

Development of an Online Ticket Booking System as a Solution to Long Queues at the Bengkalis–Pakning Ferry Port

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Abstract

The high number of passengers at Bengkalis-Pakning Port often causes long queues due to an inefficient conventional ticketing system. This study aims to address this issue by designing an online ticket booking system. Using a descriptive qualitative approach, data was collected through in-depth interviews, direct observation, and secondary data analysis. The results of the study identified several key root causes: slow manual transaction processes with an average of 2-3 minutes per vehicle, uncertainty regarding schedule information and capacity availability, dependence on cash payments, and inefficient and error-prone manifest recording. As a solution, a conceptual design for an online ticket booking system was formulated, which includes key features such as an intuitive interface, digital payment integration, QR code-based ticket issuance, and a real-time information center. The implementation of this system is projected to significantly reduce queues, improve data accuracy, and optimize port operational performance. This design serves as a practical foundation for the digital transformation of ferry services in Bengkalis-Pakning.

1. INTRODUCTION

The increase in the number of passengers at ferry ports, especially on the Bengkalis Port-Pakning Port route, often causes long queues and congestion at ticket counters. The conventional ticket booking system, which still relies on manual transactions, is considered inefficient in handling passenger surges during peak hours or holiday seasons. An empirical study by the Bengkalis State Polytechnic in a research paper titled “Implementation of an Online Ticket Booking System to Improve Passenger Waiting Time Efficiency at Bengkalis Port” (2023) shows that queues at the port can be reduced by up to 45% after the implementation of a digital system. These findings highlight the urgency of transforming ticket booking services to make them faster, more transparent, and integrated with port operational systems.

From a theoretical perspective, online ticket booking systems can be explained through the Technology Acceptance Model (TAM) approach, which emphasizes two main factors—perceived usefulness and perceived ease of use—as the main determinants of technology acceptance by users. In addition, the Queueing Theory approach is also relevant to explain how digitization can reduce waiting times and optimize passenger flow. The integration of these two theories provides a strong conceptual foundation for designing a ticket booking system that is not only efficient, but also accessible and accepted by ferry service users.

The novelty of this research lies in the application of an online ticket booking system specifically designed for the context of the Ro-Ro ferry port in Bengkalis-Pakning, which until now has mostly relied on manual systems. Unlike previous studies that focused on land or air transportation modes, this system will take into account the operational characteristics of local ferry ports, such as ship departure times, vehicle capacity, and internet network conditions in coastal areas. Thus, this study is expected to contribute both practically and academically to the development of effective digital solutions to overcome long queues at ports.



Fig. 1. Long queues at the Air Putih Bengkalis roll-on/roll-off port.

2. REVIEW OF LITERATURE

In recent years, digital ticketing systems have become a key strategy for improving the efficiency of public transportation services, including ferry services. Previous studies have shown that the implementation of these systems not only increases user satisfaction, but also plays a role in reducing queues and streamlining port operations.

- a. Research by (Khoiriyah, 2022) highlights the weaknesses of the ship ticket reservation system at PT. PELNI, which is still limited to providing information without online booking and payment features. Using the IT Infrastructure Library (ITIL) framework at the Continual Service Improvement stage, this study recommends the development of online passenger registration, booking, payment, and ticket cancellation features. These recommendations aim to improve service quality and reduce queues at port counters.
- b. The study conducted by Dewi Rispawati at PT ASDP Indonesia Ferry Lembar Branch demonstrated that user satisfaction is significantly enhanced by system quality, information quality, and the quality of e-ticketing services. The implementation of the e-ticketing system has been shown to improve ticket purchasing efficiency and minimize physical queues at the port. Consistent results were reported by (Efan Dwi Nugraha et al., 2024) at the Ketapang Branch, indicating that 66% of customer satisfaction is directly influenced by the quality of e-ticketing services.
- c. The implementation of an e-ticketing system has become one of the main strategies in modernizing sea transportation services in Indonesia. Based on research by (Mantik et al., 2023a), the development of an e-ticketing system for ferry transportation in Indonesia using the Object-Oriented Analysis and Design (OOAD) approach enables information integration, efficient manifest data processing, and ease for users in making changes or cancellations to their travel schedules. This research confirms that digitizing the ferry ticket booking process can speed up service and improve the accuracy of schedule information and ship availability.
- d. Furthermore, research conducted by (Pratama & Nusraningrum, 2025) revealed that the implementation of an e-ticketing system has a positive impact on improving port operational performance. The study also emphasizes that customer satisfaction plays a significant mediating role between the use of digital technology and improved operational performance. Through the e-ticketing system, the ticket purchasing process becomes more efficient, queues can be minimized, and port service quality is optimized.
- e. However, the effectiveness of e-ticketing is also greatly influenced by user readiness and system socialization. A study by (Nugroho Widjatomoko et al., 2025) at Telaga Punggur Ferry Terminal found that even though the e-ticketing and cashless payment systems had been implemented, many people still preferred to purchase tickets manually. Habits and digital literacy among the public pose challenges in the implementation of this digital system.

- f. From a service quality perspective, (Annisa et al., 2023) revealed that system quality, information quality, and e-ticketing service quality have a significant positive influence on customer satisfaction. This study highlights that digital ticketing systems not only speed up transactions but also increase customer trust in service providers.
- g. In addition to web and application systems, ticket booking innovations have also been developed using bot technology. (Linus Evrianus Ama Kean & Yohanes Suban Belutowe, 2025) designed a ferry ticket booking system integrated with Telegram bot-based Customer Relationship Management (CRM). This system allows customers to make ticket reservations interactively while strengthening the relationship between users and service providers.
- h. The implementation of the e-ticketing system has become one of the important innovations in improving the quality of sea transportation services in Indonesia. The digitization of ticketing services not only aims to speed up the transaction process, but also to increase the convenience and satisfaction of service users. According to the results of research by (Tiara et al., 2025), Kamal Ferry Port has implemented an e-ticketing system to improve the efficiency and convenience of its services. Through a quantitative approach with descriptive analysis and the Customer Satisfaction Index (CSI), this study measures the extent to which the implementation of e-ticketing affects user satisfaction.
- i. In addition to technical aspects and user satisfaction, system and price factors have also been shown to affect port operational performance. Research by (Roro Bengkalis Suharyono et al., 2024) at the Bengkalis Roro Port shows that the system (X1) and price (X2) variables have a significant partial and simultaneous effect on port operational performance (Y). An e-ticketing application that is easy to use, has fast access, is reliable, and flexible is a major requirement for roro users. In addition, the public also hopes that the implementation of e-ticketing will not burden them with additional costs. This study provides an overview that economic factors and user experience are key to the acceptance of e-ticketing technology in crossing areas.
- j. Research by (Yuniar Affandy et al., 2025) at Kayangan Port emphasizes the importance of e-ticket service effectiveness in optimizing the fuel crossing process. Through a descriptive qualitative approach, this study identifies three main aspects of effectiveness, namely the resource approach, process approach, and target approach. The results show that the effectiveness of e-ticket services is greatly influenced by the availability of adequate human and technological resources, the smoothness of operational processes, and the achievement of service targets.
- k. Furthermore, an international study by (Jonah Grace S. Mejias & Riah E. Encarnacion, 2024) on Siargao Island, Philippines, shows that a web-based ticket booking system can significantly overcome the problems of inefficient manual services. This study used a mixed method (online survey and interviews) and found that ticket digitization can shorten waiting times, improve information availability, and strengthen communication between operators and passengers. The study recommends the development of a “Smart Lancha” platform that functions as a real-time ticket booking system and integrated information center.
- l. The journal article by (Utama et al., 2024) highlights that digital transformation (DT) has become a major driver of efficiency and competitiveness in the maritime industry. This study developed a model called the Digital Transformation Maturity model for Ports in Archipelago countries (DTMPA), which is specifically designed to evaluate the digital maturity level of ports in archipelagic countries such as Indonesia. This model takes into account the unique geographical challenges faced by Indonesia, including the existence of various sizes of ports in a hub-and-spoke network.

- m. A journal by (Luhur et al., 2021a) shows that e-ticketing systems are highly sought after by passengers due to their convenience, time efficiency, and practicality. E-commerce allows producers and customers to connect more closely, even in remote locations, and also serves as a highly effective marketing tool. However, the biggest challenge in integrating independent electronic ticketing systems into general e-commerce platforms is not a technical issue, but rather the need for real-time and reliable ship schedules. Conventional systems, which are still widely used in Indonesian ports, require passengers to come directly to the ticket counter to obtain information and purchase tickets, resulting in long queues.
- n. Traditional paper-based ticketing systems have significant limitations that hinder the optimization of public transportation services. According to (Santoro et al., 2025), this system fails to capture detailed ticket usage data, making the revenue sharing (clearing) process complicated and non-transparent, does not collect any validation data, and relies on passenger boarding/alighting data from counting devices that are often unreliable. These limitations prevent operators from gaining an accurate view of passenger behavior and needs, making it difficult to plan services effectively.
- o. As a solution, the development of a digital ticketing system (e-ticketing) aims to modernize and transform the public transportation experience. (Kulkarni et al., 2024) propose a state-of-the-art digital system that aims to improve security, convenience, and efficiency for both users and administrators. The main focus of this initiative is to eliminate manual cash transactions, reduce waiting times, and improve operational inefficiencies. At the core of this solution is the use of QR code-based tickets that can be accessed through a dedicated mobile application and an intuitive online interface, thereby significantly simplifying the ticket purchasing process.

3. METHOD

This study will use a descriptive qualitative approach with a case study at the Bengkalis-Pakning Roro Ferry Port. Data collection will be conducted through in-depth interviews with port management, service users, and relevant agencies to gain a comprehensive understanding of queueing issues. In addition, direct observation at the location will be conducted to validate empirical data on queue length and operational dynamics. Secondary data, such as operational reports and relevant policies, will also be collected. Data analysis will be conducted inductively to identify the root causes of the problems and formulate a conceptual design for an Online Ticket Booking System that suits the needs and characteristics of the port.

4. RESULT & DISCUSSION

Identifying the Root Causes of Queues and Dependence on Manual Systems

Based on direct observations at the Air Putih Bengkalis Roro Port, it was found that long queues of vehicles, as documented in Figure 1, occur consistently, especially during rush hours (morning and evening) and during weekends and holiday seasons. In-depth interviews with three ticket office staff and five service users revealed several key root causes:

1. **Slow Manual Transaction Process:** The fully manual ticket purchasing process is the main cause of delays. Officers must perform several steps: ask about the destination and type of vehicle, calculate the fare, accept cash payments, find change, and manually record manifest data. The average time required to serve one vehicle is 2-3 minutes, which cumulatively causes a significant buildup of queues.
2. **Uncertainty of Schedule and Availability Information:** Service users often do not receive accurate and real-time information about ship departure schedules and capacity availability. This forces them to arrive early at the port and wait without certainty, which exacerbates the queue conditions. These findings are in line with research by (Luhur et

- al., 2021), which highlights that the conventional system requires passengers to come directly to the ticket counter to obtain information.
3. **Limited Payment Options:** Reliance on cash transactions is another obstacle. As stated by (Nugroho Widjatmoko et al., 2025), although cashless systems have been introduced in several ports, public preferences and habits remain a challenge. In Bengkalis, the lack of digital payment options slows down the transaction process.
 4. **Inefficient Manifest Recording:** The manual process of recording passenger and vehicle manifest data is not only time-consuming but also prone to human error. This contrasts with the digital system proposed by (Mantik et al., 2023), where manifest data processing can be carried out more efficiently and in an integrated manner.

These findings confirm that the conventional ticketing system, as described by (Santoro et al., 2025), has significant limitations in terms of operational efficiency and data collection. The reliance on manual systems at the Bengkalis-Pakning Port is a major obstacle to optimizing passenger and vehicle flow.

Conceptual Design of an Online Ticket Booking System as a Solution

Responding to the identified problems, this study formulates a conceptual design for an online ticket booking system tailored to the characteristics of the Bengkalis-Pakning Port. This design refers to the Technology Acceptance Model (TAM) framework, which emphasizes usability and ease of use, and integrates features that have been proven effective in previous studies.

The proposed system concept includes several key features:

1. **Intuitive User Interface:** Adopting suggestions from (Kulkarni et al., 2024), the system is designed with a simple mobile and web-based interface. Users can easily select schedules, vehicle types, and the number of passengers with just a few clicks.
2. **Digital Payment Integration:** The system will provide various cashless payment options, such as bank transfers, digital wallets, and virtual accounts. This step aims to eliminate dependence on cash and speed up the transaction process, in line with the main objectives of the digitization initiative described by (Kulkarni et al., 2024).
3. **QR Code-Based Ticket Issuance:** After successful payment, the system will automatically issue an electronic ticket in the form of a QR code that is sent to the user's email or application. This QR code can be scanned at the port gate, making the validation process faster and more efficient.
4. **Real-Time Information Center:** This system will function as an integrated information center that provides departure schedules, ship capacity availability, and notifications in case of changes or delays. This is in line with the recommendations from a study by (Jonah Grace S. Mejias & Riah E. Encarnacion, 2024) to improve the availability of information for passengers.

The implementation of this system is expected to have a significant positive impact. By moving the ticket booking process to an online platform, queues at physical ticket counters can be minimized. In addition, this system will improve port operational performance through more accurate data collection, which supports the statement (Pratama & Nusraningrum, 2025) regarding the positive impact of e-ticketing on operational performance. This conceptual design serves as the foundation for developing a digital solution that is not only technically efficient but also easily accepted and used by the community in the Bengkalis-Pakning crossing area.

The graph shows a significant difference in time at each stage of service. The manual system requires several steps, such as questioning, calculating fares, and manual recording, with a total time of around 2-3 minutes. In contrast, the online system simplifies the process to ticket validation and vehicle data verification, reducing the total service time to 0,4-0,7 minutes per

vehicle. This demonstrates an increase in efficiency through the implementation of digital tickets.

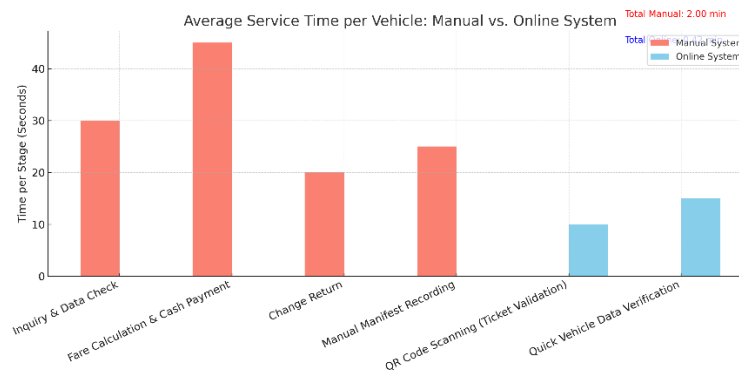


Fig. 2. Comparison of Average Service Time per Vehicle: Manual System vs. Online System Projection

Table 1. Comparison of Processes and Estimated Service Time per Vehicle

Process Stages	Manual System (Estimated Time)	Online System (Time Projection)
Booking & Payment	Q&A, rate calculation, pay cash, find change ($\pm 1.5 - 2$ minutes)	Self-booking and payment by the user before arriving at the port (N/A at the counter)
Ticket Validation	Checking paper tickets	Quick QR Code Scan ($\pm 10-20$ seconds)
Manifest Recording	Manual recording by the officer ($\pm 25-30$ seconds)	Data is automatically input by the system
Total Time at the Gate	2 - 3 Minutes	< 1 Minute

5. CONCLUSION

This study concludes that long queues and inefficiencies at the Bengkalis-Pakning Roro Port are directly caused by dependence on the conventional ticketing system. Field investigations identified several key root causes, namely: manual transaction processes that take an average of 2-3 minutes per vehicle, uncertainty regarding schedule information and ship capacity availability, limitations on cash payment methods, and inefficient and error-prone manifest recording processes. These findings confirm that the existing manual system is a major obstacle to optimizing passenger and vehicle flow at the port.

In response to these issues, this study successfully formulated a conceptual design for an online ticket booking system specifically tailored to the characteristics of the Bengkalis-Pakning Port. The proposed solution integrates key features that have proven to be effective, including an intuitive user interface, digital payment integration to speed up transactions, QR code-based ticket issuance for efficient validation, and the provision of a real-time information center to increase certainty for users. The implementation of this system is projected to significantly reduce queues at ticket counters, improve data accuracy, and ultimately enhance port operational performance, in line with the findings of previous studies. Thus, this conceptual design provides a practical foundation for the digital transformation of ferry services in Bengkalis-Pakning.

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