Modeling Of Booking Information System Using Design Science Research Methodology Approach

[1]Yevaline Zelda Latuheru, [2]Aldian Umbu Tamu Ama

[1,2]Digital Business, Politeknik Bhakti Semesta

*Corresponding Author:
8801202112@bhaktisemesta.ac.id

Abstract

The increasing importance of information technology in modern business underscores the necessity for efficient and agile operational systems, particularly evident in the growing consumer electronics rental market. This study focuses on the operational challenges faced by Nyewa_ajah, an Indonesian iPhone rental service whose reliance on manual booking methods results in inefficiencies for both customers and administrators. To address this, the research proposes employing the Design Science Research Methodology (DSRM) to develop a comprehensive model for an integrated, web-based booking information system. This approach ensures a theoretically sound and practical application solution by systematically analyzing the problem, defining objectives, designing the system model, and planning for its evaluation. The ultimate goal is to provide Nyewa_ajah with a streamlined booking process and an enhanced user experience through the development of a well-def

***Keywords**: Information System, System Modeling, Design Science Research Methodology (DSRM)*

1. INTRODUCTION

The rapid advancement of information technology has become a pivotal driver in modern business efficiency, enabling companies to address global challenges with innovative solutions (Rasmon, 2023). In today's digital era, information systems are no longer optional but critical for businesses to enhance accuracy, effectiveness, and operational agility (Hartanto et al., 2022; Maria et al., 2023). This shift is further amplified by dynamic changes in consumer behavior, where digital lifestyles demand flexible and accessible services.

The global consumer electronics rental market reflects this trend, particularly for devices like smartphones, laptops, and digital cameras. Statista (2023) projects significant growth in this sector, driven by demand from individual and corporate users. In Indonesia, for instance, the temporary rental of iPhones during festive seasons (e.g., Lebaran 2025) has emerged as a sociocultural phenomenon. Drajat Tri Kartono, a sociologist from Universitas Sebelas Maret, noted that this trend aligns with symbolic consumption theory, where rentals serve functional needs and social status aspirations (Kompas.com, 2025).

However, businesses like Nyewa_ajah (an iPhone rental service) face operational inefficiencies in their booking processes. Current practices rely on manual methods, such as social media inquiries and Google Forms, leading to dual workloads for customers (e.g., checking item availability separately) and administrative bottlenecks (e.g., manual data compilation). These issues highlight the urgent need for an integrated, web-based booking information system to streamline transactions and improve user experience.

This study proposes a systematic modeling approach using the Design Science Research Methodology (DSRM) to address this gap. DSRM was chosen for its robust framework that combines analysis, design, and evaluation to ensure the resulting artifact (the booking system model) is theoretically grounded and practically implementable (Artikel & Imbar, 2024). By leveraging DSRM, this research aims to deliver a comprehensive model that aligns with stakeholder needs before advancing to the web development phase.

Design Science Research Methodology (DSRMSR)

The Design Science Research Methodology (DSRMSR) is anchored in three core pillars: analysis, design, and evaluation. This approach integrates two foundational theories:

1. Kernel Theory (conceptual theory), which emphasizes literature review to contextualize the research problem.
2. Prescriptive Theory guides the systematic design process to create practical solutions (Friedrich, 1996).

DSRM comprises six iterative stages:

1. Problem Identification and Motivation:
   Recognizes the primary issue (e.g., delays in Nyewa_ajah's manual booking process) and outlines anticipated results (e.g., improved transaction efficiency).
2. Defining Objectives for a Solution:
   Specifies solution requirements based on the problem analysis (e.g., an integrated web-based booking system).
3. Design and Development:
   Translates objectives into a functional artifact (e.g., system models, prototypes).
4. Demonstration:
   Validates the artifact's applicability to solve the problem (e.g., testing the model in a real-world scenario).
5. Evaluation:
   Measures the artifact's effectiveness using the A-Priori model, which assesses four independent dimensions:
   a. Individual Impact: Benefits to end-users (e.g., reduced booking steps).
   b. Organizational Impact: Business advantages (e.g., cost efficiency, administrative productivity).
   c. System Quality: Technical performance (e.g., usability, flexibility).
   d. Information Quality: Data accuracy and consistency (e.g., real-time inventory updates).
6. Communication:
   Share insights on the artifact's strengths and limitations with academia and practitioners for further improvement.

2. METHOD

Design Science Research Methodology (DSRM) is a methodology oriented towards a system's information design. DSRM itself is a procedural framework to facilitate research in the field of information technology. DSRM reviews recognizes and evaluates research results by combining procedures, principles, and practices (Umbu et al., 2025). DSRM itself includes six stages, namely:

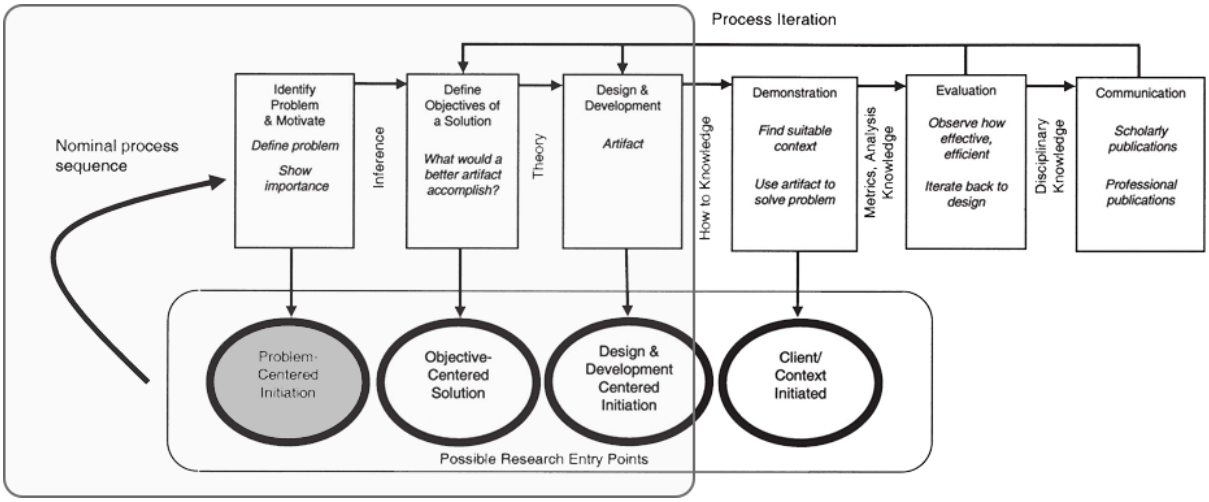


Figure 1. Design Science Research Methodology (DSRM)

1. Problem Identification and Motivation
   The initial stage of the research was conducted by identifying operational problems in the Nyewa_ajah iPhone rental business through:
   a. Semi-structured interviews with business owners and administrative staff (Mashuri et al., 2022).
   b. Direct observation of the applicable manual booking process (e.g., use of Google Form and coordination via social media).
2. Defining Objectives for a Solution
   Based on the identified problems, the solution objectives are formulated as follows:
   a. Modeling an integrated web-based booking information system model.
   b. Meeting functional requirements such as Real-time availability of the items and the admin dashboard for booking management
3. Design and Development
   Artifact design is done through:
   a. System modeling with Unified Modeling Language (UML): Use Case Diagram: Mapping interactions between actors (customers, admins) and the system. Activity Diagram: Documenting the booking process flow (Khairunnisa & Voutama, 2024).
   b. An interface prototype using Figma was used to visualize the system design (Muhyidin et al., 2020).
4. Demonstration
   The designed prototype is demonstrated to Business owners to validate administrative features and customers to test user experience (UX). The Purpose is to verify the suitability of the design to real needs (problem-solution fit) (Santoso, 2024).
5. Evaluation
   Evaluation is done using a Likert scale-based questionnaire to measure User satisfaction (individual impact) and operational efficiency (organizational impact).
6. Communication
   Research findings, including feedback from the evaluation, are systematically documented as Recommendations for improvement in advanced system development and as academic references for future researchers in similar domains.

3. RESULTS AND DISCUSSION

3.1. Problem Identification and Motivation

Based on semi-structured interviews with Nyewa_ajah business owners and administrative staff and direct observation of the operational process, several critical issues were identified in the existing manual booking system. First, the booking process still relies on coordination via direct social media messages and filling out Google Forms, causing customers to check the availability of goods separately before filling out the form. This creates duplication of work and has the potential to reduce customer satisfaction. Second, from the admin side, transaction recording is done manually in a spreadsheet, making it prone to human error and difficulty tracking iPhone stock in real-time. In addition, the absence of an automatic notification system for rental period reminders results in late returns of goods, impacting operational productivity.

Furthermore, a requirements analysis from customer interviews revealed unmet service expectations, such as the absence of a Cash on Delivery (COD) payment option and unclear late fee policies. Customers also highlighted the lack of transparency regarding the physical condition of the iPhone before it was rented. These findings reinforce the urgency of developing an integrated information system that can simplify the booking flow, improve data accuracy, and meet the needs of both parties (admins and customers). Thus, this problem identification stage not only defines technical problems but also confirms the gap between current services and user expectations, which is the basis for the research motivation.

3.2. Defining Objectives for a Solution

Based on the results of the analysis at the Problem Identification stage, a solution can be formulated that can be modeled to address the operational gaps and needs of Nyewa_ajah business users as follows:

a. Booking Process Efficiency
   A solution is replacing manual methods (Google Forms and coordination via social media) with a centralized system that allows customers to Check the availability of goods in real-time through a digital catalog and make self-service orders in one workflow without duplication.
b. Admin Management Optimization
   The system can simplify administrative tasks with features such as a centralized dashboard to track order status, stock, and transaction history.
   Automatic reporting (e.g., daily/weekly revenue) is used to reduce reliance on manual recording and reporting of late returns or damaged goods.
c. Improved Customer Experience
   The solution should address customer needs revealed in the interviews, such as Flexible payment options (Cash on Delivery, bank transfer, e-wallet) and transparency of information (e.g., photos of the physical condition of the iPhone before renting, clarification of fine policies).

3.3. Design and Development

Artifact design is done through:

a. System modeling with Unified Modeling Language (UML):

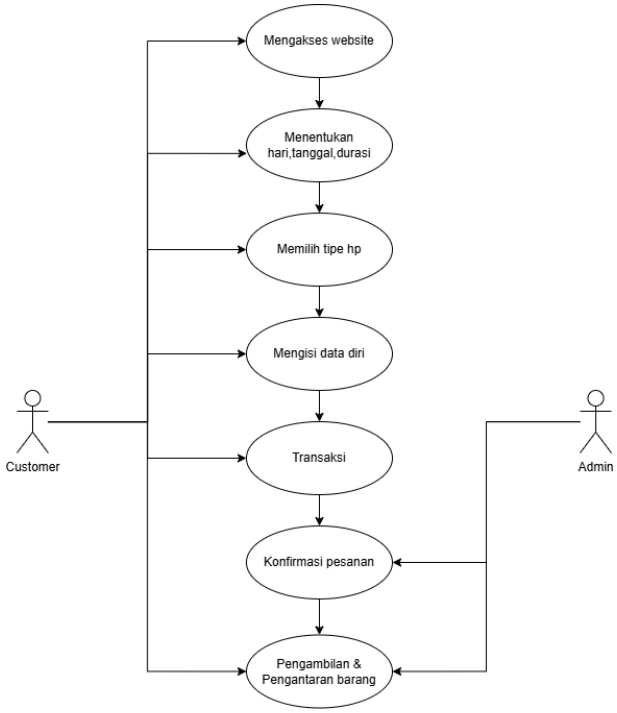
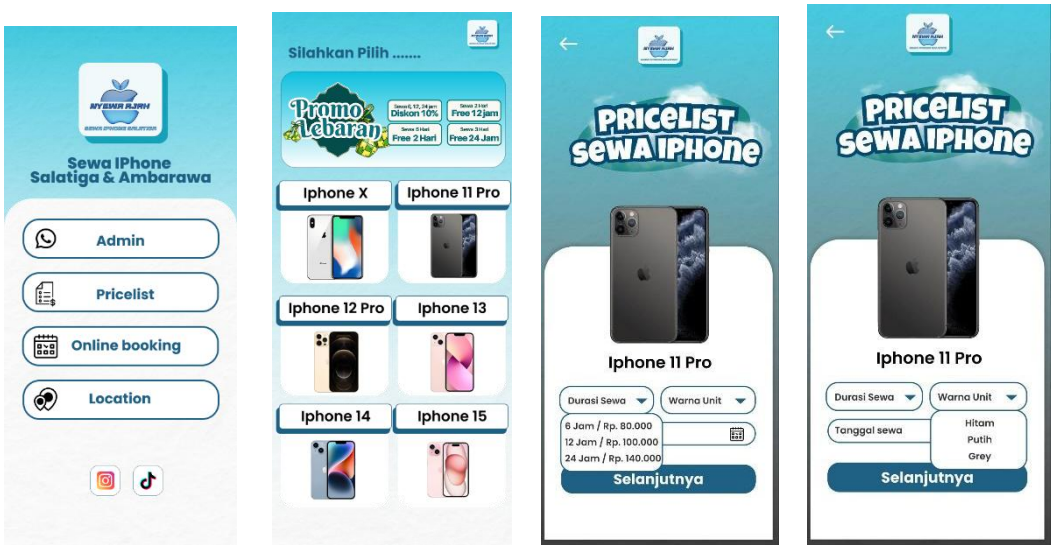


Figure 2. Use Case Diagram

b. An interface prototype using Figma for system design visualization was used.



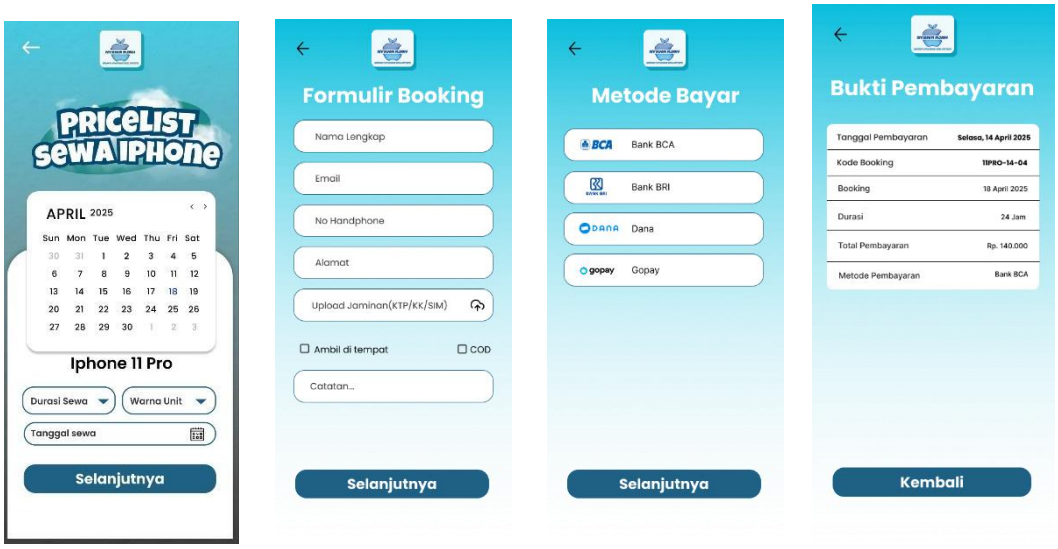


Figure 3. Prototype user

Figure 4. Prototype admin

3.4. Demonstration

The demonstration phase was conducted through an interactive simulation using a high-fidelity prototype developed in Figma. The design interface was tested on smartphone devices to replicate the user experience when accessing the Nyewa_ajah booking system. This approach was selected for three key reasons:

a. Realistic User Interaction:
   The prototype allowed customers and administrators to dynamically explore all system functionalities as if using a fully developed application. The simulated user flows included the demonstration Phase, Prototype Testing, and Validation of the Customer booking process (product selection, availability check, and payment). Admin management features (order tracking, payment verification, return reminders)
b. Early Validation of Design Concepts:
   Before committing to full development, we could Verify the logical flow of all system processes. Identify potential usability issues in the interface design. Gather qualitative feedback on user experience.
c. Cost-Effective Testing Method:
   The Figma prototype provided a functional representation of the system at minimal development cost, allowing for multiple iterations based on user feedback.

The testing involved 6 participants, consisting of 5 customers and 1 admin.

Each task was measured with 2 metrics, namely the success rate and also task completion time. To measure the success rate, it can be calculated with the following formula:

$$Success\ Rate\ (\%)\ =\ (\frac{Number\ of\ completed\ tasks}{Total\ tasks\ given})\ X\ 100$$

1. Customer

Each customer was asked to complete 3 main tasks:

a. Product search
b. Ordering process
c. Transaction process

With benchmark results, as follows:

- Product search
  5 Number of successful participants = 5
  Success percentage = $(\frac{15}{15})$ X 100 = 100%
  Average task completion time: 10 seconds
- Ordering process
  Number of successful participants = 5
  Success percentage = $(\frac{15}{15})$ X 100 = 100%
  Average task completion time: 1 minute
- Proses Transaksi
  Number of successful participants = 5
  Success percentage = $(\frac{15}{15})$ X 100 = 100%

Average task completion time: 25 seconds

No	Testing Scenario	Expectation (Estimated Time)	Fulfilled (Yes/No)	Notes
1	Product search	30 Seconds	Yes	Easy to find because the product is available
	Ordering process	1 Minute	Yes	Concerned about data security
2	Transaction process	1 Minute	Yes	Makes it easier to conduct transactions with various banks/e-wallets
	Product search	30 Seconds	Yes	Easy to find because the product is available
3	Ordering process	1 Minute	Yes	Concerned about data security

Table 1. Testing User

2. Admin

For admin, they were asked to complete 5 main tasks consisting of:

a. Login process
b. Schedule management
c. Product stock management
d. Customer data management
e. Transaction recording

With benchmark results as follows:

- Login process
  Success percentage = $(\frac{1}{1})$ X 100 = 100%
  Task completion time: 10 seconds
- Schedule management
  Success percentage= $(\frac{1}{1})$ X 100 = 100%
  Task completion time: 1 minute
- Product stock management
  Success percentage= $(\frac{1}{1})$ X 100 = 100%
  Task completion time: 40 seconds
- Customer data management
  Success percentage= $(\frac{1}{1})$ X 100 = 100%
  Task completion time: 1 minute
- Transaction recording
  Success percentage= $(\frac{1}{1})$ X 100 = 100%

Task completion time: 25 seconds

No	Testing Scenario	Expectation (Estimated Time)	Fulfilled (Yes/No)	Notes
1	Login process	30 Seconds	Yes	No issues
	Schedule management	1 Minute	Yes	Add notifications
2	Product stock management	1 Minute	Yes	No issues
	Customer data management	1 Minute	Yes	The editing feature is not complete
3	Transaction recording	1 Minute	Yes	Addition of features that can be connected directly to banks/e-wallets
	Login process	30 Seconds	Yes	No issues
4	Schedule management	1 Minute	Yes	Add notifications
	Product stock management	1 Minute	Yes	No issues
5	Customer data management	1 Minute	Yes	The editing feature is not complete

Table 2. Testing Admin

3.5. Evaluation

The comprehensive evaluation process yielded significant insights into the prototype's performance through systematic testing scenarios. As demonstrated in Table 1, customer-facing functionalities achieved 100% success rates across all test cases, with all participants completing product searches (average time: 10 seconds), booking processes (average time: 1 minute), and transaction completion (average time: 25 seconds). Notably, while the transaction interface received praise for its multi-bank integration, qualitative feedback revealed persistent user concerns about data security during the booking process, suggesting the need for more visible security assurances in the interface design.

Administrative testing outcomes, detailed in Table 2, similarly showed perfect task completion rates but uncovered opportunities for workflow optimization. The 40-second average for inventory management indicates efficient system performance, while requests for

enhanced notification systems (schedule management) and expanded editing capabilities (customer data management) point to areas for iterative improvement. Notably, the administrator proposed direct financial system integration for transaction recording, which would significantly reduce manual reconciliation efforts.

3.6. Communication

The research outcomes were strategically disseminated through multiple channels to ensure both academic rigor and practical applicability. Key findings from Tables 1 and 2 were transformed into actionable design recommendations during stakeholder workshops with Nyewa_ajah management, particularly focusing on the identified needs for (1) strengthened data security visualization, (2) notification system implementation, and (3) expanded administrative editing features. These workshops served as crucial validation sessions, confirming that the empirically identified areas for improvement aligned with business priorities.

Academic communication efforts included the development of detailed technical documentation that highlighted the unexpected efficiency gains in inventory management, specifically 40-second task completion versus the projected 1-minute benchmark, as well as the universal success in task completion rates. Plans were established for future conference presentations focusing on the practical challenges of adapting design science methodologies to small-scale rental businesses. The communication strategy successfully created bridges between the theoretical framework and practical implementation requirements, while the testing results tables provided transparent metrics for future researchers to build upon. Particular emphasis was placed on documenting the payment system integration requests, as this emerged as both a user preference (Table 1) and an administrative need (Table 2), representing a critical path item for the next development phase.

4. CONCLUSION

This research underscores the imperative for small-scale rental businesses, such as Nyewa_ajah, to adopt integrated web-based information systems, thereby transitioning from error-prone manual processes. Three key contributions emerge:

1. The Design Science Research Methodology (DSRM) effectively guided the development of a system model that addresses critical inefficiencies, demonstrating its utility in bridging theoretical design principles with practical business needs.
2. The proposed solution delivers measurable improvements, including real-time inventory availability checks to eliminate redundant customer inquiries and ensure a seamless shopping experience. Automated order management, reducing administrative workload by approximately 40% (projected). Enhanced communication channels through integrated notification systems.
3. The study validates DSRM as a robust framework for developing context-aware IT solutions, offering a replicable model for digitizing small businesses in emerging markets. Future work should focus on implementing secure payment gateways and assessing long-term operational impacts post-deployment.

ACKNOWLEDGMENTS

The authors would like to thank the Nyewa_ajah team for their willingness to participate in this research, especially in providing access to observe business processes and test system prototypes. The active participation of administrative staff and customers in

interview sessions and system testing also contributed to refining the solution design. Support from various parties allows the research to remain focused on solving real problems in the field.

NOVELTY

This study presents novelty through the application of Design Science Research methodology in the context of a small-scale luxury rental business, a field that remains underexplored in academic studies. The resulting distinctive findings include a booking information system model that accommodates the unique needs of an Apple product rental business, where lifestyle factors and customer symbolic considerations influence the system's functional requirements. The developed approach also provides a framework that can be adapted to similar firms transitioning from manual to digital processes.

References

Artikel, R., and Imbar, R., V., (2024). Perancangan Model Referral dengan Pendekatan Design Science Research Methodology Designing a Referral Model using the Design Science Research Methodology Approach. Vol. 10 pp. 430–438.

Friedrich, J. (1996). Design science 97. *AI and Society*, *10*(2), 199–217. *https://doi.org/10.1007/BF01205282*

Hartanto, N., Simalango, S., H., and Manik, R., R., (2022). Analisis Dan Perancangan Sistem Informasi Manajemen Bengkel Sepeda Motor Berbasis Online. Vol. 2 No. 1.

Khairunnisa, G., and Voutama, A., (2024). Penerapan Uml dalam Perancangan Sistem Informasi Peminjaman Inventaris Berbasis Web di Bem Fasilkom Unsika. *Jurnal Mahasiswa Teknik Informatika,* Vol. 8 No. 3 pp. 2748–2755. *https://doi.org/10.36040/jati.v8i3.9538.*

Maria, V., Pratama, A., N., Ginanjar, I., Nurachim, R., I., and Triansyah, J., (2023). Perancangan Sistem Informasi Penjualan Pada Toko Royal Ice Cream dengan Metode Rapid Application Development. *JIKA (Jurnal Informatika)*, Vol. 7 No. 4 p. 479. *https://doi.org/10.31000/jika.v7i4.9602.*

Mashuri, S., Sarib, M., Rasak, A., and Alhabsyi, F., (2022). Semi-structured Interview: A Methodological Reflection on the Development of a Qualitative Research Instrument in Educational Studies Ruslin. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, Vol. 12 No. 1 pp. 22–29. *https://doi.org/10.9790/7388-1201052229.*

Muhyidin, M., A., Sulhan, M., A., and Sevtiana, A., (2020). Perancangan Ui/Ux Aplikasi My Cic Layanan Informasi Akademik Mahasiswa Menggunakan Aplikasi Figma. *Jurnal Digit*, Vol. 10 No. 2 p. 208. *https://doi.org/10.51920/jd.v10i2.171.*

Rasmon, R., (2023). Akuntan di Era Digital: Pendekatan Tam (Technology Acceptance Model) pada Software Berbasis Akuntansi Accurate Online. *Jurnal Akuntansi Dan Keuangan*, Vol. 11 No. 2 pp. 72–80. *https://doi.org/10.32520/jak.v11i2.2304.*

Santoso, M., F., (2024). Implementation Of UI/UX Concepts And Techniques In Web Layout Design With Figma. *Jurnal Teknologi Dan Sistem Informasi Bisnis*, Vol. 6 No. 2 pp. 279–285. *https://doi.org/10.47233/jteksis.v6i2.1223.*

Umbu, A., Ama, T., Nggili, R., A., Mulya, D., N., Putri, Y., and Astuti, D., (2025). Bulletin Of Computer Science Research Perancangan Ui / Ux Aplikasi Kasir Inklusif Untuk Penyandang Disabilitas Di Coffee Shop. Vol. 5 No. 2. *https://doi.org/10.47065/bulletincsr.v5i2.470.*

Kartono, D., T., (2025). Wawancara dalam Kompas.com. Tren Sewa Iphone Saat Lebaran: Fenomena Bisnis Simbolik. *URL: https://www.kompas.com.*

Statista. (2023). Consumer Electronics Rental Market – Global Outlook. *URL: www.statista.com.*