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Analysis of Ferry Transport Management on the Smoothness and Security of Passenger and Goods Flow: A Research Study on the Ferizy Application System at the Merak and Bakauheni Ferry Ports

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Abstract

The main problem in the services provided at the Merak–Bakauheni ferry ports is the limited attention given to governance, particularly in the way the Ferizy application system supports the smoothness and security of passenger and goods flow. This study therefore aims to investigate the impact of implementing the Ferizy application system for ticket purchasing on the smoothness and security of passenger and goods flow at the Merak–Bakauheni ferry ports. A quantitative approach was applied using questionnaires completed by 69 respondents. The Method of Successive Interval (MSI) was used to convert the ordinal-scale questionnaire data into interval data, after which inferential testing (multivariate analysis of variance, MANOVA) was carried out to answer the research hypotheses. The results indicate that the implementation of the Ferizy application — covering system quality, information quality, service quality and user satisfaction — produces a significant difference in the smoothness and security of passenger and goods flow, both simultaneously and partially. The findings specifically address the discrepancy between the data recorded in the Ferizy application and the manifest of the Sailing Approval Letter (SPB) for both the Merak–Bakauheni and the Bakauheni–Merak crossings.

Keywords : Governance; Ferizy application system; Smoothness; Security

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1. INTRODUCTION

The geographical condition of Indonesia, with its many islands stretching from Sabang to Merauke [1]–[3], has produced an uneven distribution of natural resources and human resources. Socio-economic capacity is a national issue that must be resolved through development programmes that are directed, integrated and well coordinated [2], [4]–[6]. One of the sectors that guarantees the continuity of social, economic, cultural, political and security life is the transport sector [7]–[9]. This sector supports the dynamics of development when it is organised in an integrated, smooth, safe, comfortable and efficient manner [10]. The role of river, lake and ferry transport (ASDP) as a mode of transport requires a considerable period of time to support and accelerate development, to strengthen national unity, and to influence every aspect of national life [11]. Ferry transport acts as a support, a driver and a catalyst for regional growth, yet its governance is still far from optimal.

Ferry transport is a mode commonly used by the public. It functions as a vehicle that connects road networks separated by straits, carrying passengers, vehicles and their cargo [12]–[14]. Ports serve as the place where vessels berth, where passengers embark and disembark, and where goods are loaded and unloaded. Ports are equipped with navigational safety and security facilities as well as supporting activities, acting as the point of transfer between and within transport modes. Based on monitoring data for ferry crossings, seven regions record dense public mobility: (1) Merak–Bakauheni (57%); (2) Ketapang–Gilimanuk (26%); (3) Kariangau–Penajam (6%); (4)

Kayangan–Pototano (5%); (5) Padangbai–Lembar (2%); (6) Tj. Api-api–Tj. Kelian (2%); (7) Ajibata–Ambarita (1%); and (8) Bajoe–Kolaka (1%) [15]–[17]. These figures show that the Merak–Bakauheni crossing is extremely busy, particularly during the Christmas and New Year holidays and the Eid period. Moreover, the total number of vehicles crossing from Merak to Bakauheni increased by 14% between 2019 and 2022, which indicates the high mobility of the population in this region, especially at the ports of Merak and Bakauheni.

The ports of Merak and Bakauheni connect the island of Java with the island of Sumatra across the Sunda Strait. Both ports play an important role in supporting economic activity, the distribution of goods and the mobility of people between the two islands [18]. However, a range of problems has been identified at both ports, several of which have become national issues. First, congestion of passenger and vehicle flow, particularly during long holidays, when high mobility means that ferries cannot accommodate all the passengers and vehicles wishing to cross. Second, the condition of the infrastructure in several port facility areas is not optimal. Third, accidents involving ferries occasionally occur, raising concerns about the safety standards applied to both vessels and port facilities. Fourth, complaints from the public regarding long waiting times and delayed ferry departures. Fifth, the Sunda Strait, which forms the sailing route between Merak and Bakauheni, is at times subject to bad weather or high waves that can obstruct or delay sailings. Sixth, the ongoing government effort to eradicate illegal levies. Seventh, the dense activity at both ports has an impact on the surrounding environment, in terms of water, air and general environmental pollution.

A further problem that has become a national issue at the Port of Merak is the bottleneck affecting the smooth flow of vehicle traffic during holiday periods and whenever there is a heavy flow of vehicles heading towards Sumatra. The government has attempted to resolve this bottleneck at Merak–Bakauheni by adding vessels and berths. This demonstrates the government's commitment to building an identity as a maritime nation by improving the quality and capacity of vessels, berths, passenger terminals and the transport routes leading to the ports. Nevertheless, these efforts to break the bottleneck remain sub-optimal, so that more efficient alternatives are required.

The problems outlined above call for solutions in the form of sound infrastructure development, increased vessel capacity and fleet size, the application of technology to improve service efficiency, and law enforcement to prevent illegal practices such as unofficial levies. One aspect that has attracted particular attention is the importance of safety management in ferry services, achieved through improvements by every stakeholder at the ferry ports. In this respect, PT ASDP Indonesia Ferry (Persero) and the Ministry of Transportation play a key role in improving the governance of ferry transport as an effort to raise security and safety standards. Such governance requires a comprehensive strategy, including infrastructure and management improvement. For example, terminals need to be designed to facilitate the flow of passengers and goods, and vessel capacity needs to be increased so that more passengers and goods can be accommodated. From the perspective of technology and information systems, an online ticket booking system needs to be developed to distribute passenger loads evenly, together with a ferry information system that announces sailing schedules, journey status and other information relevant to passengers.

PT ASDP Indonesia Ferry (Persero), together with the Directorate General of Land Transportation and all ferry partners, is committed to improving the governance of ferry transport in order to raise security and safety standards in operational activities and crossing services throughout Indonesia. One problem that became a national issue was the fire on board KMP Royce I, which serves as a lesson for all parties at ferry ports to consistently improve and prioritise safety management in every crossing service in accordance with the applicable regulations. This is also related to the issue of manifest data accuracy, including the obligation for all passengers — whether on foot or inside a vehicle — to hold a ticket and to register their personal data, and to the control of unofficial agents around the ports. These requirements follow Ministerial Regulation No. 25/2016 on the List of Passengers and Vehicles of Ferry Transport and Ministerial Regulation No. 28/2016 on the Obligation of Ferry Passengers to Hold a Ticket. Passengers inside vehicles that are about to board must first have their identity verified through the shelter facilities available at the ports of Merak and Bakauheni.

The issue of manifest data accuracy also covers the obligation for all passengers, on foot or in vehicles, to hold a ticket; the control of unofficial agents around the ports; support for the expansion of Ferizy sales channels through online travel agents (OTA), e-commerce and mobile banking; the implementation of vehicle filtering in the buffer-zone area outside the ports; safety management; the optimisation of the ferry supervision function; the handling of vehicles

carrying dangerous goods; and coordination on tariff application for all passengers, whether on foot or inside vehicles, with the Directorate of River, Lake and Ferry Transport of the Ministry of Transportation [10]. ASDP, together with its sales-channel partners, is committed to issuing warnings and sanctions to agents operating illegally or failing to comply with the Ferizy terms and conditions, and to reinforcing the rules applied to officers both at the ports and on board the vessels.

Data on the problems occurring on the Merak–Bakauheni crossing reveal a number of issues for both the outbound and the return flows [19]. From the Merak side, the first issue was the increase in demand during the 1443 H Eid transport period, which produced long queues to board the vessels. The follow-up measures were: (1) increasing vessel capacity from 34 to 45 units under an arrival–departure system, raising hourly capacity from 820 to 1,570 vehicles; (2) using nearby ports, namely the Port of Indah Kiat and the Port of Bojonegara (PT BBJ); (3) operating vessels belonging to PT ALP, namely KM Mutiara Ferindo VII and KM Sumber Berkah I, which cleared a 4.75 km queue over four realised trips; and (4) diverting goods vehicles through the port of PT BBJ. The second issue was the bottleneck and the closely spaced turning points on the access road to the port, addressed by: (1) managing traffic flow at congestion points; (2) restricting U-turn locations; and (3) applying police discretion (a red-zone designation) at the request of PT ASDP Indonesia Ferry (Persero) to disperse all vehicles queuing on the upper Cikuasa section. The third issue was that many service users had not purchased tickets while travelling to the port, combined with continuing problems in the Ferizy application system. The follow-up measures were: (1) socialisation through mainstream media, distribution of leaflets to factories, SMS blasts and banner installation encouraging service users to buy tickets online; (2) accelerated system repair by the IT team of PT ASDP Indonesia Ferry (Persero); and (3) the application of a standard operating procedure for vehicles without tickets.

From the Bakauheni side, the first issue was the anticipated increase in demand during the return flow, addressed by [19]: (1) maintaining installed capacity by operating 45 vessels under an arrival–departure system, raising hourly capacity from 820 to 1,570 vehicles; (2) using nearby ports, namely the Port of Panjang bound for Ciwandan and the BBJ Bakauheni port bound for the Port of Bojonegara (PT BBJ); (3) operating six vessels on the Panjang–Ciwandan sea route, comprising three sea vessels (KM Mutiara Ferindo VII, KM Sumber Berkah I and KM Ceremai) and three ferries (KMP Titian Nusantara, KMP Panorama Nusantara and KMP Kumala); and (4) diverting goods vehicles through the port of PT BBJ. The second issue was the vehicle delaying scenario, for which the Lampung Regional Police implemented several scenarios to anticipate the build-up at the port of Bakauheni. The third issue was the anticipated bottleneck in front of the toll gate, addressed by: (1) positioning stoppers to check tickets; (2) creating a turning lane for vehicles without tickets; (3) creating a dedicated lane for two-wheeled vehicles entering the port, together with tents at each berth and additional signage at the motorcycle lane entrance; (4) separating the lanes for the executive berth and the regular berth; and (5) placing officers at each strategic location and berth.

The problem observed in the field concerns incomplete or inaccurate passenger manifest data, that is, a discrepancy between the passenger data recorded on the tickets and the actual number of passengers crossing. The ideal condition is that all passengers are recorded on a ticket and that the conformity of service-user data is checked in the buffer zone, at the stopper, at check-in and at boarding. The discrepancy arises because service users are not yet orderly and disciplined in entering complete and correct passenger data during ticket purchase. This indicates that the Ferizy application system, or online ticketing service, is not yet working optimally in meeting public needs. Improvements are therefore required, particularly in the system itself, for example: (1) vessel operators should use the facility for real-time access to production and manifest data through the Ferizy dashboard, so that owners can monitor the operational activity of their vessels anywhere and at any time; (2) ASDP should follow up the expansion of Ferizy cooperation with OTAs and e-commerce platforms; (3) the capability of Ferizy should be enhanced so that it can print a boarding pass for each passenger inside a vehicle, which can then be scanned when boarding through the shelter facility at the port; (4) the Ferizy network should be prepared in the buffer-zone area outside the ferry port to ensure that handheld verification devices work properly, supporting smooth and easy verification of service-user data; (5) the Ferizy account registration process should be enhanced using a one-time password (OTP) method; and (6) the Ferizy system should be able to deactivate agent accounts in real time as a sanction when an agent is found to have breached the rules on ferry ticket sales.

The identified problems can therefore be summarised as follows. First, the increase in demand during the 1443 H Eid transport period produced long queues to board the vessels. Second,

a bottleneck and closely spaced turning points occur on the access road to the port. Third, many service users have not purchased tickets while travelling to the port, and problems persist in the Ferizy application system. Accordingly, the problem addressed in this study is the following: does the implementation of the Ferizy application system for ticket purchasing influence the smoothness and security of passenger and goods flow at the Merak–Bakauheni ferry ports?

2. METHOD

Based on the background, problem identification and problem limitations described above, the research questions are formulated as follows: how does the discrepancy between the number of passengers recorded in the Ferizy application and the number of passengers recorded in the manifest of the Sailing Approval Letter (SPB) at the ports of Merak and Bakauheni exert an influence, and how does the sub-optimal use of the features of the Ferizy application system affect the effectiveness and satisfaction of service users?

2.1 Determination of the Sample

The research method used in this study follows a quantitative approach. Data collection and data analysis were each carried out as distinct processes; once both processes had been completed, the two sets of results were compared with, and related to, one another.

2.2 Data Collection and Analysis

In order to answer the research question concerning the influence of the implementation of the Ferizy application system for ticket purchasing on the smoothness and security of passenger and goods flow at the Merak–Bakauheni ferry ports, open questionnaires were used: one addressing the implementation of the Ferizy application system, and one addressing the smoothness and security of passenger and goods flow. The data collected produced the information presented in Table 1.

Table 1. Research Participants

No	Respondent	Number of Samples
1	Regulator	14
2	Operator	13
3	Service user	42
	Total	**69**

The questionnaires were then distributed after passing a validation process and being declared fit for use in this study. They measured system quality, information quality, service quality and user satisfaction. In addition, an assessment questionnaire on the smoothness and security of goods was used.

The completed questionnaires were analysed using the Method of Successive Interval (MSI) to convert the ordinal-scale data into interval data, after which inferential testing (multivariate analysis of variance, MANOVA) was carried out to answer the research hypotheses. The hypotheses are as follows.

Null hypothesis (H0): There is no significant effect of the discrepancy between the number of passengers recorded in the Ferizy application and the number of passengers recorded in the manifest of the Sailing Approval Letter (SPB) at the ports of Merak and Bakauheni.

Alternative hypothesis (H1): There is a significant effect of the discrepancy between the number of passengers recorded in the Ferizy application and the number of passengers recorded in the manifest of the Sailing Approval Letter (SPB) at the ports of Merak and Bakauheni.

Second hypothesis (H2): The optimal use of the features of the Ferizy application system has an effect on the effectiveness and satisfaction of service users.

3. RESULTS AND DISCUSSION

In order to test the effect of implementing the Ferizy application in supporting navigational safety and the smoothness of passenger and vehicle flow at the Merak–Bakauheni ferry ports, the following tests were carried out.

3.1 Normality Test

The results of the test of normality are presented in Figure 1.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Residual for Kelancaran	.070	69	.200*	.974	69	.154
Residual for Keamanan	.096	69	.190	.970	69	.097

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Figure 1. Tests of Normality

As shown in Figure 1, the significance values are greater than 0.05, which indicates that the residual data for smoothness (significance 0.154) and for security (significance 0.097) are normally distributed.

3.2 Homogeneity Test

The results of Levene's test of equality of error variances are presented in Figure 2.

Levene's Test of Equality of Error Variances[a]

	F	df1	df2	Sig.
Kelancaran	.693	2	66	.504
Keamanan	.260	2	66	.772

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Kualitas_Sistem + Kualitas_Informasi + Kualitas_Pelayanan + Kepuasan_Pengguna + Partisipan

Figure 2. Levene's Test of Equality of Error Variances

Based on the smoothness and security data, the significance values are greater than 0.05: the smoothness data have a significance value of 0.504 and the security data a significance value of 0.772. It can therefore be concluded that the variance of the data is homogeneous.

3.3 Simultaneous Multivariate Test

To assess the effect of governance on the security and smoothness of goods flow, the results presented in Figure 3 were obtained.



Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.277	11.690[b]	2.000	61.000	.000
	Wilks' Lambda	.723	11.690[b]	2.000	61.000	.000
	Hotelling's Trace	.383	11.690[b]	2.000	61.000	.000
	Roy's Largest Root	.383	11.690[b]	2.000	61.000	.000
Kualitas_Sistem	Pillai's Trace	.000	.053[b]	2.000	61.000	.000
	Wilks' Lambda	.998	.053[b]	2.000	61.000	.000
	Hotelling's Trace	.000	.053[b]	2.000	61.000	.000
	Roy's Largest Root	.000	.053[b]	2.000	61.000	.000
Kualitas_Informasi	Pillai's Trace	.049	1.579[b]	2.000	61.000	.000
	Wilks' Lambda	.951	1.579[b]	2.000	61.000	.000
	Hotelling's Trace	.052	1.579[b]	2.000	61.000	.000
	Roy's Largest Root	.052	1.579[b]	2.000	61.000	.000
Kualitas_Pelayanan	Pillai's Trace	.069	2.256[b]	2.000	61.000	.000
	Wilks' Lambda	.931	2.256[b]	2.000	61.000	.000
	Hotelling's Trace	.074	2.256[b]	2.000	61.000	.000
	Roy's Largest Root	.074	2.256[b]	2.000	61.000	.000
Kepuasan_Pengguna	Pillai's Trace	.159	5.751[b]	2.000	61.000	.005
	Wilks' Lambda	.841	5.751[b]	2.000	61.000	.005
	Hotelling's Trace	.188	5.751[b]	2.000	61.000	.005
	Roy's Largest Root	.188	5.751[b]	2.000	61.000	.005
Partisipan	Pillai's Trace	.278	4.861	4.000	124.000	.001
	Wilks' Lambda	.731	5.191[b]	4.000	122.000	.001
	Hotelling's Trace	.360	5.393	4.000	120.000	.000
	Roy's Largest Root	.322	10.300[c]	2.000	62.000	.000

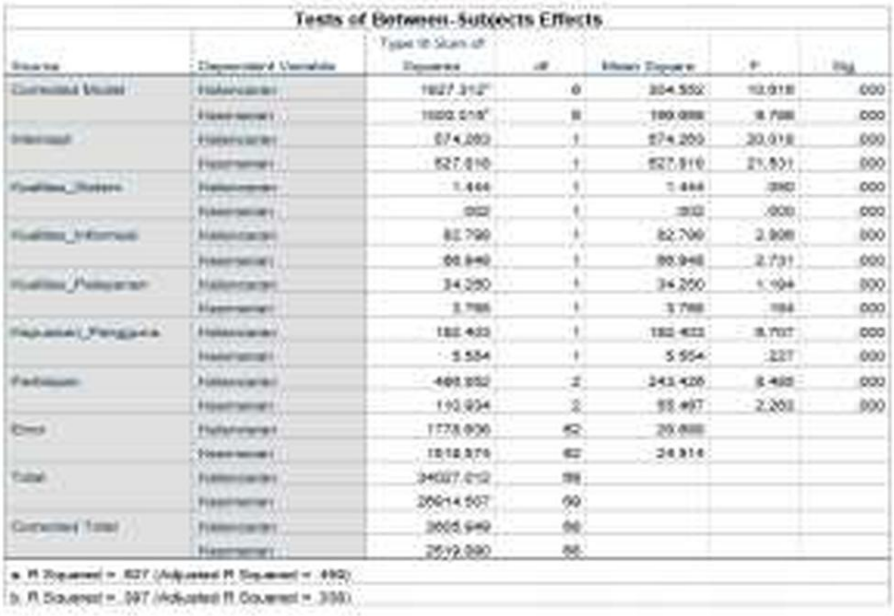
Figure 3. Multivariate Tests

The data indicate that:

1. The type of user produces a significant difference in the smoothness and security of passenger and goods flow simultaneously.
2. The implementation of the Ferizy application system for ticket purchasing (system quality, information quality, service quality and user satisfaction) produces a significant difference in the smoothness and security of passenger and goods flow simultaneously.

3.4 Partial Multivariate Test

To assess the results of the partial analysis, the tests of between-subjects effects are presented in Figure 4.



Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Kepuasan	1827.312[a]	8	304.552	12.018	.000
	Kepuasan	1600.018[b]	8	199.999	8.798	.000
Intercept	Kepuasan	574.200	1	574.200	20.018	.000
	Kepuasan	527.810	1	527.810	21.531	.000
Kualitas_Sistem	Kepuasan	1.444	1	1.444	.060	.000
	Kepuasan	.002	1	.002	.000	.000
Kualitas_Informasi	Kepuasan	82.790	1	82.790	2.908	.000
	Kepuasan	66.946	1	66.946	2.731	.000
Kualitas_Pelayanan	Kepuasan	34.200	1	34.200	1.194	.000
	Kepuasan	3.788	1	3.788	.154	.000
Kepuasan_Pengguna	Kepuasan	182.403	1	182.403	8.707	.000
	Kepuasan	5.554	1	5.554	.227	.000
Partisipan	Kepuasan	486.852	2	243.426	8.488	.000
	Kepuasan	110.934	2	55.467	2.263	.000
Error	Kepuasan	1778.936	62	28.692		
	Kepuasan	1518.375	62	24.514		
Total	Kepuasan	34027.012	99			
	Kepuasan	25914.507	99			
Corrected Total	Kepuasan	3606.949	98			
	Kepuasan	3272.390	98			

a. R Squared = .507 (Adjusted R Squared = .492)
b. R Squared = .397 (Adjusted R Squared = .359)

Figure 4. Tests of Between-Subjects Effects

The data lead to the following conclusions:

1. System quality has a significant partial effect on the smoothness and security of passenger and goods flow.
2. Information quality has a significant partial effect on the smoothness and security of passenger and goods flow.
3. Service quality has a significant partial effect on the smoothness and security of passenger and goods flow.
4. User satisfaction has a significant partial effect on the smoothness and security of passenger and goods flow.

The research results therefore show that the implementation of the Ferizy application system for ticket purchasing — covering system quality, information quality, service quality and user satisfaction — produces a significant difference in the smoothness and security of passenger and goods flow on a partial basis.

More specifically, several crucial points were observed in the questionnaires completed by regulators, operators and service users. First, there is a discrepancy between the data in the Ferizy application and the manifest of the Sailing Approval Letter (SPB), particularly in the number of passengers on the Merak–Bakauheni crossing. Second, a similar discrepancy between the Ferizy data and the SPB manifest appears in the number of passengers on the Bakauheni–Merak crossing. Both findings are attributable to the limited awareness of service users when entering passenger data, which results in differences in the manifest data. This can be anticipated by building an alert system for passengers who have not yet been recorded in the Ferizy application. Such a system would require additional vessel and port operating personnel to re-check passengers.

The results show that good governance has a positive effect on the smoothness and security of passenger and goods flow, particularly at the ports of Merak and Bakauheni. This provides a new avenue for improving the quality of port management by prioritising a high-quality system, information that is easily accessible to the public, excellent service and, ultimately, customer satisfaction. The study is consistent with earlier research showing that good governance makes matters easier for the public [10], [13], [16], [18], [19]. These results will provide input to the management of ferry ports for the continued improvement of governance in facilitating the flow of passengers and goods.

Besides smoothness, the security of goods is also a critical concern for the public. This is consistent with previous research [18], [19] showing that the security of goods is a primary priority for people travelling by land, sea or air. The security of goods needs to be strengthened by making use of the various platforms that the public can access online.

The findings of this study provide a general picture of the use of the Ferizy application, namely: (1) service users (stakeholders) need to be more aware of how the Ferizy application is used, so that possible discrepancies in the number of passengers on board can be minimised; (2) the discrepancy found between the SPB manifest and the Ferizy application data requires attention with respect to navigational safety, as it may have a negative impact; and (3) in the event of a vessel accident, the data required for insurance claims cannot be realised because of the difference between the data in the SPB manifest and the data in the Ferizy application.

4. CONCLUSION

The results show that the type of user significantly influences the smoothness and security of passenger and goods flow, both simultaneously and partially. In addition, the implementation of the Ferizy application system for ticket purchasing — involving system quality, information quality, service quality and user satisfaction — also has a significant effect on the smoothness and security of passenger and goods flow, both overall and in specific aspects.

The findings of this study have considerable potential to contribute to the management of the Merak–Bakauheni ports by encouraging improvements in governance, particularly with regard to system quality, information quality, service quality and user satisfaction. The implementation of these best practices across all ports is expected to deliver better smoothness and security for the flow of passengers and goods.

The study further underlines the need to integrate the Ferizy website and application owned by PT ASDP Indonesia Ferry so that the data obtained are real-time and accurate. In addition, the development of governance at the Merak–Bakauheni ports towards a fully online ticket sales system is a key point that can improve the efficiency and convenience of the service. The development of an alert system capable of monitoring members of the public who do not use the Ferizy application is also considered crucial for improving understanding and supervision of the entire passenger flow at these ports. The following recommendations can be made: (a) integration of the Ferizy website and application of PT ASDP Indonesia Ferry (Persero) with Siasati, so that data can be accessed in real time and accurately; (b) implementation of Ministerial Regulation No. 19

of 2020 by PT ASDP Indonesia Ferry (Persero), so that all the ports it manages can apply online ticket sales; (c) adjustment of the dashboard features of the Ferizy application; and (d) periodic data verification as a step towards integrating factual data with the application.

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