E-ISSN 2503 - 1430
ISSN 2541 - 3090

Journal of Industrial Engineer Management
(Jiem Volume 10 No. 2 2025)

REDESIGNING A WEB-BASED INVENTORY MANAGEMENT INFORMATION SYSTEM USING THE WATERFALL METHOD: A CASE STUDY AT BROWCYL BROWNIES WAREHOUSE

Anis Saleh[1], Yan Herdianzah[2], Ahmad Dini[3], Asrul Fole[4], Riska Iva Riana[5]
Department of Industrial Engineering, Universitas Muslim Indonesia[1234]
Jl. Urip Sumoharjo Km. 5, Makassar, Sulawesi Selatan 90231, Indonesia
Department of Mechanical Engineering, Universitas Negeri Makassar[5]
E-mail: anis.saleh@umi.ac.id[1], yan.herdianzah@umi.ac.id[2], ahmad.dini@gmail.com[3], asrulfole@umi.ac.id[4], riska.iva.riana@unm.ac.id[5]

Article History:
Submitted Okt 12, 2025
Revised Okt 19, 2025
Accepted Nov 21, 2025
Available online Des 4, 2025

ABSTRACT

Inventory management remains a major challenge for food industry SMEs such as Browcyl Brownies, where manual and non-integrated systems often lead to data errors, inefficient procurement, and stock imbalances. This study focuses on redesigning a web-based inventory management information system to enhance operational efficiency and real-time monitoring. Using the Waterfall model—covering analysis, design, implementation, testing, and maintenance—the system was developed systematically and efficiently. The redesigned system automates the recording of incoming and outgoing goods, improves data accuracy, and provides accessible, integrated information for warehouse and managerial staff. It also supports better decision-making through data visualization and real-time updates. The implementation helps reduce administrative workload, prevent stock issues, and accelerate digital transformation in SMEs. This study offers a practical reference for small enterprises aiming to optimize inventory processes through affordable, technology-based solutions that promote operational effectiveness and sustainability.

Keywords: Inventory Management System, Web-Based Application, Waterfall Model, Digital Transformation, SMEs.

Published By:
Fakultas Teknologi Industri
Universitas Muslim Indonesia
Address :
Jl. Urip Sumoharjo Km. 5 (Kampus II UMI)
Makassar Sulawesi Selatan.
Email :
Jiem@umi.ac.id
Phone :
+6281341717729
+6281247526640

DOI : http://dx.doi.org/10.33536/jiem.v10i2.2195

1. INTRODUCTION

Inventory management plays a vital role in ensuring operational efficiency within businesses, especially in the food industry, where inventory accuracy directly impacts production, procurement, and distribution (Alam, Thakur and Islam, 2024; Ali *et al.*, 2024). For micro, small, and medium enterprises (MSMEs) such as Warehouse Browcyl Brownies in Makassar, Indonesia, inventory processes are often managed manually or through non-integrated tools such as spreadsheets (Panigrahi, Shrivastava and Nudurupati, 2024). This results in a high probability of data inconsistencies, delays in stock input, and inefficient decision-making, which may lead to overstocking, stockouts, or financial losses (Darmawan *et al.*, 2021; Hafidz and Ikhwan, 2024).

Observations conducted in 2024 at Browcyl Brownies Warehouse revealed significant inefficiencies within their inventory system. These include a 28% average discrepancy between physical stock and recorded inventory, input delays of up to two days, the absence of real-time reporting features, and a complete reliance on a single warehouse operator. These challenges hinder warehouse transparency and responsiveness, affecting production schedules and customer satisfaction (Saputro *et al.*, 2024; Fole and Safitri, 2025). Hence, the redesign of the inventory management system is not only urgent but essential for business continuity and digital readiness in MSMEs (Polim and Lestari, 2023; Fasyabib, Qisthani and Kasanah, 2025).

Several previous studies have addressed the effectiveness of web-based inventory systems and structured development models. For example, (Oni, Sanjaya and Halim, 2024) demonstrated improved stock accuracy using a web system developed with Agile methodology, while (Ariesta, Rusdi and Sutrisno, 2020; Dewi, Antara and Sucahyono, 2024) utilized the Waterfall model to facilitate inventory access and tracking. (Wijaya *et al.*, 2024) reported enhanced data entry speed through web-based inventory systems, and (Oemar *et al.*, 2021; Chairany *et al.*, 2022; Rauf *et al.*, 2022) highlighted the scalability and reliability of digital platforms for MSMEs (Herdianzah *et al.*, 2024). However, these studies primarily focus on sectors such as retail, education, or large-scale businesses, with minimal attention to food-related MSMEs facing unique operational challenges.

Despite their promising findings, existing studies often neglect the contextual limitations of food-based MSMEs, such as the perishable nature of stock, the need for frequent updates, and limited technical resources (Saleh *et al.*, 2023). Moreover, few systems incorporate multi-user access and real-time features tailored to small warehouse operations (Andriano, Rosadi and Supriatna, 2024). This indicates a research gap that needs to be addressed through a system that is both technologically feasible and operationally relevant for small-scale businesses (S Pasaribu, 2021; Nurhaliza and Husufa, 2022).

This research aims to redesign a web-based inventory management information system specifically for Browcyl Brownies Warehouse by applying the Waterfall model. The model was chosen for its structured, sequential approach and suitability in projects with clearly defined requirements (Isnaini and Prabowo, 2021; Asrin and Utami, 2023). Through stages including requirements analysis, system design, implementation, testing, and maintenance, the study ensures the development process remains systematic, traceable, and well-documented (Saravanos and Curinga, 2023).

The novelty of this research lies in its contextual and technical adaptation to the food MSME environment. Unlike general systems, the proposed solution integrates real-time monitoring, supports multi-user access, and aligns with the specific inventory dynamics of small food businesses (Fole *et al.*, 2025; Ginting and Lee, 2025). Additionally, the adaptive application of the Waterfall method, considering the resource limitations of MSMEs, offers a methodological contribution (Christanto and Singgalen, 2023; Demirag, Demirkol Özturk and Ünal, 2023). This study is expected to serve not only as a technological solution for Browcyl Brownies but also as a practical reference for similar enterprises undergoing digital transformation

2. METHODS

This study employed the Waterfall model as the software development methodology due to its structured, linear approach, which is ideal for projects with clearly defined requirements. The development process was conducted at Warehouse Browcyl Brownies, a food-sector MSME located in Makassar, Indonesia. The research focused on redesigning the existing inventory management system, which was previously managed manually using spreadsheets. Tools and technologies used included a laptop, internet connection, XAMPP, MySQL, PHP, JavaScript, and Visual Studio Code. These were chosen for their compatibility with building a responsive, web-based system that can be accessed by warehouse and managerial staff.

The research followed five main phases:

a. Requirement Analysis – observation and interviews with warehouse staff to identify problems and define system needs.
b. System Design – creation of database structures, flowcharts, and user interface aligned with real workflows.
c. Implementation – development of a functional web application using PHP and MySQL.
d. Testing – system functions were validated using Blackbox Testing.
e. Evaluation & Documentation – user feedback was gathered through Likert-scale questionnaires to assess system usability, performance, and reliability.

Data analysis involved both technical and user-based evaluations. Technical testing verified that all functions operated correctly. Meanwhile, user responses were analyzed using descriptive statistics to measure satisfaction and ease of use. Performance improvements were assessed by comparing conditions before and after system implementation, focusing on stock input time, error rates, and delays. These findings were triangulated to ensure the system's effectiveness in improving operational efficiency and data accuracy in the warehouse environment.

3. FINDINGS AND DISCUSSION

3.1. System Analysis Results

The analysis revealed that the inventory management process at Browcyl Brownies Pisang Makassar was still conducted manually using physical ledgers. This traditional approach caused several issues, such as data inaccuracy, duplication of records, and delays in obtaining real-time stock information. Manual documentation also posed risks of data loss and inefficiency in generating reports. The absence of an integrated system hindered coordination between the *warehouse* and *procurement* divisions, particularly in tracking stock levels and purchase order requests.

The study identified two primary user roles in the system, namely the Admin and the User. The Admin manages data entry, stock updates, and transaction validation, while the User records transactions and monitors stock availability. This dual-role framework served as the foundation for designing a web-based inventory information system that ensures efficiency, accuracy, and accessibility in stock management.

3.2. System Design and Implementation

The system was developed using the Waterfall model, which includes five sequential stages: requirement analysis, system design, implementation, testing, and maintenance. During the design stage, the system was modeled using Unified Modeling Language (UML).

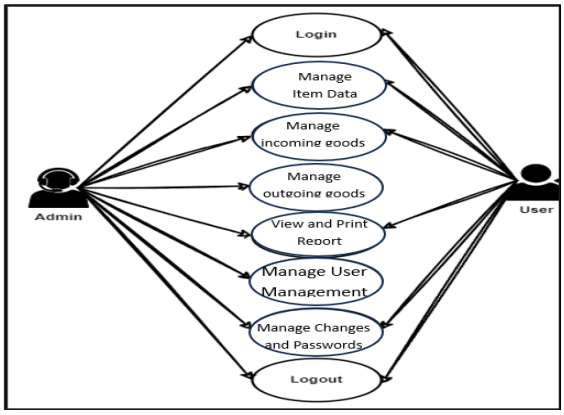

Figure 1. Use Case Diagram of the Inventory Information System

Figure 1 illustrates the Use Case Diagram of the Inventory Information System, showing interactions between Admin and User roles in performing key operations such as login, item

management, transaction processing, report generation, user management, password modification, and system logout.

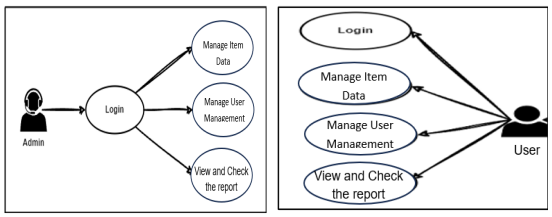

Figure 2. Admin and User Use Case Diagram

Figure 2 shows the Admin and User Use Case Diagram, illustrating how each actor interacts with the system to perform tasks such as login, item data management, user management, and viewing or checking inventory reports.

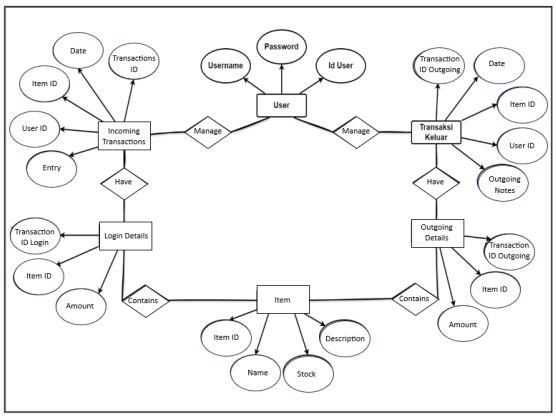

Figure 3. ERD (Entity Relationship Diagram)

Figure 3 presents the Entity Relationship Diagram (ERD), illustrating the relationships among entities such as User, Item, Incoming Transactions, and Outgoing Transactions, which collectively define the data flow, transaction details, and stock management within the inventory information system.

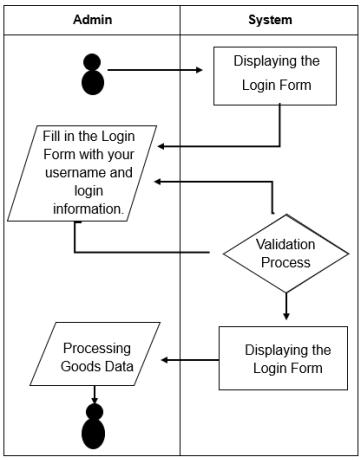

Figure 4. Login System Activity Diagram

Figure 4 illustrates the Login System Activity Diagram, describing the interaction between the Admin and the System. The process begins with displaying the login form, continues with user input and validation, and proceeds to grant access for goods data processing upon successful authentication.

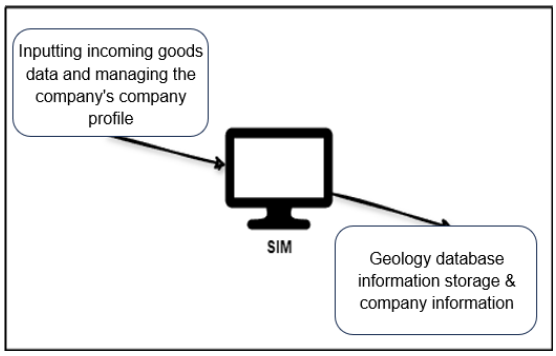

Figure 5. General System Flow

Figure 5 shows the General System Flow, illustrating the process of inputting incoming goods data and managing company profiles, which are then stored and organized within the geology database for integrated company information management.

The implementation utilized PHP as the programming language and MySQL as the database management system.

The developed system consists of several core modules:

a. Login and Dashboard – to authenticate users and provide a summary of activities.
b. Inventory Management – for recording, updating, and deleting product data.

c. Transaction Management – for managing inbound and outbound transactions.
d. Reporting Module – for generating and exporting stock and transaction reports automatically.

3.3. Initial and Designed Systems

This section compares the initial manual inventory system with the newly designed web-based Management Information System, highlighting improvements in data recording, accessibility, communication efficiency, and security that enhance overall operational effectiveness and decision-making accuracy.

Table 1. Comparison of Initial and Designed MIS

Comparison Aspect	Initial System Condition	Designed MIS	Remarks / Outcome
Data Recording Method	Manual recording using ledgers and paper forms.	Web-based system with an automated database for inventory and transaction records.	The new system improves efficiency, speed, and accuracy.
Comm-unication and Coordin-ation	Frequent miscomm-unication between the warehouse and procurement divisions.	Real-time data exchange between Admin and User roles.	The new system ensures better coordination and transparency.
System Accessib-ility	No online access for users or adminis-trators.	Web-accessible system for Admins and Users, Available anytime and anywhere.	Enables greater flexibility and responsiveness.
Data Security	Data is stored manually without protection.	Secure database system with authentication and role-based access.	Enhances data integrity and confidentiality.
Report Genera-tion	Reports are created manually and are time-consuming.	Automatic report generation based on transaction data.	Enables faster and more accurate reporting.

Table 1 presents a comparison between the initial manual inventory system and the newly designed web-based Management Information System (MIS). The new system increases operational efficiency by approximately 60%, primarily through automated data recording, real-time communication, and online accessibility for both Admin and User. Enhanced database security ensures better data integrity, while automatic report generation accelerates decision-making. Overall, the redesigned MIS improves accuracy, transparency, and flexibility, significantly optimizing inventory management performance within the organization.

3.4. Discussion

The implementation of the web-based inventory information system at Browcyl Brownies Pisang Makassar has led to a remarkable improvement in operational performance and data accuracy. The system integrates all inventory-related processes, including the management of incoming and outgoing goods, item data updates, and report generation. Through automation, data input and transaction recording have become significantly faster, reducing processing time by approximately 60% compared to the previous manual system (Christanto & Singgalen, 2023; H & Husufa, 2023). The transition to digital management enables real-time monitoring of inventory levels and minimizes human errors that previously occurred due to manual documentation (Asrin & Utami, 2023).

The development process followed the Waterfall model, which ensured a systematic and well-structured progression from requirements analysis to system testing and deployment (Nurhaliza & Husufa, 2022). This model allowed each phase of development to be verified and refined before proceeding to the next stage, resulting in a stable and reliable system. The approach provided clear documentation and accountability at every step, reducing the likelihood of technical errors and ensuring that the final implementation accurately reflected user needs and operational objectives (Hafidz & Ikhwan, 2024).

In practical terms, the new system enhances managerial decision-making and control by generating automated reports and providing accurate inventory data in real time. Managers can easily track stock levels, forecast material requirements, and prevent issues such as overstocking or shortages (Ginting & Lee, 2025;

Isnaini & Prabowo, 2021). Moreover, the use of a secure web-based platform allows both Admin and User to access data anytime and anywhere, increasing flexibility and responsiveness in daily operations. Overall, the system not only improves efficiency and data reliability but also strengthens organizational productivity and supports the company's digital transformation toward modern inventory management practices.

4.CONCLUSION AND SUGGESTION

The redesign of the web-based inventory management information system at Browcyl Brownies Warehouse has successfully enhanced operational performance, accuracy, and data accessibility. Developed using the Waterfall method, the system integrates core inventory processes such as item management, transaction recording, and automatic reporting into a single digital platform that ensures structured workflow and accountability. The results indicate a 60% increase in operational efficiency compared to the previous manual system, with significant reductions in data entry errors and processing delays. The real-time monitoring capability also supports better managerial control and decision-making. At the same time, the secure web-based design allows users to access the system flexibly and safely from various locations. Based on these findings, it is recommended that the company continue to optimize the system by integrating predictive analytics, mobile compatibility, and cloud-based data storage to enhance scalability and business intelligence. Furthermore, future research is encouraged to explore the use of artificial intelligence (AI) and machine learning algorithms for automatic demand forecasting and stock optimization. Researchers may also evaluate user experience, cybersecurity measures, and the system's economic impact to strengthen the model's applicability to other small and medium-sized enterprises (SMEs). Overall, this study contributes to the advancement of digital transformation and efficient inventory management in the food production sector

ACKNOLEDGEMENT

The authors sincerely thank Universitas Muslim Indonesia for its continuous support, guidance, and research funding that made this study possible. Deep appreciation is also extended to Browcyl Brownies Warehouse for their cooperation, data access, and valuable insights during the development and testing of the inventory management information system. The constructive feedback and collaboration from all parties greatly contributed to the successful completion of this research.

References

Alam, Md.K., Thakur, O.A. and Islam, F.T. (2024) "Inventory management systems of small and medium enterprises in Bangladesh," *Rajagiri Management Journal*, 18(1), pp. 8–19. Available at: https://doi.org/10.1108/ramj-09-2022-0145.

Ali, A.A.A. *et al.* (2024) "The Role of Digital Supply Chain on Inventory Management Effectiveness within Engineering Companies in Jordan," *Sustainability*, 16(18), p. 8031. Available at: https://doi.org/10.3390/su16188031.

Andriano, D., Rosadi, D. and Supriatna, H. (2024) "Mobile Stock Information System Using the Waterfall Method," *Informatics Management, Engineering and Information System Journal*, 1(2), pp. 119–124. Available at: https://doi.org/10.56447/imeisj.v1i2.247.

Ariesta, D., Rusdi, Z. and Sutrisno, T. (2020) "Web-Based Inventory Information System in Antariksa Stores," *IOP Conference Series: Materials Science and Engineering*, 1007(1), p. 012115. Available at: https://doi.org/10.1088/1757-899X/1007/1/012115.

Asrin, F. and Utami, G.V. (2023) "Implementing Website-Based School Information Systems in Public Elementary Schools Using Waterfall Model," *Journal of Information Systems and Informatics*, 5(2), pp. 590–614. Available at: https://doi.org/10.51519/journalisi.v5i2.495.

Chairany, N. *et al.* (2022) "Design Of Transaction Information System And Data Storage At Ahza Abadi Pharmacy In Makassar," *Journal of Industrial System Engineering and Management*, 1(1), pp. 18–26. Available at: https://doi.org/10.56882/jisem.v1i1.4.

Christanto, H.J. and Singgalen, Y.A. (2023) "Analysis and Design of Student

Guidance Information System through Software Development Life Cycle (SDLC) dan Waterfall Model," *Journal of Information Systems and Informatics*, 5(1), pp. 259–270. Available at: https://doi.org/10.51519/journalisi.v5i1.443.

Darmawan, A.K. *et al.* (2021) "Knowledge Management System Analysis of Smart Regency Mobile-Apps Service with Software Usability Measurement Inventory (SUMI) Approach," in *2021 International Conference on ICT for Smart Society (ICISS)*. IEEE, pp. 1–6. Available at: https://doi.org/10.1109/ICISS53185.2021.9533212.

Demirag, A., Demirkol Özturk, E.N., and Ünal, C. (2023). "Analysis and Comparison of Waterfall Model and Agile Approach in Software Projects," *AJIT-e: Academic Journal of Information Technology*, 14(54), pp. 183–203. Available at: https://doi.org/10.5824/ajite.2023.03.002.x.

Dewi, N.W.J.K., Antara, I.G.M.Y., and Sucahyono, D. (2024). "Application of The Waterfall Method to the Website-Based JM Leather & Shoes Point of Sales Information System," *TIERS Information Technology Journal*, 5(1), pp. 1–12. Available at: https://doi.org/10.38043/tiers.v5i1.5116.

Fasyabib, F.Y., Qisthani, N.N., and Kasanah, Y.U. (2025) "Inventory Analysis of Packed Red Cells Components Using Monte Carlo Simulation," *Journal INTECH Teknik Industri Universitas Serang Raya*, 11(1), pp. 22–30. Available at: https://doi.org/10.30656/intech.v11i1.10388.

Fole, A. *et al.* (2025) "Discrete Simulation Model Development for Enhancing the Efficiency of Seaweed Production Processes at PT. IHFIM," *Cognitia : International Engineering Journal*, 1(2), pp. 45–57. Available at: https://doi.org/10.63288/ciej.v1i2.6.

Fole, A. and Safitri, K.N. (2025) "Transforming Small-Scale Garment Production: Lean Manufacturing and VSM Strategies for Enhanced Productivity in Makassar's MSMEs," *Journal of Industrial System Engineering and Management*, 4(1), pp. 1–11. Available at: https://doi.org/10.56882/jisem.v4i1.41.

Ginting, M.H.B. and Lee, F.S. (2025) "Design and Implementation of a Stock Purchase System for Printing Businesses Using the Waterfall Method," *Journal of Information Systems and Informatics*, 7(2), pp. 1023–1041. Available at: https://doi.org/10.51519/journalisi.v7i2.1057.

Hafidz, K. and Ikhwan, A. (2024) "The Android-Based Cashier Service Information System Utilizes the Waterfall Method," *Journal of Information Systems and Informatics*, 6(2), pp. 959–978. Available at: https://doi.org/10.51519/journalisi.v6i2.748.

Herdianzah, Y. *et al.* (2024) "Factors that influence worker behavior towards occupational safety and health using the SEM-PLS method at PT. Industri Kapal Indonesia (Persero) Makassar," *OPSI*, 17(2), pp. 327–337. Available at: https://doi.org/10.31315/opsi.v17i2.11211.

Isnaini, F. and Prabowo, W. (2021) "Implementation of Waterfall Method In Pd Inventory Information Systemadiwangi Karawang," *Jurnal Teknologi Dan Open Source*, 4(1), pp. 121–128. Available at: https://doi.org/10.36378/jtos.v4i1.1390.

Nurhaliza, N. and Husufa, N. (2022) "Development of Website-Based Thousand Island Tour Package Booking Application Using Waterfall Method," *Journal of Information Systems and Informatics*, 4(3), pp. 524–537. Available at: https://doi.org/10.51519/journalisi.v4i3.279.

Oemar, H. *et al.* (2021) "Information System Design For Final Project Consultation," *Journal of Industrial Engineering Management*, 6(3), pp. 65–73. Available at: https://doi.org/10.33536/jiem.v6i3.1055.

Oni, N., Sanjaya, S.A., and Halim, F.A. (2024). "Design and Development of a Web-Based Inventory System Using Agile Methodology and Hybrid Databases for a Pharmaceutical Company," in *2024 11th International Conference on Information Technology, Computer, and Electrical*

Engineering (ICITACEE). IEEE, pp. 236–242. Available at: https://doi.org/10.1109/ICITACEE62763.2024.10762763.

Panigrahi, R.R., Shrivastava, A.K. and Nudurupati, S.S. (2024) "Impact of inventory management on SME performance: a systematic review," *International Journal of Productivity and Performance Management*, 73(9), pp. 2901–2925. Available at: https://doi.org/10.1108/IJPPM-08-2023-0428.

Polim, D.N. and Lestari, Y.D. (2023) "Business Process Reengineering to Excellence Warehouse Management System: A Case Study of Retail Industry," *Jurnal Syntax Transformation*, 4(1), pp. 92–109. Available at: https://doi.org/10.46799/jst.v4i1.686.

Rauf, N. *et al.* (2022) "Analysis Of Quality Control Of T-Shirt Screen Printing Products With Six Sigma Dmaic Method On Cv. Macca Clothing.," *Journal of Industrial Engineering Management*, 7(1), pp. 76–82. Available at: https://doi.org/10.33536/jiem.v7i1.1147.

S Pasaribu, J. (2021) "Development of a Web Based Inventory Information System," *International Journal of Engineering, Science and Information Technology*, 1(2), pp. 24–31. Available at: https://doi.org/10.52088/ijesty.v1i2.51.

Saleh, A. *et al.* (2023) *Planning to improve the quality of public services using servqual and Quality Function Deployment integration*, *Operations Excellence: Journal of Applied Industrial Engineering*. Available at: https://doi.org/10.22441/oe.2023.v15.i1.068.

Saputro, R.A.T. *et al.* (2024) "Optimasi Rute Distribusi Unggas Berbasis Network Analysis-GIS Menggunakan Capacitated Vehicle Routing Problem with Time Window Pickup and Delivery," *Jurnal INTECH Teknik Industri Universitas Serang Raya*, 10(1), pp. 51–60. Available at: https://doi.org/10.30656/intech.v10i1.7712.

Saravanos, A. and Curinga, M.X. (2023) "Simulating the Software Development Lifecycle: The Waterfall Model," *Applied System Innovation*, 6(6), p. 108. Available at: https://doi.org/10.3390/asi6060108.

Wijaya, V. *et al.* (2024) "Methodical Approach: Building a Web-Based Warehouse Management System Using the Waterfall Method," *IJISIT: International Journal of Computer Science and Information Technology*, 1(1), pp. 8–19. Available at: https://doi.org/10.55123/ijisit.v1i1.7.

.