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Digital Transformation in Floral Retail: Designing a Website-Based Sales Information System Using the Waterfall Method

Miswadi

*Software Engineering Techniques, Faculty of Engineering
Politeknik META Industri
Cikarang, Indonesia
miswadi@gmail.com*

Vina Yuliana

*Digital Business Study Program, Faculty of Economics and Business
Universitas Pancasakti Tegal
Tegal, Indonesia
vinayuliana@gmail.com*

Bei Harira Irawan

*Digital Business Study Program, Faculty of Economics and Business
Universitas Pancasakti Tegal
Tegal, Indonesia
beiharira@upstegal.ac.id*

Abstract –

The accelerating pace of digital transformation compels modern retail enterprises to adopt integrated information systems to optimize operational efficiency and business performance. Local floral retail businesses frequently encounter administrative hurdles in managing sales, inventory, raw materials, purchasing, financial settlements, and reporting due to reliance on conventional manual recording practices. These operational limitations often lead to data discrepancies, delayed inventory updates, prolonged transaction retrieval times, and inefficient reporting workflows. To address these challenges, this study aims to design and develop a web-based sales information system for a local floral retail enterprise utilizing the Waterfall methodology, while comprehensively evaluating system functionality through black-box testing. Data were collected via direct observation, semi-structured stakeholder interviews, and an extensive literature review. The system was structured following sequential development phases: requirements analysis, system design, implementation, testing, and maintenance, engineered using PHP, MySQL, HTML, CSS, JavaScript, and local server environments. The resulting web-based platform streamlines core business processes by centralizing product, raw material, supplier, procurement, sales, payment, stock, and financial management into a single architecture, featuring automated inventory adjustments driven by sales and purchase activities. Black-box testing confirmed that all primary functional modules including user authentication, inventory control, procurement, transactional workflows, payment processing, invoicing, and automated reporting performed flawlessly according to operational scenarios. Ultimately, this digital solution fulfills organizational requirements, enhances internal operational governance, and supports technology-driven business innovation in the retail service sector.

Keywords – Digital Transformation; Retail Management Information System; Waterfall Methodology; Inventory and Sales Control; Business Efficiency

I. INTRODUCTION

Digital transformation has fundamentally reshaped modern business operations, driving organizations across industries to adopt digital systems to enhance data management, productivity, and competitiveness. For small and medium-sized enterprises (SMEs), information systems serve as a strategic catalyst to streamline daily transactions and administrative workflows (Laudon & Laudon, 2020; Chen & Lin, 2018). In the context of retail and service sectors, adopting structured digital platforms allows businesses to replace traditional manual processes with automated, transparent, and responsive management tools. Within retail floristry and specialized gift enterprises, inventory management represents a critical operational pillar. Retailers must manage perishable raw materials and finished arrangements that require precise stock monitoring and rapid turnover to minimize losses and maintain optimal product quality (Ghiani et al., 2013). Consequently, efficient data recording and real-time inventory tracking are paramount for sustaining business continuity and satisfying consumer demand in competitive local markets (Slack et al., 2016).

Despite the growing imperative for digitization, many local retail floristry businesses still rely heavily on conventional, manual recording practices using physical ledgers and notebooks for daily transactions and inventory logs. Observations and stakeholder interviews reveal that such manual workflows frequently introduce operational bottlenecks, including human recording errors, inaccurate stock levels, delayed transaction retrieval, and prolonged financial reporting cycles (O'Brien & Marakas, 2011).

Furthermore, the lack of an integrated management platform prevents store administrators from simultaneously monitoring inventory movements, supplier procurement, and sales performance in real time. Stock tracking often requires manual physical audits and the reconciliation of fragmented paperwork, which severely restricts managerial responsiveness and operational efficiency (Laudon & Laudon, 2020). These administrative limitations underscore the urgent need for a centralized, web-based sales and inventory information system. To address these operational vulnerabilities, this study focuses on designing and engineering an integrated website-based sales information system tailored for a local retail floral enterprise. The proposed platform centralizes core business modules including product cataloging, raw material tracking, supplier databases, purchasing, sales transactions, payment settlements, automated inventory updates, and financial reporting into a single unified architecture designed specifically for administrative governance.

The system development follows the structured Waterfall methodology, chosen for its linear and sequential approach, which is highly suitable when system requirements are clearly defined through preliminary observations and stakeholder consultations (Pressman & Maxim, 2020; Sommerville, 2016). The development lifecycle systematically progresses through requirements analysis, system design, implementation using web technologies (PHP, MySQL, HTML, CSS, JavaScript, and local server environments), rigorous black-box testing, and deployment maintenance (Kendall & Kendall, 2019).

Grounded in these operational challenges, this study addresses three core research questions: how to design and build a website-based sales information system that integrates product, raw material, supplier, procurement, sales, payment, inventory, and reporting workflows; how to systematically apply the Waterfall methodology to accommodate administrative operational needs; and how to verify system functionality using black-box testing techniques. Consequently, this study aims to deliver an integrated web-based sales information platform, implement the Waterfall development framework, and ensure functional compliance through comprehensive software testing. Ultimately, this research contributes to the broader discourse on digital transformation in retail SMEs by providing a scalable technological solution that improves inventory control, eliminates manual recording errors, and optimizes administrative productivity. By bridging the gap between traditional retail operations and digital innovation, the findings offer practical insights for retail floral enterprises seeking to enhance operational resilience and business performance in a dynamic market environment.

II. METHOD

This study focuses on the design, engineering, and digital transformation of sales and inventory operations within a local floral retail enterprise. As part of a digital transition initiative, the research addresses traditional administrative bottlenecks where daily operational workflows such as retail sales transactions, raw material availability tracking, and stock reconciliation were previously managed through manual ledger recording. Data collection was conducted using a multi-faceted approach comprising direct observation, semi-structured interviews, and a comprehensive literature review. Observation involved examining day-to-day operational practices, including customer order intake, floral inventory handling, sales logging, and financial reporting workflows. Semi-structured interviews were carried out

directly with the business owner, who also acts as the primary administrative user, to elicit deep insights regarding existing operational constraints, system requirements, data needs, and user interface expectations. Furthermore, a literature review was performed by examining academic books, peer-reviewed journals, and conference proceedings related to sales information systems, database management, the Waterfall methodology, Unified Modeling Language (UML), and web technologies including PHP, MySQL, HTML, CSS, and JavaScript.

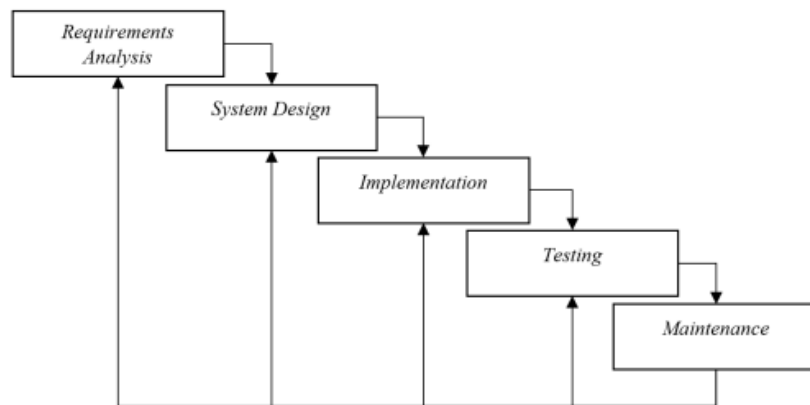


Figure 1. Waterfall Method

The software engineering lifecycle was structured using the classical Waterfall methodology, characterized by its linear and sequential progression across five core phases: requirements analysis, system design, implementation, testing, and maintenance. During the requirements analysis phase, functional and non-functional specifications were established based on field observations and stakeholder interviews. The system design phase utilized Unified Modeling Language (UML) to model system architecture, encompassing use case diagrams, activity diagrams, sequence diagrams, and class diagrams. The implementation phase translated these designs into a responsive web platform using PHP, MySQL, HTML, CSS, and JavaScript, hosted locally via XAMPP development environments. System evaluation was executed through Black-Box Testing. This testing phase focused rigorously on verifying the core functional modules of the web platform, including user authentication, inventory control, raw material procurement, sales transactions, payment processing, invoice generation, and automated reporting. Testing was conducted by injecting specific input scenarios and evaluating whether actual system outputs matched expected behaviors, thereby confirming that the digitally transformed platform successfully fulfills all defined operational requirements.

III. RESULTS AND DISCUSSION

The development of the web-based sales information system followed a structured sequential lifecycle, beginning with planning, analysis, design, and implementation. In the planning phase, the scope of the digital transformation initiative was established, identifying the core need to transition from manual ledger records to an integrated web platform that streamlines retail operations and inventory management. Following the planning stage, the analysis phase gathered comprehensive operational requirements through stakeholder interviews and observations, identifying major administrative bottlenecks such as recording errors, delayed stock updates, and prolonged reporting cycles. The functional requirements derived from this analysis served as the foundational basis for the entire system architecture.

As part of the proposed system analysis, a flowmap was developed to illustrate the sequence of business processes and the flow of information within the proposed web-based sales information system. The flowmap describes the transition from conventional manual procedures to an integrated digital workflow, covering data input, transaction processing, inventory updates, payment recording, and report generation. It also identifies the interactions between the administrator, the system, and the database to clarify how operational data are processed and stored systematically. This flowmap serves as a visual representation of the proposed business process and provides a clear reference for the subsequent system design and implementation stages.

Based on the results of the requirements analysis, an integrated web-based sales information system was designed to replace the existing manual system at Adelia Florist. The proposed system adopts a web-based client-server architecture, allowing the store administrator or cashier to access all system features through a web browser on various devices connected to the internet.

The business process of the proposed system begins with the administrator logging in to access the system's management features. Customers who visit or contact the store are served by the administrator or cashier to place their orders. The system displays product stock availability in real time, enabling the administrator to promptly confirm product availability. Once an order is approved, the administrator records the sales transaction through the system interface. The system automatically calculates the total price, updates inventory by reducing the stock of sold products, and stores all transaction data in a centralized database.

At the end of each reporting period, the administrator can generate daily, monthly, and annual sales reports, as well as inventory reports, without performing manual data consolidation. This integrated workflow improves data accuracy, operational efficiency, and information management throughout the sales process. To provide a clearer illustration of the proposed business process and the flow of information within the system, the flowmap of the proposed system is presented in the following figure.

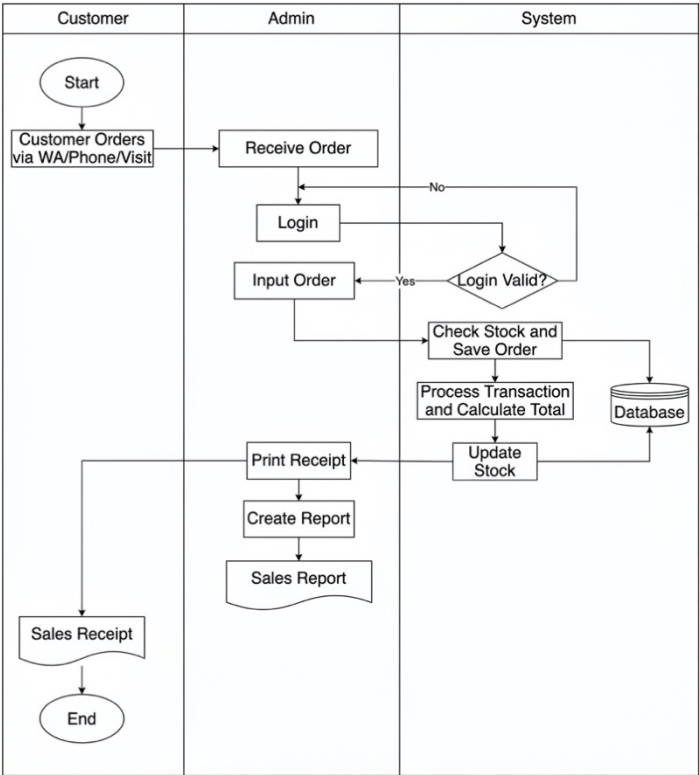


Figure 2. Proposed System Flow Map

During the design phase, these requirements were translated into structured system models using Unified Modeling Language (UML) to map out system behavior and data structures before coding began. The system incorporates a single primary actor role, namely the administrator (admin), who holds comprehensive access privileges across all system modules. The designed architecture encompasses key functional components, including administrator authentication, supplier management, category management, raw material tracking, product catalogs, material procurement, sales transactions, payment processing, inventory control, invoice generation, and automated financial reporting. All administrative actions and business events are systematically recorded in a relational database to generate accurate operational insights, sales logs, and inventory statuses.

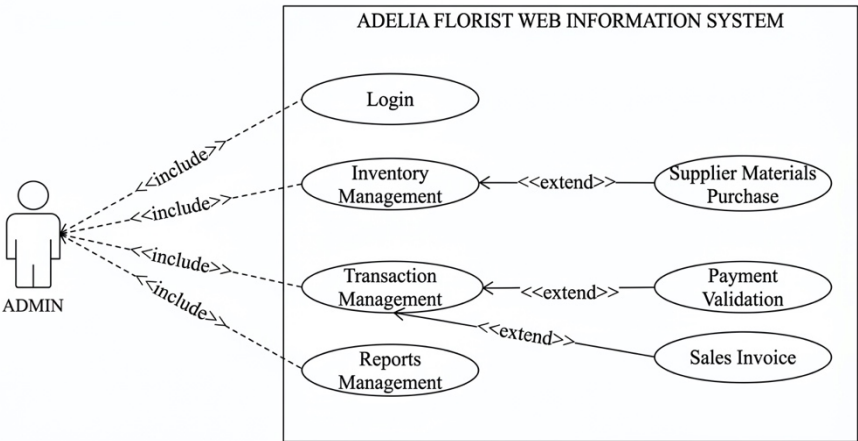


Figure 3. Proposed System UML

In the implementation phase, the finalized architectural designs were translated into a fully functional web platform utilizing PHP as the programming language, MySQL for database management, and Apache via XAMPP as the local development server environment. Several core interfaces were successfully implemented and deployed, including the login portal, administrative dashboard, supplier master data, category master data, raw material master data, product catalogs, procurement modules, sales transaction interfaces, and reporting dashboards. These pages collectively empower administrators to manage daily enterprise workflows with high precision.

A standout operational feature implemented in the system is automated inventory management. When raw material purchases occur, the system automatically updates and increases stock levels. Conversely, when retail sales transactions are executed, the system dynamically deducts stock based on items sold. This automated mechanism successfully eliminates reliance on manual stock counting, ensures real-time inventory visibility, and enhances overall administrative productivity.

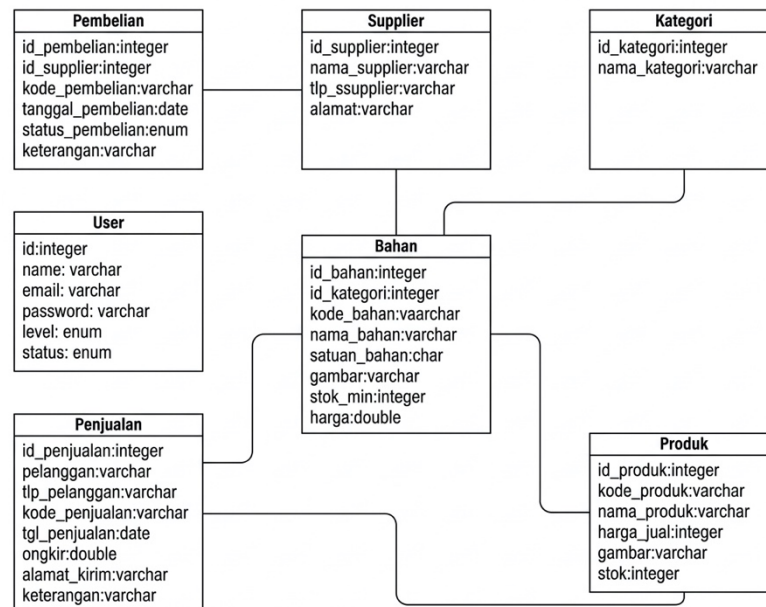


Figure 4. Logical Record Structure (LRS)

System testing was conducted using black-box testing to evaluate the core functionalities of the application. For the login function, testing covered scenarios involving valid credentials, incorrect emails or passwords, and empty input fields, with all test cases successfully yielding the expected authentication outcomes. Regarding the inventory function, evaluations were performed on data addition, editing, deletion, and search operations, where all tested scenarios produced outputs fully consistent with expected results. For the procurement function, testing encompassed purchase record additions, automated stock updates, and procurement report generation, all of which demonstrated successful execution.

TABLE I. SYSTEM FUNCTIONAL TESTING RESULTS

No.	Tested Module	Test Scenario	Result
1	Login	Login successful, incorrect data, empty data	Succeed
2	Inventory	Add, edit, delete, and search data	Succeed
3	Purchase	Add purchases, stock updates, reports	Succeed
4	Sale	Add transaction, calculate total, update stock, generate report	Succeed
5	Payment	Payment amount validation	Succeed
6	Invoice	Generation of transaction invoices	Succeed
7	Report	Presentation of sales and inventory reports	Succeed

The research findings demonstrate that the web-based sales information system successfully resolves the primary operational challenges previously encountered in manual retail workflows. Prior to the system's development, inventory management, raw material procurement, sales transactions, and financial reporting were managed through physical ledgers and standalone spreadsheets, exposing the business to risks of recording errors, delayed inventory updates, prolonged data retrieval times, and inefficient reporting cycles.

Following the deployment of the system, these administrative processes are efficiently consolidated into a single web-based application. Administrators can centrally manage suppliers, categories, inventory, products, sales transactions, payments, invoices, and financial reports. Furthermore, the platform dynamically updates stock levels automatically upon the completion of material purchases and retail sales transactions. These results indicate that the developed system provides robust operational support, successfully eliminating manual administrative bottlenecks and enhancing overall business productivity.

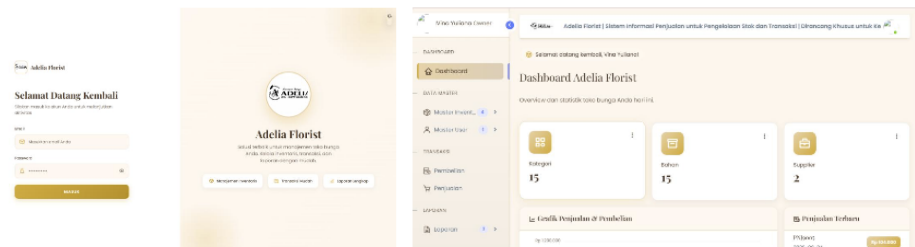


Figure 5. Login and Dashboard System

IV. CONCLUSIONS

Based on the research and evaluation conducted, it can be concluded that a website-based sales information system was successfully designed and engineered using PHP and MySQL. The system effectively integrates product cataloging, raw material tracking, supplier management, procurement, sales transactions, payment processing, inventory control, and financial reporting into a unified architecture. Furthermore, the platform automatically updates inventory levels based on procurement and sales transactions, thereby enhancing inventory data accuracy and mitigating the risks associated with manual recording errors.

The Waterfall methodology was successfully implemented across its structured sequential phases, encompassing requirements analysis, system design, implementation, testing, and maintenance. This methodology ensured a systematic and orderly development process tailored to the operational governance needs of the enterprise.

Finally, black-box testing demonstrated that all core system functions including user authentication, inventory management, material procurement, sales transactions, payment processing, invoice generation, and automated reporting operated flawlessly according to predetermined testing scenarios. All inputs were successfully processed to generate expected outputs, confirming that the developed system fully fulfills the established functional requirements.

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