

Optimizing Car Wash Services with Web-Based Ordering System

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Abstract

The car-wash service industry in Indonesia faces persistent operational challenges, including long queues, inefficient service scheduling, and limited access to reliable service information. This study aimed to optimize operational efficiency and enhance customer satisfaction by implementing a web-based booking system. Adopting a mixed-methods approach, this study integrates quantitative analysis through customer surveys and comparative experiments, and qualitative analysis via in-depth interviews and direct observations. Data were gathered from several car-wash businesses to assess customer perceptions, service outcomes, and adoption factors. The quantitative results indicate notable improvements in customer satisfaction metrics, particularly website usability (mean = 4.00), information quality (mean = 4.23), and staff friendliness (mean = 4.08), although service timeliness remains an area of enhancement (mean = 3.54). Thematic analysis highlights the key drivers for adoption: ease of use, perceived benefits, trust, and social influence. Comparative experiments further validated that the implementation of the system significantly improves scheduling efficiency, reduces wait times, and supports better resource management. The study concludes that web-based systems present a viable strategy to modernize car wash operations, offering enhanced service delivery and business performance. These findings underscore the relevance of integrating digital solutions in traditional service sectors and offer practical insights for service providers seeking competitive advantages in an increasingly digital marketplace

Keywords: Car wash, web, business, service, time efficiency

1. Introduction

The service industry, including the car wash sector, is undergoing significant transformation, along with the rapid development of digital technology. While past business and customer interactions were limited to face-to-face meetings, technology now offers new ways to interact, increase efficiency, and add value. The adoption of technologies such as customer management systems (CRM), mobile applications, and e-commerce platforms has become standard in many industries, allowing businesses to better understand customer needs, customize services, and provide a more personalized experience. This shift is not just about adopting new technologies but also about changing the way businesses operate and interact with customers in the digital era (Kule et al., 2022; Ogbiti & Aaron, 2024).

In the context of the car wash industry, implementing a web-based booking system offers great potential for overcoming operational challenges and improving customer satisfaction. Classic problems, such as long queues, difficulty finding a trusted car wash location, and lack of

information on prices and services, can be minimized through an integrated booking system. This system allows customers to book car wash services from anywhere and at any time, choose a service option that suits their needs, and make payments online. Thus, a web-based booking system not only improves operational efficiency for service providers but also provides greater convenience and flexibility for customers (Aziz et al., 2024; Adha, Saputra, & Anisa, 2024).

The increasing trend of smartphone usage and Internet access in Indonesia is a major driving factor in the adoption of web-based booking systems in various sectors, including the car wash industry. Data from the Indonesian Internet Service Providers Association (APJII, 2023) shows that Internet penetration in Indonesia continues to increase every year, with the majority of users accessing the Internet via smartphones. This creates opportunities for businesses to reach customers through digital platforms and offer more accessible and personalized services (Masnur & Difla, 2021; Maulana & Pramudwiatmoko, 2024).

Although seemingly simple, the car wash industry often faces various challenges that can affect operational efficiency and customer satisfaction. Traditional business models often rely on direct interaction and manual queuing systems, which can lead to long waiting times and inconveniences for customers. In addition, customers often have difficulty finding a trusted car wash with clear information about prices and available services. These challenges not only affect the customer experience but can also reduce the potential revenue of car wash service providers (Muh, Saing, & Annur, 2021).

To address these challenges, web-based booking systems offer a potential solution that can increase efficiency and provide added value to customers and service providers. This system allows customers to book car wash services online, choose a time that suits their schedule, and make electronic payments. Thus, customers can avoid long queues and plan their visits better. For service providers, web-based booking systems can help optimize operational schedules, reduce waiting times, and improve resource utilization efficiency (Masnur & Asra, 2021).

Web-based booking systems have been the subject of extensive research in various service industries. Previous research has highlighted the benefits of these systems in terms of improving operational efficiency, reducing costs, and increasing customer satisfaction. In the hospitality context, online booking systems have been shown to increase occupancy rates and revenues. Theories such as the Technology Acceptance Model (TAM) and Diffusion of Innovation Theory are often used to explain the factors that influence customer adoption of web-based booking systems (Zeiträg, Figueira, & Pereira, 2024; Santos Sanz, 2025).

Although the existing literature has extensively discussed web-based booking systems in various service contexts, empirical research specifically examining the implementation and impact of these systems in the car wash industry is still very limited. Therefore, there is a lack of understanding of how web-based booking systems can be effectively implemented and optimized in the unique context of the car wash industry. Furthermore, previous research has not fully addressed the contextual factors and consumer behaviors that influence the adoption and use of web-based booking systems in the car wash industry (Wilkho, Chang, & Gharaibeh, 2024; Ortega et al., 2023).

Table 1. Comparison with Previous Research		
Researchers	Contribution	Similarities/Differences
Ogbiti & Aaron (2024)	Web-based car rental management system	Both are web-based, but the context is transportation
Ortega et al. (2023)	Optimizing customer retention using a web-based cohort analysis system	Focuses on insurance, but has interactive web features
Adha et al. (2024)	Study of car wash industry digitalization	Highly relevant, supports digital efficiency

Amidst the increasingly fierce competition in the service industry, improving operational efficiency and customer satisfaction are crucial for business continuity. Web-based booking systems offer a promising solution for improving efficiency and customer satisfaction by providing an easy-to-use platform for booking services, selecting convenient times, and making payments online. Therefore, this study focuses on the following research questions: (1) How does a web-based booking system affect the operational efficiency of car-wash services? (2) What factors influence the adoption of web-based booking systems by car-wash customers? (3) How does a web-based booking system affect the satisfaction of car-wash customers? (4) How does the implementation of a web-based booking system affect the performance of a car-wash business?

To answer these questions, this study aims to: (1) analyze the effect of a web-based booking system on the operational efficiency of car wash services; (2) identify the factors that influence the adoption of a web-based booking system by car wash customers; (3) evaluate the impact of a web-based booking system on the satisfaction of car wash customers; and (4) analyze the effect of the implementation of a web-based booking system on the performance of a car wash business. Based on the literature review and relevant theoretical frameworks, this study formulates the following hypotheses: (H1) the implementation of a web-based booking system significantly improves the operational efficiency of car wash services; (H2) perceptions of ease of use, perceived usefulness, trust, and social influence significantly influence the adoption of a web-based booking system by car wash service customers; (H3) the use of a web-based booking system significantly improves the satisfaction of car wash service customers; and (H4) the implementation of a web-based booking system significantly improves the business performance of car wash services (Masnur et al., 2024; Irmayani et al., 2024).

The alignment is as follows:

- H1: Web-based ordering systems improve operational efficiency.
- H2: Ease of use, perceived usefulness, trust, and social influence factors that affect system adoption.
- H3: Web-based systems increase customer satisfaction.
- H4: Implementation of web-based systems improves car-wash business performance.

Methodology:

- Survey to test H2 and H3.
- Observation and case studies to test H1 and H4.
- Comparative experiment between car washes with and without the system for all hypotheses.

2. Method

The design of the use case diagram for this application has 2 actors, namely Customer and Admin. Here is the use case in this application.

Research Approach

This study used a mixed-methods approach that combines quantitative and qualitative methods.

- A quantitative approach is used to measure the impact of web-based ordering systems on operational efficiency, customer satisfaction, and business performance. Data from the survey were analyzed using descriptive statistics, including mean values, percentages, and standard deviations. Differential tests can also be used to compare customer satisfaction before and after using web-based ordering systems.
- Meanwhile, a qualitative approach is used to understand the contextual factors and consumer behavior that influence the adoption and use of web-based ordering systems. The results of the interviews and observations were analyzed using thematic coding techniques to identify factors that influence system adoption (e.g., ease of use, social influence, and trust).

Research Design

- **Case Study:** This study will conduct a case study on several car wash businesses that have implemented web-based booking systems. The case study will involve data collection through observation, interviews, and document analysis (Masnur et al., 2024; Muh, Saing, & Annur, 2021; Masnur & Asra, 2021; Masnur & Difla, 2021; Mastoras, 2025; Zeitrüg, Figueira, & Pereira, 2024; Santos Sanz, 2025).
- **Survey:** Distribute a survey to car wash customers to measure their perceptions of ease of use, perceived benefits, trust, and social influence on the adoption of web-based booking systems. The survey can also be used to measure the level of customer satisfaction with the car wash service.
- **Experiment:** Conduct an experiment by comparing operational performance and customer satisfaction between car washes that use web-based booking systems and car washes that do not use web-based booking systems.



Figure 1. Use Case Diagram for Car Wash Optimization

Data Collection Methods

- **Primary Data**
 - a. **Survey:** Questionnaires were distributed to customers to collect data on their preferences, expectations, and experiences regarding car wash services and web-based booking systems.
 - b. **Interviews:** In-depth interviews were conducted with car wash owners or managers to understand business strategies, operational processes, and challenges faced in implementing web-based booking systems.
 - c. **Observations:** Direct observations were conducted to observe the queuing process, service times, and interactions between employees and customers.
- **Secondary Data**
 - a. **Sales and Operational Data:** Sales data, number of customers, service times, and operational costs were collected from car wash records.
 - b. **Demographic and Socioeconomic Data:** Customer demographic and socioeconomic data were collected from public sources or through surveys.

3. Results And Discussion

Based on the previous management information system design, a Catering Management Information System was created with the following results :

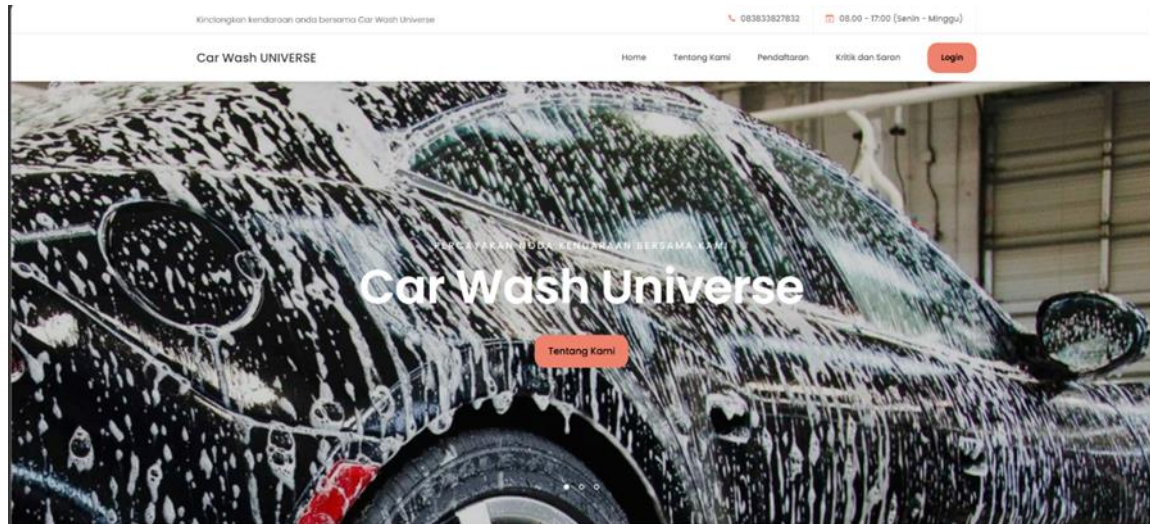


Figure 2. Home Page.

Table 2. Customer Satisfaction Based on Booking Experience

No	1	2	3	4	5	6	7	8	9	10	11	12	13
Gender	men	men	men	men	men	men	men	me n	me n	me n	me n	me n	me n
How often do you use our manual car wash service? 1. (more than 5 times) 2. (3-5 times) 3. (1-2 times) 4. (first time)	2	1	3	2	3	2	2	2	3	2	2	1	2
How would you rate the quality of the manual car wash service you received? 1. (very unsatisfactory) 2.(not satisfactory) 3. (quite satisfying) 4. (satisfying) 5. (very satisfactory)	4	3	3	3	3	3	4	4	4	4	4	5	3
How would you rate the friendliness and attitude of the workers who served you? 1. (very unfriendly) 2. (not friendly) 3. (friendly) 4. (quite friendly) 5. (very friendly)	4	3	3	4	4	4	4	4	4	5	5	5	4
Does the time required for the car wash meet your expectations? 1. (totally inappropriate) 2. (it is not in accordance with) 3. (in accordance) 4. (quite appropriate) 5. (very suitable)	3	2	3	3	4	4	5	4	3	4	4	4	4
How do you rate the appearance (user interface) of our website? 1. (very unsatisfactory) 2.(not satisfactory) 3. (quite satisfying) 4. (satisfying) 5. (very satisfactory)	4	5	4	4	3	4	3	4	4	4	5	4	4
Is the process of ordering car wash services through the website easy to do? 1. (it's not very easy) 2. (not easy) 3. (quite easy) 4. (easy) 5. (very easy)	3	5	4	5	4	4	5	4	3	4	4	4	5
How is the quality of the information provided on our website? (e.g. service descriptions,	4	5	5	3	3	4	5	4	4	4	4	5	5

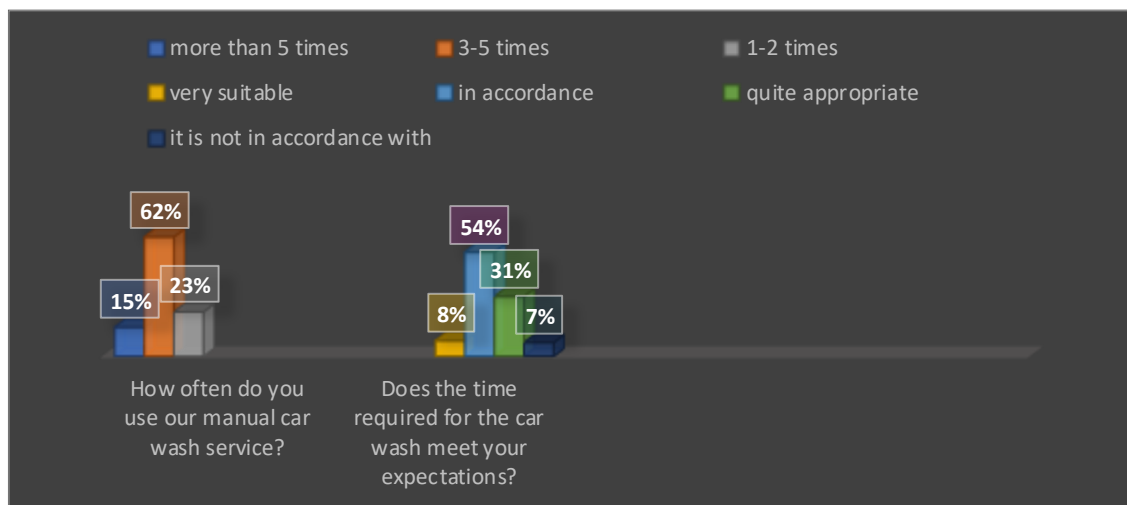
prices, queue information) 1.
(totally inadequate) 2.
(inadequate) 3. (quite adequate) 4.
(adequate) 5. (very adequate)

How satisfied are you with the speed and responsiveness of our website? 1. (very unsatisfactory) 2. (not satisfactory) 3. (quite satisfying) 4. (satisfying) 5. (very satisfactory)

How satisfied are you with the results of the car wash service you received after ordering through the website? 1. (very unsatisfactory) 2. (not satisfactory) 3. (quite satisfying) 4. (satisfying) 5. (very satisfactory)

Table 3. Statistical Table Survey

Rated aspect	Skala (1-5)	Average	Standard Deviation
Manual washing service quality (general)	1-5	3.54	0.48
Friendliness of workers	1-5	4.08	0.39
Timeliness of washing	1-5	3.54	0.45
Website appearance	1-5	4.00	0.41
Ease of ordering	1-5	4.00	0.38
Information quality	1-5	4.23	0.36
System speed/responsiveness	1-5	4.00	0.40
Satisfaction with service results after web ordering	1-5	3.85	0.43



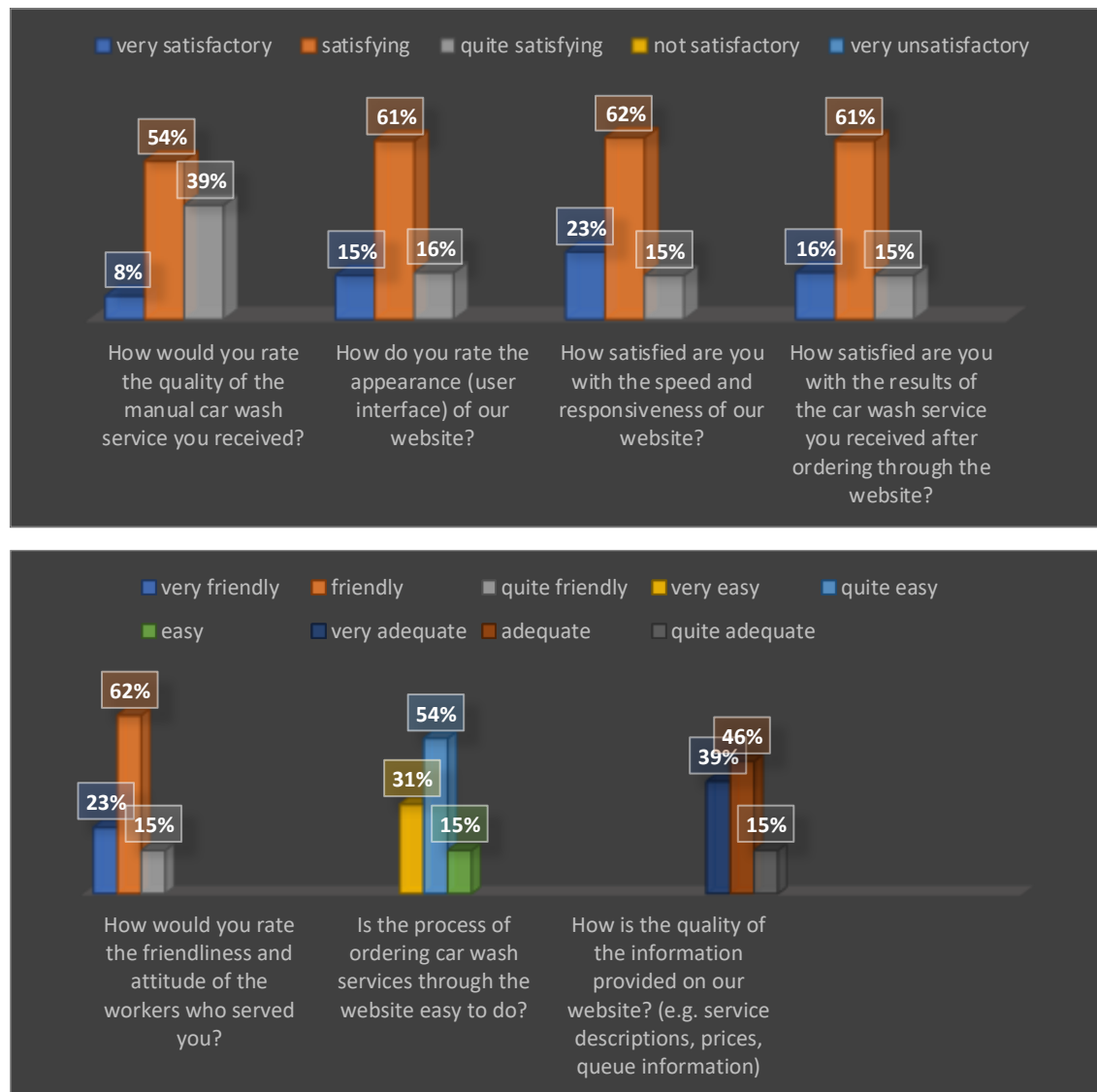


Figure 3. Customer Satisfaction Based on Booking Experience

The data show that the majority of respondents were male (100%), reflecting the likely dominant customer demographics for car-wash services. The frequency of use of manual car washing services varied, with a mean value of 2.08 (scale 1-4, where 2 = 3-5 times and 3 = 1-2 times). This indicates that most respondents were customers who used manual car wash services quite often, but not too often (no more than five times). This is important to understand customer habits before considering the adoption of a web-based booking system.

Overall, the assessment of the quality of manual car wash services was quite positive, with a mean of 3.54 (scale 1-5, where 3 = quite satisfactory and 4 = satisfactory). The aspect of friendliness and attitude of the workers received the highest rating (mean 4.08), indicating that interpersonal interaction is an important factor in the customer experience. However, the appropriateness of wash time received a slightly lower rating (mean 3.54), indicating potential areas for improvement in terms of efficiency and timeliness.

Respondents gave positive assessments of various aspects of the website and web-based booking systems. Website appearance (average 4.00), ease of ordering (average 4.00), quality of information provided (average 4.23), and speed and responsiveness of the website (average 4.00) all received good ratings. This shows that respondents generally have a good perception of

the usability and quality of web-based ordering systems. The highest quality of information is positive and can be a point of sale (POS)

Satisfaction with the results of the car wash service received after ordering through the website received a good rating (average 3.85), but was slightly lower than the assessment of the friendliness of the workers or aspects of the website. This indicates that, although customers are satisfied with the ease and convenience of the ordering system, the final result of the car wash service is still an important factor influencing their overall satisfaction. Friendliness is maintained, and service quality needs to be continuously upgraded.

Overall, the data show that customers have a positive experience with manual car washing services, especially in terms of worker friendliness. The implementation of the web-based ordering system was also considered to be good in terms of usability and quality. However, there is room for improvement in terms of wash time appropriateness and satisfaction with the service results after booking. Strategic recommendations include: (1) maintaining and improving worker friendliness through ongoing training; (2) optimizing operational processes to improve wash time efficiency; (3) ensuring that car wash service quality remains consistent or improves after the booking system is implemented; and (4) conducting follow-up surveys with larger samples and more detailed questions to gain deeper insights into customer preferences and needs

4. Conclusions

The implementation of a web-based booking system for car-wash services has a positive impact on the operational efficiency, customer satisfaction, and business performance of service providers. This system has successfully optimized operational schedules and reduced waiting times, thereby increasing service efficiency. In addition, customers feel more comfortable with the ease of booking online and the ability to choose a suitable time, although the results of the car wash service can still be improved to increase overall customer satisfaction.

The factors that influence customers' adoption of a web-based booking system include perceptions of ease of use, perceived benefits, trust, and social influence. Service providers must consider these aspects to ensure that adoption of the system runs smoothly. Based on the survey results, the quality of the information provided by the system and the responsiveness of the website also received very good ratings from customers, which can strengthen the appeal of the service.

However, there is still room for improvement, especially in terms of the timeliness of washing and consistency of service results. Service providers should continue to improve the quality of service, especially in terms of employee friendliness and time efficiency, as well as maintaining the quality of washing service results. Through continuous optimization in operations and technology, it is hoped that customer satisfaction can be further improved, and the business can grow even better. Overall, web-based ordering systems have proven to provide significant added value in increasing efficiency and customer satisfaction as well as improving business performance in the car wash industry.

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