as good which is a maximum 70 % (Table 3), the use of the Warehouse (SOR) is not used and the utility of supporting equipment for Buton asphalt distribution at Nambo Port does not exist. Recapitulation results can be seen in Table 3.

The results of the Kano analysis in modeling so that Nambo Port can be improved, 12 variables are priority for improvement that are included in the one-dimensional, must-be, and attractive Kano attributes (5 variables in the aspect of ship service, 5 variables in the aspect of asphalt loading and unloading productivity, and 7 variables in the aspect of facility and equipment utility), and each variable has been ranked according to the satisfaction of service users at Nambo Port when distributing Buton asphalt (Table 6).

The priority is obtained in the aspect of ship services, namely ships waiting at the jetty by immediately carrying out the asphalt loading and unloading process, ships waiting at the jetty due to bad weather, fast, safe and without illegal levies, ships waiting at the jetty due to work accidents, and ship guidance in port waters is carried out properly and on time by Port Officers. Second, in the aspect of Buton asphalt loading and unloading productivity, namely, heavy equipment such as loaders and excavators are always available and ready to be used at the port, the readiness of the ship/truck cargo expedition fleet, there are no delays in loading and loading and unloading asphalt due to lack of adequate equipment and manpower, information about loading and loading and unloading asphalt at the port is coordinated, and loading and loading and unloading asphalt at the port jetty are carried out relatively quickly without a break. Lastly, in terms of the utility aspect of facilities and equipment, namely lighting in the port (at night), adequate road conditions in the port (asphalt/concrete), security in the port environment with the presence of guard posts, use of asphalt stacking yards according to the amount of asphalt stacked, accessibility of the jetty with an organized and smooth stacking yard, use of adequate jetties according to the dimensions of the moored ships, and the fenders on the jetty are still adequate. The recapitulation of variables and rankings can be seen in Table 6.

The specificity of the Kano model proposed in this study is to combine interrelated aspects at the port in carrying out the distribution of Buton asphalt, from the ship arriving, then the ship mooring, loading and unloading, using port equipment and facilities, until the ship sails back. So that the results are interrelated between ship services, loading and unloading, and the use of port facilities, while some studies only specifically analyze the flow of ship services or loading and unloading carried out at the port [19–22].

The limitation of this study is that the location is only carried out at Nambo Port. In Buton Regency there are two ports that serve the distribution of Buton asphalt, namely Nambo Port and Banabungi Port. Therefore, it does not include Banabungi Port or other ports that may also play a role in the distribution of asphalt nationally and internationally. Secondly, this only covers certain services, such as the flow of ship services, loading and unloading services, and the use of port facilities (warehouses, docks, stacking yards, and port support equipment). Other facilities that support the broader logistics distribution system aren't analyzed in detail.

The weakness of this study is that the analysis only uses several analytical methods, namely the Directorate General of Sea Transportation Regulation to evaluate the operational services of Nambo Port and the Kano model in measuring service user satisfaction which results in priority strategies in improving the distribution of Buton asphalt at Nambo Port, so that other aspects such as feasibility studies, environmental impacts, and cost efficiency are not explained in depth. Therefore, in the future, this is can be developed with feasibility study, environmental impact and cost efficiency as a basis for sustainable development of Nambo Port in assessing whether or not the development of Nambo Port operational buildings, which include port facilities such as docks, warehouses and stacking fields, port offices, terminals and others. Secondly, there is a need to be on transport modelling such as Route Selection or Distribution of traffic loading for vehicles (trucks) that will deliver the asphalt to Nambo Port or Banabungi Port. This can be a comparison between the distribution between the two ports that serve asphalt, and most importantly this is can be a reference for local governments such as the Public Works Office or the Transportation Office when conducting roadworthiness tests and carrying out road repairs or maintenance.

The difficulty encountered in this study is that based on the Buton Regency Regional Regulation Number 8 of 2021 concerning the Industrial Development Plan for 2021–2024 which states that the Nambo Port is a feeder port and as a Special Asphalt Mining Terminal [24], researchers did not review unused port facilities such as warehouses and passenger terminals. So that this can be the basis for the local government in taking effective steps when the Nambo Port will be developed in the future, whether it needs development for unused facilities or maybe it will be converted into a passenger port in addition to serving Buton asphalt distribution. This will require further study.

7. Conclusions

1. The results of the evaluation of the performance of Buton asphalt delivery services at Nambo Port are:

1) the approach time service type, the results were still quite good reached 2.06 hours, which are at most 2 hours;

2) the ratio of effective loading and unloading time/berth time of ships, the results were not good reached 63.75 %, which are at least 70 %;

3) in terms of productivity of loading and unloading Buton asphalt, the results were not good reached 37.26 tons/hour, which is at least 100 tons/hour. The ship spends too much time at Nambo Port, so much time is lost (idle time). Therefore, Nambo Port requires improvement in solving the problems that have occurred to improve the distribution of Buton asphalt to various regions.

2. The formulation of priority strategies to improve the performance of asphalt delivery services at Nambo Port in solving service problems does not meet standards, especially in the productivity of loading and unloading Buton asphalt. Therefore, based on the results of the Kano model, these strategies include loading and unloading efficiency, readiness of heavy equipment and expedition fleets, management of port facility infrastructure such as lighting, road conditions, and security, as well as a fast and transparent administrative process. The proposed strategies can be implemented in practice

with infrastructure development, effective coordination among stakeholders, and monitoring of operations to ensure sustainability of improvements. Fulfillment of these priority variables has the potential to increase service user satisfaction and strengthen the role of Nambo Port as an efficient and reliable Buton asphalt distribution center.

Conflict of interest

The authors declare that they have no conflict of interest about this study, whether financial, personal, authorship, or otherwise, that could affect the study and its results presented in this paper.

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Data availability

Data will be made available on reasonable request.

Use of artificial intelligence

The authors confirm they did not use artificial intelligence technologies when creating the current work.

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