



Web Based Sales Information System Using the Waterfall Method for Cashier and Product Management

Awaluddin¹, Muhammad Fadhil Mu'min², Riandy³, Syahril Ramadhan⁴, Muhammad Nur Faiz⁵, Ahmad Khairul Shiddiq⁶

^{1,2,3,4,5} Universitas Negeri Makassar, Indonesia

Corresponding e-mail: 1a108awaluddin@gmail.com

ARTICLE INFO	ABSTRACT
<p>Keywords:</p> <p>E-commerce Information system Sales platform Transaction management Waterfall method</p> <hr/> <p>Article History</p> <p>Received: Juni 15, 2025 Revised : Juli 25, 2025 Accepted : Agustus 05, 2025</p>	<p>This article presents the development of a web based sales information system for e commerce named Comerch using the Waterfall method. E commerce offers convenient online transactions yet imposes challenges in managing complex sales processes. The study aims to design and implement a system that supports transaction processing, product management, and an accessible and efficient platform. The Waterfall stages applied include requirements analysis, system design, coding, integration, and testing. Findings show that Waterfall enabled a structured and efficient development pipeline and smooth integration of system components. The resulting system provides core functions including product management, payment transactions, and real time reporting which improve operational efficiency and user experience. Scenario based testing confirms that the system performs as expected. Black box testing across forty six scenarios achieved one hundred percent functional validation. The study contributes a practical reference for developing sales information systems for small and medium enterprises and for practitioners seeking predictable and well documented development cycles.</p>

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license



To cite this article : Author. (20xx). Title. Information Technology Education Journal, X(X), XX-XX. Doi. xxxx

INTRODUCTION

The rapid development of information technology has had a major impact on business, especially in the sales sector. E commerce represents a key advancement that enables buying and selling transactions online without constraints of distance and time [1]. It offers various advantages including easier transaction management, more efficient marketing costs, and the ability to reach wider markets [2].

Despite these benefits, entrepreneurs often face challenges in managing complex e commerce platforms. Common issues include product management, payment processing, customer data management, and integration with shipping and logistics systems [3]. If not handled properly, this complexity can hinder operational efficiency and reduce customer satisfaction.

One of the most widely used methods in software development is the Waterfall method. Waterfall is a sequential approach that proceeds through clearly defined stages, namely planning, requirements analysis, design, implementation, and testing [4]. This approach helps developers

follow a clear flow at each stage so that system development projects can be completed in an organized and measurable manner [5]. A key strength of Waterfall is its suitability for large projects with clear and stable requirements such as complex and integrated e commerce systems [6].

Waterfall supports structured and systematic development of e commerce, making it easier to build online sales platforms for businesses [7]. Applications developed with this method can improve product marketing, simplify transactions, and provide customer service twenty four hours a day [8]. For instance, Waterfall based e commerce systems have been implemented in various industries such as cosmetics and furniture [9]. These systems offer wider customer reach, more efficient data management, and improved operations [10]. Although such solutions may not be perfect, they generally meet functional needs and provide a user friendly interface, thereby addressing limitations of conventional sales methods [9] [8].

This study aims to develop a sales information system based on e commerce using the Waterfall approach. The main focus is to create a system that can manage transactions efficiently, integrate with external systems such as payments, and provide an online platform that is easily accessible to consumers. The scientific contribution lies in the systematic application of the Waterfall method to address e commerce problems in the small and medium enterprise sector by offering a technological solution that is structured, measurable, and replicable.

METHOD

Development Method

The Waterfall method is a traditional sequential software development process in which each stage analysis design development and testing must be fully completed before the next stage begins and stages are not executed in parallel [11]. The overall stages of the Waterfall method are illustrated in Figure 1. Waterfall model flowchart.

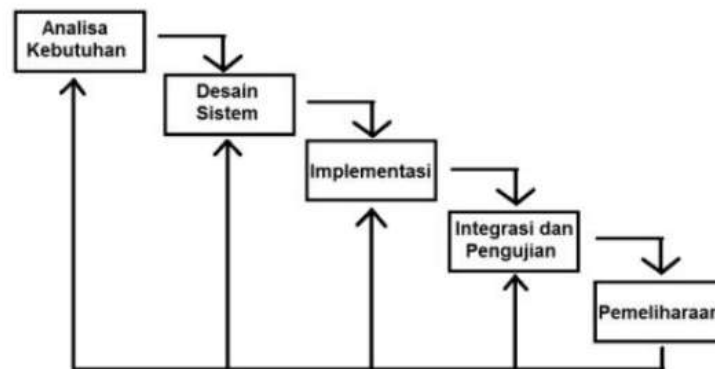


Figure 1. Waterfall model flowchart

The Comerch sales information system follows these stages.

1. Requirements Analysis

This stage identifies what the information system must provide and reviews the current process while the system is operating [12]. Requirements are gathered comprehensively according to the system to be built so that the resulting system satisfies all identified needs [13].

2. System Design

This stage prepares the conceptual and technical blueprint of the system including Use Case Diagram, Activity Diagram, Entity Relationship Diagram, and User Interface specifications [14].

3. Coding

To be executed by a computer the design is translated into a programming language during the coding stage. This is the technical implementation of the design that turns the blueprint into an executable program [14].

4. Integration and Testing

All software functions are tested to ensure they are free from errors and meet the previously identified requirements [14].

5. Maintenance

Maintenance is required because software is not permanent. During operation small errors that were not detected earlier may appear or new features may need to be added [14].

Development Method

To ensure the system is developed correctly and systematically the study used three data collection techniques.

1. Interviews

Interviews were conducted with three primary user groups of the system one administrator responsible for product data management and sales reports one cashier who handles point of sale transactions one customer as the end user of the online ordering process. The objective was to elicit current business constraints and the features they expect from the information system to be developed.

2. Document Analysis

A review was carried out on internal policy documents and Standard Operating Procedures related to stock management ordering payment and merchandise delivery. The goal was to ensure that the designed system remains aligned with the company's operational procedures.

3. Joint Application Development JAD

Group discussions with representatives of each stakeholder administrator cashier and customer were held to confirm interview findings unify perspectives on system requirements and draft the initial design of the sales information system.

RESULTS AND DISCUSSION

a. System Planning Results

The system request document was analyzed through a feasibility study to assess whether the planned system can be developed with the available resources. The feasibility study also identifies the likelihood of project success, estimates potential risks, and provides an initial view for the project team on challenges to anticipate during development [15].

Table 1. Technical Feasibility

COMERCH: Digital Information System for Sales and Merchandise Management	
Date	10 February 2025

Scale explanation	1. Very Poor	2. Poor	3. Good	4. Very Good
Familiarity with the Application				1 2 3 4
Users are familiar with operating this application				<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
Developers are familiar with developing this application				<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
Familiarity with Technology				1 2 3 4
Users are familiar with the supporting technologies of the application				<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
Developers are familiar with developing the application using the chosen platform programming language and IDE tools				<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
Project Size				
Number of developers required five people				5 Person
Time required to develop this application eight months				8 month
Compatibility				1 2 3 4
User need for application compatibility to integrate with other applications				<input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>
Application compatibility with technology existing in the organization				<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input checked="" type="checkbox"/>
Based on the technical feasibility analysis is the application feasible to be developed according to the criteria above		<input checked="" type="checkbox"/> Feasible		<input type="checkbox"/> Not Feasible

Table 2. Economic feasibility

Year	2025	2026	2027	2028
Benefits				
Increased Sales Revenue	0	160.000.000	180.000.000	200.000.000
Reduced Stock Losses	0	65.000.000	90.000.000	110.000.000
Marketing Cost Savings	0	45.000.000	55.000.000	65.000.000
Payroll Savings	0	35.000.000	40.000.000	45.000.000
Total Benefits	0	305.000.000	365.000.000	420.000.000
PV of Benefits	0	277.272.727	300.413.223	315.041.322
PV of All Benefits	0	277.272.727	577.685.950	892.727.272
Costs				
Development Costs				

Team Honorarium Analysis Design and Implementation	80.000.000	0	0	0
Total Development Costs	80.000.000	0	0	0
Operational Costs				
Software License	10.000.000	10.000.000	10.000.000	10.000.000
Server Maintenance	20.000.000	20.000.000	20.000.000	20.000.000
Digital Marketing	15.000.000	18.000.000	21.000.000	24.000.000
Total Operational Costs	45.000.000	48.000.000	51.000.000	54.000.000
Total Costs	125.000.000	48.000.000	51.000.000	54.000.000
PV of Costs	125.000.000	43.636.363	42.148.760	40.513.431
PV of All Costs	125.000.000	168.636.363	210.785.124	251.298.554
Total Project Costs Less Benefits	125.000.000	71.363.636	57.314.877	54.000.000
Yearly NPV	-125.000.000	233.636.364	258.264.463	274.527.891
Cumulative NPV	-125.000.000	108.636.364	366.900.826	641.428.717
Return on Investment (ROI)	-100%	64.44%	122.63%	155.19%
Break-even Point (BEP)	2.05			

Table 3. Organizational Feasibility

Date	12 February 2025	
Does the application support the vision and mission		
Yes this application aligns with the main objectives to be achieved such as operational efficiency and improved business management.		
Is the application consistent with your unit’s tasks functions and KPIs		
Yes this application can help the team manage sales data stock management and financial management more effectively.		
Is the application aligned with your unit’s business processes		
The application is integrated with current business needs and can increase productivity and company profitability.		
Based on the organizational feasibility analysis is the application feasible according to the above criteria	<input checked="" type="checkbox"/> Feasible	<input type="checkbox"/> Not Feasible

b. Analysis Results**Table 4.** Functional Requirements

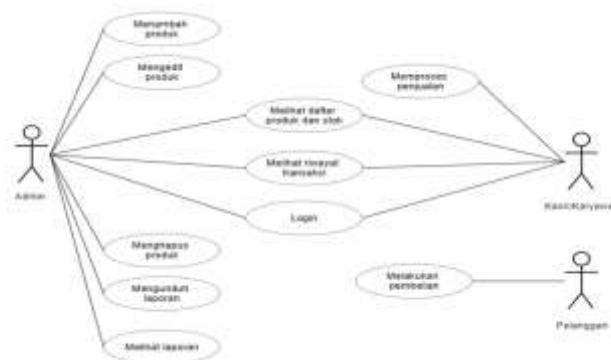
ID	Functional Requirement	Explanation
FR-001	Admin can add a new product	Admin can enter product name price category and initial stock
FR-002	Admin can edit a product	Admin can change product information such as name price category or stock
FR-003	Admin can delete a product	Admin can delete products that are no longer available
FR-004	Admin can view product list and stock	The system displays all products along with their stock information
FR-005	Admin can update product stock	Admin can increase or decrease product stock quantities
FR-006	The system provides an alert if product stock is empty	If stock reaches zero the system displays a notification
FR-007	The system must store product and stock changes in the database	All changes to products and stock must be saved correctly
FR-008	Cashier can process a transaction	Cashier can input purchased products and calculate the total price
FR-009	The system can print a receipt	After the transaction the system prints the purchase receipt
FR-010	The system stores transaction history	All transactions must be stored for reporting purposes
FR-011	Admin can view transaction reports	The system displays transactions based on a selected time range
FR-012	Admin can download transaction reports	The system provides download options in PDF or Excel format
FR-013	Admin and cashier must log in to access the system	The system can be used only after login
FR-014	The system restricts access based on roles	Admin and cashier have different access rights
FR-015	The system must store login data securely	Passwords must be encrypted before storage

Table 5. Non Functional Requirements

ID	Parameter	Requirement
NFR-001	Availability	The system must be available twenty four hours seven days a week except during scheduled maintenance
NFR-002	Reliability	The system must achieve ninety nine percent successful operation during one month of operation
NFR-003	Ergonomy	The user interface must be user friendly and easy to use without special training
NFR-004	Portability	The system must run on web browsers such as Google Chrome Mozilla Firefox and Microsoft Edge
NFR-005	Memory	The system must be able to run on a server with at least 4GB RAM and 10GB storage
NFR-006	Response time	The system response time for each transaction must not exceed five seconds under normal conditions
NFR-007	Security	The system must implement data encryption for user and payment information using SSL protocol
NFR-008	Backup	The system must automatically back up data every twenty four hours

Besides defining functional and nonfunctional requirements, the analysis process is often represented through Unified Modeling Language diagrams which allow clear visualization of interactions between systems and users. At this analysis stage there are use case diagrams that describe how users interact with the system and activity diagrams that show workflow or processes within the system [16]. This ensures that both types of requirements are effectively integrated to achieve the system objectives, with details shown in Figure 2 and Figure 3.

Use case diagrams aim to describe interactions between actors and the system. Actors may include individuals, devices, or other systems that interact with the system being built. These diagrams portray the system from a functional perspective [17]. They provide a visual illustration of system functionalities and the involved usage scenarios. The use case diagram for Comerch can be seen in the following figure.

**Figure 2.** Use Case Diagram

Activity diagram merupakan sebuah jenis diagram yang menggambarkan rangkaian alur kerja atau proses sebuah sistem. Diagram ini menggambarkan urutan aktivitas yang dilakukan, keputusan yang diambil, serta keterkaitan antara berbagai aktivitas yang terlibat [18]. An activity diagram is a type of diagram that depicts a sequence of workflows or processes of a system. It shows the order of activities performed, decisions taken, and the relationships among the various activities involved [18].

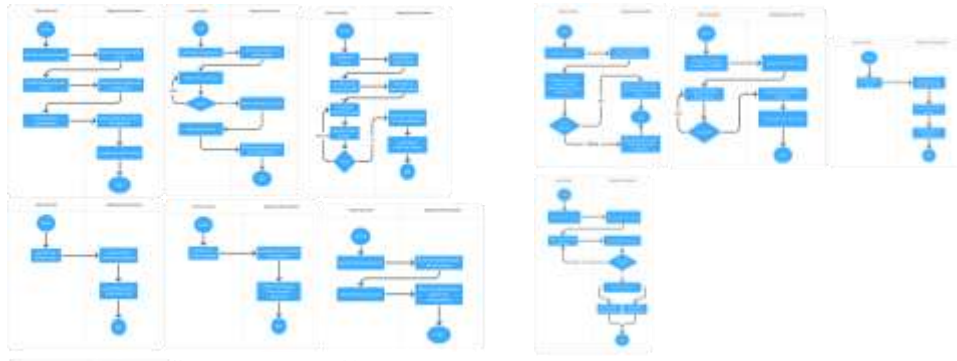


Figure 3. Activity diagram

c. Design

The design stage of this study produces Class and Sequence diagrams and the User Interface design which have been aligned with the provided references and adjusted as needed according to the features of the Comerch web based sales system.

1) Use Case and Class Diagram Design

In program visual design, Unified Modeling Language is used as an object oriented modeling language to simplify complex problems so they are easier to understand and study [19]. At this stage, modeling includes creating class diagrams to define the structure of classes to be used in the application including key attributes and methods as well as relationships among classes [20]. The model is presented in the figure below.

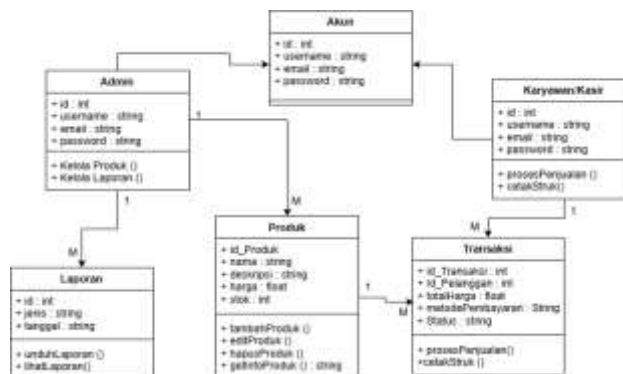


Figure 4. Class Diagram

Sequence diagrams are used to explain interactions among objects over time in a process and to provide clear guidance for the execution flow of operations based on each use case [21]. The details are presented in the following figure.



Figure 5. Sequence Diagram

2) User Interface Design

Next, the UI was designed based on the previously defined functionalities using the Figma design application and following a style guide to ensure consistency and to facilitate developers in building the application [22][23]. Several icons were taken from Google and free Figma collections that can be used freely by anyone. The complete design is shown below.



Figure 6. System Figma Design









d. Implementation Results

The implementation stage in this study includes the complete code that implements a transaction based web cashier application. The authors used Visual Studio Code as the primary development environment with HTML, CSS, JavaScript, and PHP for the user interface, interactive logic, and

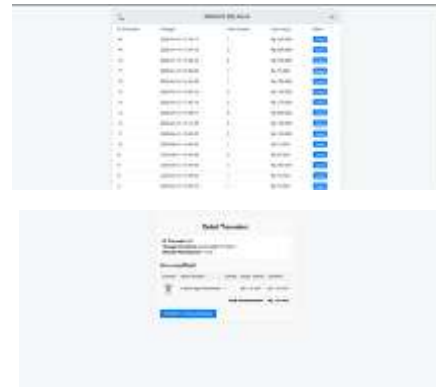
backend data management. For the database, MySQL was used through phpMyAdmin to store user, product, transaction, and sales report data.

The application's functionality was tested through a browser using a local XAMPP server, covering user scenarios such as login, product management, payment transactions, and report downloading. The tests ensured that all features worked as expected prior to full implementation.

Table 6. Coding Results

Coding	Output Display
Login	
<p>Login</p> 	
CASHIER	
<p>Cashier home computes purchased products, performs logout, decreases stock according to purchases, and selects payment method</p> 	 
<p>Checkout and Print Receipt</p> 	 

Transaction History



ADMIN

Admin Dashboard



Manage Reports



Manage Products



Edit Product

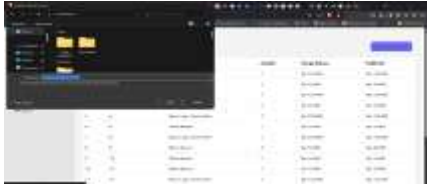


Add Product



Delete Product



Download Reports		
------------------	-----------------------------------------------------------------------------------	------------------------------------------------------------------------------------

4. Testing Results

a. Black Box Testing

Table 7. Black Box Test Results

Black Box Testing				
Code	Test case	Expected result	Actual result	Status
UB 1	Login with empty username field	Error message "Username is required" is displayed	Error message "Username is required" appears	Passed
UB 2	Login with empty password field	Error message "Password is required" is displayed	Error message "Password is required" appears	Passed
UB 3	Login with incorrect username	Error message "Username password or role is incorrect" is displayed	Error message "Username password or role is incorrect" appears	Passed
UB 4	Login with incorrect password	Error message "Username password or role is incorrect" is displayed	Error message "Username password or role is incorrect" appears	Passed
UB 5	Login with incorrect role	Error message "Username password or role is incorrect" is displayed	Error message "Username password or role is incorrect" appears	Passed
UB 6	Login with incorrect username password and role	Error message "Username password or role is incorrect" is displayed	Error message "Username password or role is incorrect" appears	Passed
UB 7	All fields empty then click "ADD"	Error message "Required field" is displayed	Error message "Required field" appears	Passed
UB 8	Empty "Product Name" field	Error message "Required field" is displayed	Error message "Required field" appears	Passed

UB 9	Empty "Product Description" field	Error message "Required field" is displayed	Error message "Required field" appears	Passed
UB 10	Empty "Price" field	Error message "Required field" is displayed	Error message "Required field" appears	Passed
UB 11	Empty "Image" field	Error message "Required field" is displayed	Error message "Required field" appears	Passed
UB 12	Empty "Stock" field	Error message "Required field" is displayed	Error message "Required field" appears	Passed
UB 13	Price field filled with text for example "ten thousand"	Error message "Price must be a number" is displayed	Error message "Price must be a number" appears	Passed
UB 14	Stock field filled with negative number for example minus five	Error message "Stock amount is not valid" is displayed	Error message "Stock amount is not valid" appears	Passed
UB 15	Upload an image with a disallowed format for example PDF	Error message "Invalid image format. Use jpg jpeg or png." is displayed	Error message "Invalid image format. Use jpg jpeg or png." appears	Passed
UB 16	All fields filled correctly then click "ADD"	Product data is successfully added and appears on the manage products page	Product data is successfully added and appears on the manage products page	Passed
UB 17	Change product name then save	Product data is successfully updated in the database	Product data is successfully updated in the database	Passed
UB 18	Change product description	Product description is updated in the database	Product description is updated in the database	Passed
UB 19	Change product price	Product price is saved correctly	Product price is saved correctly	Passed
UB 20	Change product stock	Product stock is saved correctly	Product stock is saved correctly	Passed
UB 21	Upload a new image then save	Old image is replaced with the new one	Old image is replaced with the new one	Passed
UB 22	Click "SAVE" without changing anything	No error occurs and data remains saved	No error occurs and data remains saved	Passed

UB 23	Leave one field empty then press SAVE	Validation appears "All fields except image are required"	Validation appears "All fields except image are required"	Passed
UB 24	Click "CANCEL"	Redirect back to the products page without changes	Redirect back to the products page without changes	Passed
UB 25	Click "Delete" on a product	Product is successfully deleted on the page and in the database	Product is successfully deleted on the page and in the database	Passed
UB 26	Access kelola laporan dot php while logged in	Product report data is displayed in a table	Product report data is displayed in a table	Passed
UB 27	Click "Manage Reports" menu in the sidebar	Manage Reports page is displayed	Manage Reports page is displayed	Passed
UB 28	Check number of report table columns	Table displays columns No Checkout ID Product Name Quantity Unit Price Subtotal	Columns are displayed accordingly	Passed
UB 29	Product data displayed in currency format	Price and subtotal displayed in the format "Rp xxx.xxx"	Correct currency format	Passed
UB 30	More than one product	Subtotal equals quantity times unit price	Subtotal is correct for example three times Rp 10.000 equals Rp 30.000	Passed
UB 31	Click "Download Report" button	Report file is downloaded in the specified format for example csv	File is downloaded accordingly	Passed
UB 33	Check page display at small resolution	Table remains readable or uses scroll	Table remains clearly visible	Passed
UB 34	Check report view "Products Sold Revenue and sales graph"	Correctly displays Products Sold Revenue and sales graph based on the database	Products Sold Revenue and sales graph display correctly based on the database	Passed
UB 35	Check product list view	All products appear complete with image name price and stock	All products appear complete with image name price and stock	Passed
UB 36	Click "Add" on a product	Product appears in the transaction list with initial quantity one and correct price	Product appears in the transaction list with initial quantity one and correct price	Passed

UB 37	Add more than one product to cart	Total field automatically calculates price times quantity for each product	Total field automatically calculates price times quantity for each product	Passed
UB 38	Click "Reset"	All fields and product list are cleared	All fields and product list are cleared	Passed
UB 39	Click "Pay Now" without selecting a payment method	Warning notification or input validation appears	Warning notification or input validation appears	Passed
UB 40	Select a payment method and click "Pay Now"	Transaction is processed and data is saved	Transaction is processed and data is saved	Passed
UB 41	Click "Choose Method" dropdown	List of available payment methods appears	List of available payment methods appears	Passed
UB 42	Enter a keyword in the search field	Products matching the keyword are displayed	Products matching the keyword are displayed	Passed
UB 43	Make a purchase	Product stock decreases according to quantity purchased	Product stock decreases according to quantity purchased	Passed
UB 44	Click "Print Receipt"	Receipt file opens in a print window and can be saved in the specified format dot pdf	Receipt opens in a print window and can be saved in the specified format dot pdf	Passed
UB 45	Click "Payment Complete"	User is directed back to the cashier page	Successfully directed back to the cashier page	Passed
UB 46	Click "Logout"	User is directed to the Login page	Successfully directed back to the Login page	Passed

There are four main feature areas that were developed and tested using the black box method. One is the login feature for authentication with email and password. This feature improves user security which is important since the application handles transactions and product data [24] [25]. The second is the cashier home page with an interactive interface that includes five main menus compute total products payment print receipt and transaction history. Admin features include a dashboard showing total revenue financial charts and items sold product management add edit update stock delete and report management which allows the admin to download sales history for archiving or analysis.

b. White Box Testing**1 Test case WB 1**

The purpose of case WB 1 is to test the logic of the function login in the backend module login dot js. This function is a core part of user authentication allowing users to log in as admin or cashier. Testing used the Jest framework to ensure that all conditions that may occur during login are handled correctly for both valid and invalid inputs.

Table 8. Pseudocode and white box outcomes for case WB 1

Pseudocode	Outcome
START	
Simulate login with valid username password and role	Passed
Simulate login with valid username but incorrect password	Passed rejected
Simulate login with username not found	Passed rejected
Simulate login with incorrect role	Passed rejected
Simulate login with empty fields all or some	Passed rejected
Verify redirect and session object when login succeeds	Passed
FINISH	All tests passed

Table 9. Test results summary

No	Test description	Result
1	Login succeeds with correct admin username and password	Passed
2	Login succeeds with correct cashier username and password	Passed
3	Login fails when the password is incorrect	Passed
4	Login fails when the username is not found	Passed
5	Login fails when the role is incorrect	Passed
6	Login fails when all fields are empty	Passed
7	Login fails when only the username is filled	Passed
8	Login fails when only the password is filled	Passed
9	Login fails when only the role is filled	Passed


```

PASS Atmint/___tests___/WB_1_test.js
Pengujian Login
  ✓ Harus login sebagai admin dengan kredensial yang benar (1 ms)
  ✓ Harus login sebagai kasir dengan kredensial yang benar
  ✓ Harus gagal login jika password salah
  ✓ Harus gagal login jika username tidak ditemukan
  ✓ Harus gagal login jika role salah
  ✓ Harus gagal login jika semua field kosong
  ✓ Harus gagal login jika hanya username yang diisi
  ✓ Harus gagal login jika hanya password yang diisi (3 ms)
  ✓ Harus gagal login jika hanya role yang diisi

-----|-----|-----|-----|-----|-----
File      | % Stmts | % Branch | % Funcs | % Lines | Uncovered Line #s
-----|-----|-----|-----|-----|-----
All files |    100 |    93.33 |    100 |    100 |
login.js  |    100 |    93.33 |    100 |    100 | 31
-----|-----|-----|-----|-----|-----
Test Suites: 1 passed, 1 total
Tests:       9 passed, 9 total
Snapshots:   0 total
Time:        0.396 s
Ran all test suites.

```

Figure 7. Test results for case WB 1 using Jest

From the Jest based experiments the login function works as expected across all scenarios. Input validation correctly handles empty fields and incorrect credential combinations. All branching logic has been exercised with no errors or bugs found. Test coverage is very high because it includes all main branches including user existence checks password verification and page redirection according to role. This indicates that the login component is sufficiently stable and ready for production use.

c. Discussion

1) Confirmation of findings

This study confirms that the Waterfall method remains relevant and effective for developing web based information systems as also applied by Rahmat Al Ghani and colleagues 2023 [26]. In both studies Waterfall stages are applied sequentially from requirements analysis design implementation to system testing.

2) Modifications and enhancements

The Comerch study not only adopts a similar approach but also modifies and refines several aspects of Al Ghani and colleagues as follows.

Aspect	Rahmat Al Ghani et al	Comerch study
Waterfall method	Applied in full but without detailed project feasibility	Applied completely with technical economic and organizational feasibility studies
Login and transactions	Shows a simple login page only	Login with role based authentication admin and cashier and password encryption
Order history	Displayed as a feature only	Includes download of reports time filters and graph integration
System testing	No formal test results reported	Forty six black box scenarios achieve one hundred percent success

Input validation	Not discussed	Complete validation for text numeric image and error message formats
Stock management	Not available	Includes low stock alerts and automatic stock updates after purchase

3) Comparative view

- a. Feature scope is broader. Comerch covers stock management complete transaction reporting security validation and user authentication.
- b. System testing is more systematic. Al Ghani and colleagues present visual implementation results while Comerch is supported by systematic black box testing.
- c. System feasibility is analyzed comprehensively. Comerch includes technical economic ROI NPV BEP and organizational analyses which are not presented by Al Ghani and colleagues.
- d. Design models are more complete. Comerch uses Use Case Activity Class and Sequence diagrams while Al Ghani and colleagues present Use Case only.
- d. Added context Within the digitalization of small and medium enterprises and retail in Indonesia Comerch offers a more realistic and ready to implement approach. Features such as automatic stock management downloadable reports sales graphs and economic feasibility make the system suitable for small to medium business actors who require integrated digital solutions. Conversely the system developed by Rahmat Al Ghani and colleagues can be categorized as an early prototype suitable for learning or for developing a basic e commerce system but it still requires further development to meet the needs of a complete production ready system.

CONCLUSIONS

This study successfully designed and implemented Comerch, a web based sales information system for cashier and product management, using the Waterfall approach through clearly defined stages of requirements analysis, system design, coding, integration, and testing, resulting in core capabilities for secure authentication and role based access, comprehensive product and stock management, reliable transaction processing with receipt printing, and downloadable reports that support managerial decisions; feasibility evaluations classify the project as technically and organizationally feasible, with the economic analysis yielding a positive cumulative net present value from the second year and a break even point of approximately two point zero five years; quality assurance is strong with forty six black box scenarios passing and high coverage white box tests confirming correct branching for user existence, password verification, and role redirection, indicating readiness for controlled deployment; the work contributes a reproducible blueprint that includes complete UML artifacts, a transparent feasibility framework, and a comprehensive test suite for practitioners; future improvements should address validation at larger scale and under higher loads, deeper security hardening following established secure coding practices, broader usability evaluation, tighter integration with production payment and logistics services, automated backup and monitoring, enhanced audit trails, and richer analytics to support data driven decisions.

REFERENCES

- [1] R. Anggraeni dan I. E. Maulani, "Pengaruh Teknologi Informasi Terhadap Perkembangan Bisnis Modern," *Jurnal Sosial Teknologi*, vol. 3, no. 2, hlm. 94–98, Feb 2023, doi: 10.59188/jurnalsostech.v3i2.635.
- [2] Y. S. Mulyani, "E-Commerce Solusi Pemasaran UMKM Dalam Mengembangkan Industri Pariwisata Di Tengah Pandemi Covid-19 (Studi Kasus UMKM di Kota Tasikmalaya)," *Khasanah Ilmu - Jurnal Pariwisata Dan Budaya*, vol. 12, no. 2, Art. no. 2, Sep 2021, doi: 10.31294/khi.v12i2.11293.
- [3] D. Riswan, H. E. R. Putra, dan R. N. Saputra, "Pengembangan Sistem Rekomendasi Berbasis Kecerdasan Buatan Untuk Meningkatkan Pengalaman Pengguna Di Platform E-Commerce," *Jurnal Komputer Teknologi Informasi dan Sistem Informasi (JUKTISI)*, vol. 2, no. 3, Art. no. 3, Feb 2024, doi: 10.62712/juktisi.v2i3.145.
- [4] A. Adenowo dan B. Adenowo, "Software Engineering Methodologies: A Review of the Waterfall Model and Object- Oriented Approach," *International Journal of Scientific and Engineering Research*, vol. 4, hlm. 427–434, Sep 2020.
- [5] S. Yulina, S. P. Arifin, dan Y. D. L. Widyasari, "PELATIHAN PENGEMBANGAN KOMPETENSI SISWA DALAM MERANCANG UI/UX MENGGUNAKAN FIGMA PADA SMK MUHAMMADIYAH 2 PEKANBARU," *Jurnal Pengabdian Masyarakat Multidisiplin*, vol. 8, no. 1, Art. no. 1, Okt 2024, doi: 10.36341/jpm.v8i1.4982.
- [6] C. Ningki dan N. P., "Implementasi Aplikasi Penjualan Produk Tradisional Berbasis Website Menggunakan Metode Waterfall," *Informatik : Jurnal Ilmu Komputer*, vol. 19, no. 2, Art. no. 2, Sep 2023, doi: 10.52958/iftk.v19i2.6149.
- [7] R. Risald, "IMPLEMENTASI SISTEM PENJUALAN ONLINE BERBASIS E-COMMERCE PADA USAHA UKM IKE SUTI MENGGUNAKAN METODE WATERFALL," *Journal of Information and Technology*, vol. 1, hlm. 37–42, Agu 2021, doi: 10.32938/jitu.v1i1.1393.
- [8] M. Hendriawan, T. Budiman, V. Yasin, dan A. S. Rini, "PENGEMBANGAN APLIKASI E-COMMERCE DI PT. PUTRA SUMBER ABADI MENGGUNAKAN FLUTTER," *Journal of Information System, Informatics and Computing*, vol. 5, no. 1, Art. no. 1, Jun 2021, doi: 10.52362/jisicom.v5i1.371.
- [9] S. Aisyah, R. Amelia, I. Sabrina, dan T. Syahrifah, "PERANCANGAN APLIKASI E-COMMERCE PADA TOKO LILI DENGAN PENERAPAN METODE WATERFALL," *Jurnal Sistem Informasi dan Ilmu Komputer*, vol. 5, no. 1, Art. no. 1, Agu 2021, doi: 10.34012/jurnalsisteminformasidanilmukomputer.v5i1.1917.
- [10] T. Haryati, D. H. Kusuma, dan H. Ferliyanti, "Penerapan Metode Waterfall Sebagai Pengembangan Perangkat Lunak Sistem Informasi Penjualan PT. Arta Putra Nugraha Karawang," *Simpatik: Jurnal Sistem Informasi dan Informatika*, vol. 1, no. 2, Art. no. 2, Des 2021, doi: 10.31294/simpatik.v1i2.955.
- [11] R. A. Ghani, N. W. Azani, S. N. Auliani, S. Maharani, M. D. Gustinov, dan M. L. Hamzah, "Perancangan Sistem Informasi e- Commerce Berbasis Website Menggunakan Metode Waterfall," *Prosiding Seminar Nasional Teknologi Informasi dan Bisnis*, hlm. 99–106, Jul 2022.
- [12] A. Hidayat, F. Faisal, K. P. Harum, dan M. M. Fakhri, "Sistem Informasi Permintaan Barang Atk (Alat Tulis Kantor) Pada Pengadilan Negeri Makassar Kelas Ia Khusus," *Jurnal Media Elektrik*, vol. 20, no. 2, hlm. 77–85, 2023.
- [13] B. Yuanita, M. M. Fakhri, dan W. Hidayat, "Sistem Informasi Medical Record Pasien Pada Puskesmas Sudu Kec. Alla Kab. Enrekang Berbasis Website," *Journal of Embedded Systems, Security and Intelligent Systems*, hlm. 93–100, 2021.
- [14] Fariz Rahmat Mulyadi dan Yuda Syahidin, "Rancang Bangun Sistem Informasi Kepegawaian dengan Metode Waterfall," *Explore: Jurnal Sistem Informasi dan Telematika*, vol. 12, no. 2, hlm. 186–196, Des 2021, doi: 10.36448/jsit.v12i2.2056.
- [15] "A Wearable Sonification System to Improve Movement Awareness: A Feasibility Study." Diakses: 24 April 2025. [Daring]. Tersedia pada: <https://www.mdpi.com/2076-3417/14/2/816>

- [16] M. Prihandoyo, "Unified Modeling Language (UML) Model Untuk Pengembangan Sistem Informasi Akademik Berbasis Web," *Jurnal Informatika: Jurnal Pengembangan IT*, vol. 3, hlm. 126–129, Jan 2018, doi: 10.30591/jpit.v3i1.765.
- [17] S. Syauqi dan S. Suendri, "Information System Design of Web-Based Document Archives Management In The Office Bappeda of North Sumatra Province," *Journal of Information Systems and Technology Research*, vol. 1, no. 1, Art. no. 1, Jan 2022, doi: 10.55537/jistr.v1i1.66.
- [18] M. M. Fakhri, M. S. J. Irmawan, A. S. Alwi, I. F. Asril, N. Q. Ridhaihi, dan D. Fadhilatunisa, "Perancangan Sistem Informasi Manajemen Karyawan Berbasis Website dengan Metode Waterfall," *Jurnal Mediatik*, hlm. 35–44, 2023.
- [19] Z. A. Hamza dan M. Hammad, "Analyzing UML use cases to generate test sequences," Jan 2021, Diakses: 24 April 2025. [Daring]. Tersedia pada: <https://journal.uob.edu.bh:443/handle/123456789/3923>
- [20] R. Fauzan, D. Siahaan, S. Rochimah, dan E. Triandini, "Automated Class Diagram Assessment using Semantic and Structural Similarities," *International Journal of Intelligent Engineering and Systems*, vol. 14, no. 2, hlm. 52–66, 2021, doi: 10.22266/ijies2021.0430.06.
- [21] M. R. Wayahdi dan F. Ruziq, "Pemodelan Sistem Penerimaan Anggota Baru dengan Unified Modeling Language (UML) (Studi Kasus: Programmer Association of Battuta)," *Jurnal Minfo Polgan*, vol. 12, no. 1, Art. no. 1, Agu 2023, doi: 10.33395/jmp.v12i1.12870.
- [22] Y. S. Purbo, F. S. Utomo, dan Y. Purwati, "Analisis dan Perancangan Antarmuka Aplikasi Wisata Menggunakan Metode User Centered Design (UCD)," *Jurnal Teknologi Terpadu*, vol. 9, no. 2, Art. no. 2, Des 2023, doi: 10.54914/jtt.v9i2.977.
- [23] M. Muauwanah, H. D. Saputra, M. Afifudin, dan M. Y. P. Chusnani, "Implementasi Pengujian Black Box pada Form Login E-Learning di Universitas Airlangga," *Jurnal Sistem Informasi, Manajemen dan Teknologi Informasi*, vol. 2, no. 2, Art. no. 2, Jul 2024, doi: 10.33020/jsimtek.v2i2.727.
- [24] "Keamanan Sebuah Sistem Point of Sale: Sampai Se jauh Mana?" Diakses: 24 April 2025. [Daring]. Tersedia pada: <https://www.opaper.app/blog/keamanan-point-of-sale>
- [25] C. A. Pamungkas dan A. Lutfiyani, "Sistem Informasi Kasir pada Usaha Serba Rasa Food Program Wirausaha Merdeka IPB University Berbasis Website Menggunakan Metode Waterfall," *Jurnal Penelitian Inovatif*, vol. 4, no. 2, Art. no. 2, Apr 2024, doi: 10.54082/jupin.314.
- [26] Lesmono, I. D. (2018). RANCANG BANGUN SISTEM INFORMASI PENJUALAN SEPATU BERBASIS WEBSITE DENGAN METODE WATERFALL. *Swabumi*, 6(1). <https://doi.org/10.31294/swabumi.v6i1.3316>