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Analysis of the Effectiveness of the Management Information System for Skill and People Development Training License Borrowing

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Abstract

The Skill & People Development (SPD) Department at company XYZ currently relies on Microsoft Excel as the primary tool for managing training license borrowing. This conventional approach presents several limitations, including a high potential for human error, inefficient administrative processes, and limited capability to monitor license availability in real-time. Based on these identified problems and user requirement analysis, this study aims to design and implement a Web-Based Training License Borrowing Management Information System for the SPD Department as a more effective digital solution. The system was developed using the Waterfall software development method, leveraging the C# programming language and the ASP.NET Core MVC framework, with SQL Server as the database management system. System effectiveness evaluation was conducted through a quantitative approach by distributing pre-test and post-test questionnaires to 30 internal respondents, representing the total population of users within the department. The collected data were then analyzed using the non-parametric statistical method Wilcoxon Signed Rank Test. User satisfaction levels were also precisely measured using the System Usability Scale (SUS). The research results demonstrated significant improvements across all tested aspects: speed increased from a mean of 6.87 to 24.37 (+254.7%), accuracy from 6.93 to 24.40 (+252.4%), ease of use from 8.50 to 24.70 (+190.6%), and user comfort from 6.50 to 24.87 (+282.6%). The Wilcoxon Signed Rank Test yielded significance values of $p < 0.001$ for all aspects, confirming a statistically significant difference between pre- and post-implementation conditions. Furthermore, the System Usability Scale (SUS) score of 99.83, categorized as Best Imaginable (Grade A+), indicates an exceptionally high level of user satisfaction with the system interface.

Keywords*: License Management System, Information System Effectiveness, Wilcoxon Signed Rank Test, System Usability Scale, ASP.NET Core MVC*

1. Introduction

Business capability in managing and developing human resources is crucial for organizational success and sustainability in the era of globalization and increasingly competitive manufacturing industry. XYZ Company, which operates in electronic device assembly such as printers, scanners, watches, and various types of printing ink, is highly committed to enhancing employee competencies through continuous training. The Skill & People Development (SPD) Department is responsible for implementing these development activities and plays a strategic role in planning and managing various training programs.

The training organized by the SPD Department aims to improve employees' technical competencies, which are subsequently validated through internal work eligibility certification. In practice, this training process heavily depends on the availability of professional software licenses. Without active and properly allocated licenses, instructors cannot demonstrate materials, and employees cannot practice training modules. Consequently, competency standards are not achieved, and employees fail to obtain certifications required to operate specific machines or systems in production areas.

Currently, the license borrowing management process is still conducted conventionally using Microsoft Excel as the primary tool. Based on SPD Department operational data, there are approximately 30 to 50 training license borrowing transactions per month. All borrowing and return transactions are recorded manually, where staff must input license names, employee numbers, quantities, and start/end dates of use. Given this transaction volume, the conventional method often creates various operational constraints that hinder performance.

The recording process has proven inefficient, as SPD staff require an average of 15 to 20 minutes merely to process documentation, check stock availability, and verify data for a single borrowing transaction. Beyond being time-consuming, this method is highly susceptible to human error. Common errors encountered in the field include typographical mistakes, duplicate data entries, and risks of file corruption or data loss due to simultaneous Excel file access by multiple parties. These errors result in inaccurate license availability data, directly impacting training program continuity due to unavailability of ready-to-use licenses. Additionally, staff face difficulties and require excessive time to compile monthly borrowing recapitulation reports.

As a solution to these problems, the researcher designed a web-based system titled "Design of a Web-Based SPD Training License Borrowing Management Information System at XYZ Company" based on the case study at XYZ Company. The system operates using C# with the ASP.NET Core Model-View-Controller (MVC) framework and SQL Server database to support data storage and management. With this web-based management information system, all processes from borrowing, returning, to license reporting can be conducted more rapidly, structured, accurate, and in real-time.

However, system success evaluation must be reviewed from two main aspects: significance of performance improvement and level of user acceptance. In this study, data collection was conducted through In-Depth Interviews to explore user requirements and questionnaire distribution for system evaluation. The obtained data were processed using descriptive statistical analysis to provide a general data overview, followed by inferential testing. To statistically measure system effectiveness, the Wilcoxon test was employed to analyze the significance of work efficiency differences among SPD staff between pre- and post-system implementation conditions [1]. On the other hand, to ensure system operability, usability aspects were measured using the System Usability Scale (SUS) method. The SUS method was selected for its advantage in providing objective and valid user satisfaction assessments, even with limited research sample sizes [2].

Furthermore, effectiveness analysis also helps identify system strengths and limitations, serving as evaluation material for further development whether regarding features, user-friendliness, or integration with other company systems. The software development method used in this research is the Waterfall method, as it enables researchers to complete each development stage systematically, from requirements analysis, system design, implementation, testing, to system maintenance [3].

2. Research Method

A. Research Flow

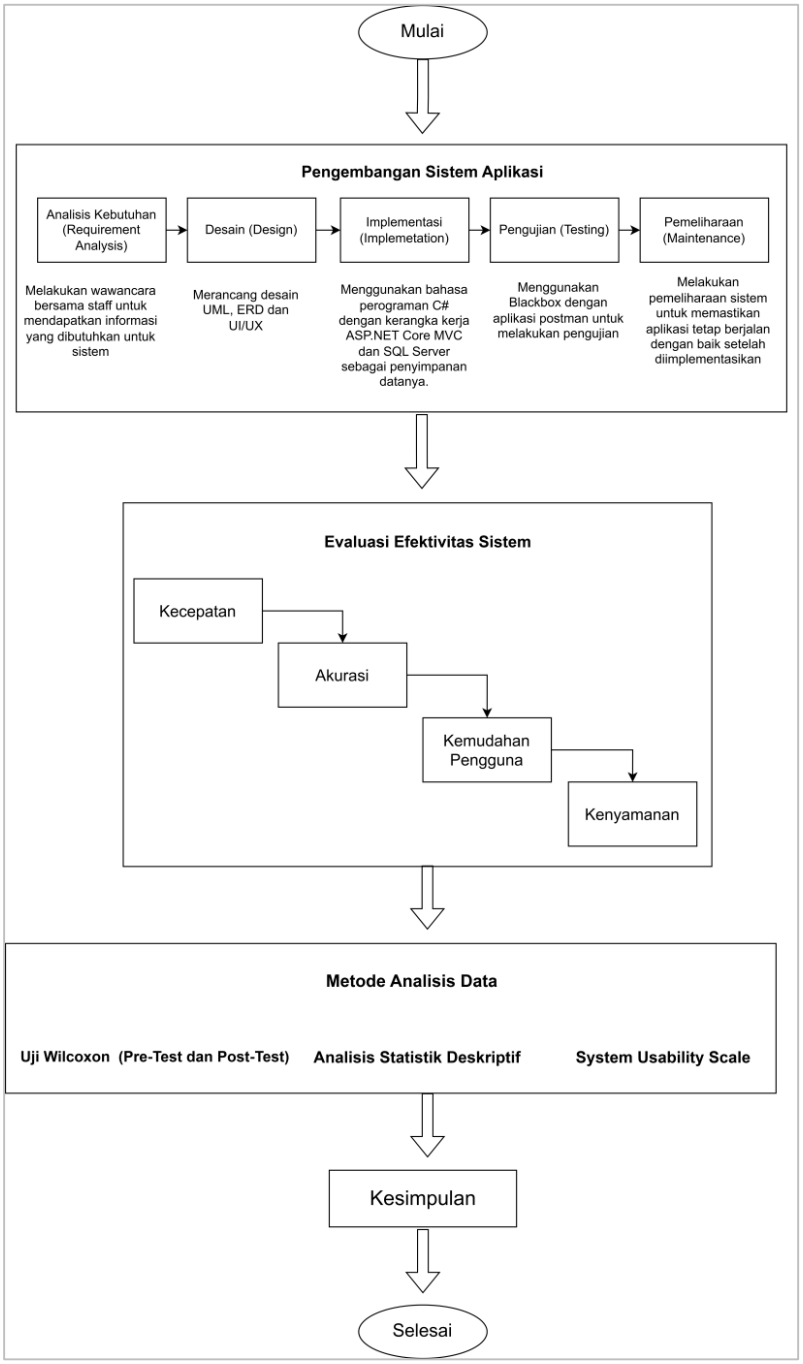


Figure 1. Research Flow

The following is an explanation of the research stages based on figure 1:

1. Start this marks the beginning of the research process, initiated with problem identification at XYZ Company.
2. Application system development the following explains the stages of application system development:
    1. Requirements Analysis: This stage involves collecting all system requirements by conducting interviews with SPD staff to understand business processes, existing problems with the conventional system (Excel), and other requirements for the new system.
    2. System Design: In this stage, the researcher processes the requirements gathered through interviews with SPD staff. To clarify the workflow, the researcher designs use case diagrams and activity diagrams to understand the system workflow, then designs the database structure using Entity Relationship Diagrams (ERD), and finally designs the visual user interface (UI/UX) using Figma.
    3. Implementation: In this stage, all design outputs are translated into functional program code.

Coding is then performed using the C# programming language with the ASP.NET Core MVC framework and SQL Server as the database.

4. Testing: The system is tested after all implementation is complete. This testing aims to ensure there are no errors and that all functionalities operate according to established specifications. The method used is Black Box Testing, which focuses on functionality. Additionally, usability testing is conducted to evaluate whether users find the website comfortable, easy to use, and user-friendly.
5. Maintenance: After the system is deployed for user access, this stage includes bug fixes that may be discovered later, as well as potential feature additions or updates in the future based on user feedback.

3. System effectiveness evaluation. After the system is completed and functionally tested, the next stage is to measure the extent to which the system is truly effective and provides positive impact. This evaluation is based on four main aspects:
   1. Speed: Measuring whether the new system can accelerate the license borrowing and return processes compared to the conventional method.
   2. Accuracy: Assessing whether the system can reduce human error, such as incorrect data input or duplicate records.
   3. Ease of Use: Measuring how intuitive and easy the system is to use for SPD staff and employees.
   4. Comfort: Measuring the overall satisfaction and comfort level of users when interacting with the system.
4. Data analysis method this is the stage where the researcher processes data obtained from the evaluation phase to produce scientifically valid findings:
   1. Descriptive Statistical Analysis: Data collected from questionnaires (before and after system implementation) is processed to identify patterns. Results are presented in the form of frequency tables, graphs, and mean values, providing a general overview of user perceptions.
   2. Wilcoxon Signed Rank Test: A statistical test used to compare paired data (pre-test vs. post-test questionnaire results). The objective is to statistically prove whether there is a significant difference in work effectiveness after the new system is implemented.
   3. System Usability Scale (SUS): A test that processes questionnaire data from the evaluation stage using the standard SUS formula to obtain a final score representing the level of user acceptance and satisfaction with the system.

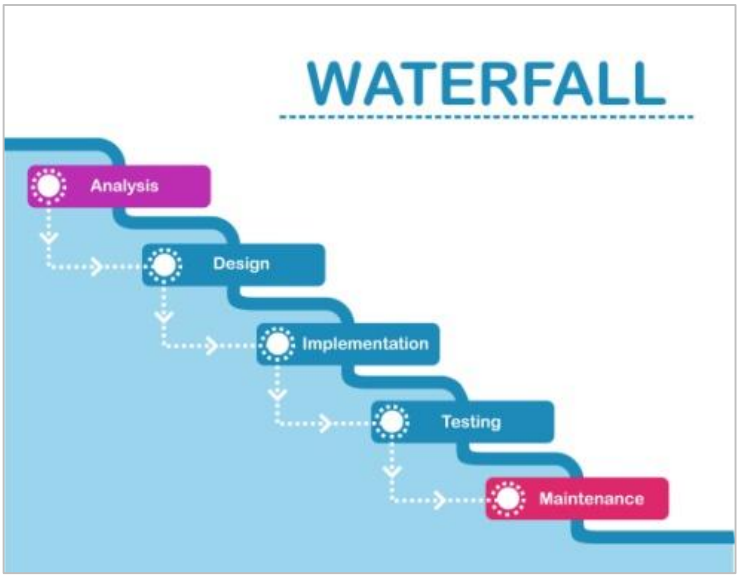
5. Application Development Stages

The application development stages in this research follow the Waterfall method. This method was selected because it aligns with the characteristics of research focused on developing web-based information systems with clearly defined requirements. As cited from Sapardi et al. (2023), the Waterfall method consists of requirements analysis, system design, implementation, testing, and maintenance. The development stages are illustrated below.

B. Application Development Stages

Figure 2. Application Development Stages

Source: Technology Advice



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requirements. As cited from Sapardi et al. (2023), the Waterfall method consists of requirements analysis, system design, implementation, testing, and maintenance. The development stages are illustrated in Figure 2 below.

The following are the stages of the Waterfall method:

1. Requirement Analysis

In this initial phase, the main focus is to identify and formulate user requirements related to the system to be developed. To achieve this objective, the researcher conducted in-depth interviews with SPD staff to understand the existing business processes and various constraints arising from the use of the conventional Excel-based system. The output of this phase is a document detailing the functional and non-functional requirements of the system.

2. System Design

After system requirements are defined, the next stage is to perform system design using the Model–View–Controller (MVC) approach. This design includes creating UML diagrams such as use case diagrams and activity diagrams to illustrate system workflows, developing an Entity Relationship Diagram (ERD) to design the database structure, designing the user interface (UI/UX) using Figma, and structuring the web-based system architecture using the ASP.NET Core MVC framework. This stage aims to ensure that the system design can serve as the primary reference during implementation.

3. Implementation

In the implementation stage, all outputs from the design phase are translated into functional program code. The researcher built the system using the C# programming language supported by the ASP.NET Core MVC framework. For data storage, the system utilizes the SQL Server database. The main features developed in this stage include login functionality, license data management, borrowing and return processes, notification systems, and license reporting features. The final output of this stage is an operational web-based application ready to undergo the testing process.

4. Testing

The testing stage aims to verify that the built system can function according to the requirements established in the analysis phase. The method applied is Black Box Testing, where testing focuses on system functionality from the user's perspective without the need to examine the internal code structure. This testing covers critical features such as the login process, borrowing and return workflows, account management, and report generation. Additionally, user satisfaction measurement, such as the System Usability Scale (SUS), was also conducted to validate non-functional aspects including ease of use, interface clarity, and interaction comfort. This step is important to ensure that the system not only functions correctly but also provides a good user experience before full deployment.

5. Maintenance

The final stage is system maintenance to ensure the application continues to run properly after implementation. Activities performed include bug fixes, feature updates, and interface improvements based on user feedback. This stage also serves to ensure the system remains relevant to the future needs of the SPD department.

C. System Overview

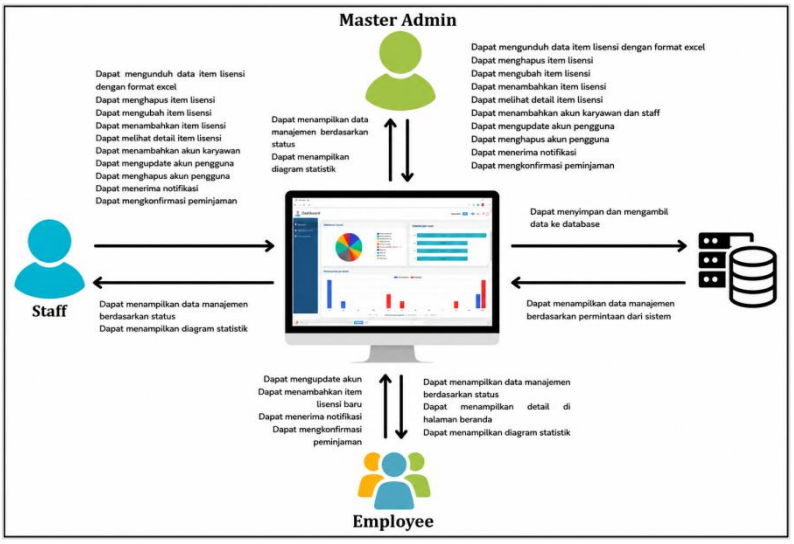

Figure 3 System Overview

The system overview in Figure 3 shows the interaction between actors and the system in managing license borrowing. The development of this system involves 3 actors: Staff, Master Admin, and Employee, where each actor has different roles.

D. Functional Requirements

Functional requirements are detailed explanations of what actions the software to be built must perform to meet user needs. In building this SPD training management information

system, there are several functional requirements in Table 1, as follows:

Table 1 Functional Requirements

Code	Functional Requirements
F001	Staff and employees can register if they do not yet have an account
F002	System can perform login authentication according to user role
F003	Users can access the homepage before entering the dashboard
F004	Users can submit license borrowing requests
F005	Staff and Master Admin can modify license borrowing request data
F006	Staff and Master Admin can delete license borrowing request data
F007	Staff and Master Admin can export license data to Excel and PDF formats
F008	Users can view detailed information for each license borrowing request
F009	Users can display the dashboard page containing summary information and statistical diagrams
F010	Staff and Master Admin can confirm license borrowing requests
F011	Staff and Master Admin can add new user accounts
F012	Users can modify their own account data
F013	Users can view system notifications
F014	Staff and Master Admin can delete user accounts
F015	Employees can confirm license returns
F016	Master Admin can access and view the audit log page
F017	System can securely terminate user sessions during the logout process

E. Non - Functional Requirements

In building this SPD training equipment borrowing management information system, there are several non-functional requirements in Table 2 as follows:

Table 2 Non-Functional Requirements

Security	The system must protect data from unauthorized access through login mechanisms and role-based access restrictions
Usability	The system interface must be designed to be intuitive, responsive, and easy to use by users with varying levels of technical expertise
Language	The system uses English

F. Use Case Diagram

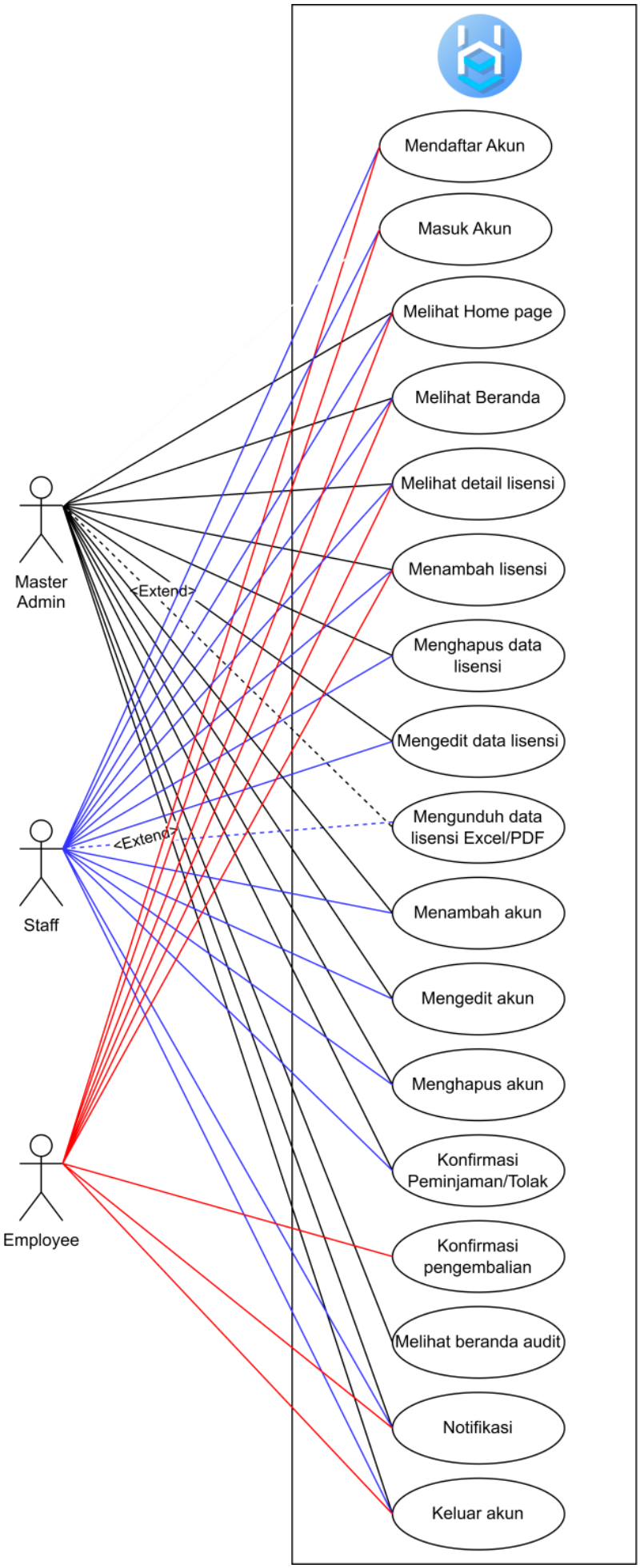

Figure 4. Use Case Diagram

The Use Case diagram illustrates the functional interactions between the system and three primary actors: Master Admin, Staff, and Employee, each defined by specific privileges and responsibilities. The Master Admin, exclusively held by the SPD Supervisor, possesses the highest level of authority to oversee the entire system, including managing license items, controlling user accounts, and exclusively accessing the audit log to monitor security activities. The Staff acts as the operational personnel within the SPD department, assisting in daily administrative tasks such as adding or updating license data, managing employee user accounts, and exporting data to Excel or PDF formats. Finally, the Employee represents users from various multi-departments who utilize the system to browse license details, submit borrowing requests, confirm returns, and update their own profile information.

In addition, the Use Case Diagram also demonstrates the implementation of role-based access control within the system. Each actor is granted access only to features that correspond to their responsibilities, thereby improving operational efficiency and maintaining data security. This separation of roles helps minimize unauthorized access and ensures that all system activities are performed according to the designated authority of each user.

Furthermore, the diagram reflects the integration of core system functionalities such as authentication, borrowing management, return confirmation, notification handling, and report generation. Through these interactions, the system supports real-time information access and enables the SPD department to manage training license activities in a more structured and transparent manner. Therefore, the Use Case Diagram serves not only as a visualization of user interactions, but also as a foundation for designing the system workflow and validating the functional requirements of the application.

G. ERD (Entity Relationship Diagram)

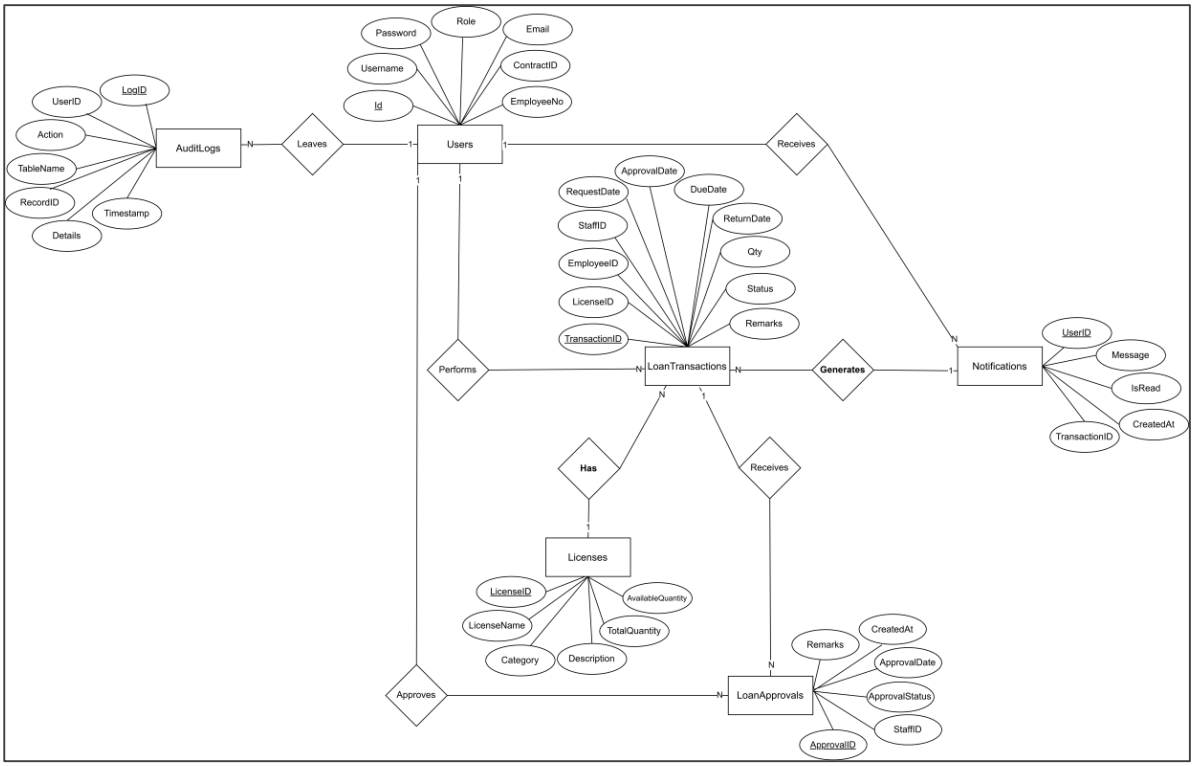

Figure 5. ERD

The Entity Relationship Diagram (ERD) in Figure 5 illustrates the relational structure among entities in the Training License Borrowing Management Information System database. This ERD consists of six main entities that are interconnected to manage user data, licenses, borrowing transactions, approvals, audit logs, and notifications.

H. Analysis Plan

The researcher designed an analysis plan to assess the effectiveness level of the web-based SPD Training License Borrowing Management Information System implemented at XYZ Company. The primary objective of this analysis is to identify the extent to which the system contributes to improving operational efficiency, data management accuracy, information transparency, as well as user experience and satisfaction (Hastriyandi & Wahyuni, 2023). To achieve this objective, the researcher outlined several analytical steps as described below.

1. Data Collection

At this stage, the researcher utilized two main instruments: in-depth interviews and questionnaires. Interviews were conducted first with the aim of obtaining comprehensive information regarding the use of the conventional Microsoft Excel-based system, including its effectiveness and constraints encountered during the license borrowing process (Pasaribu, 2021). The interview results served as the foundation for formulating the functional requirements of the system to be developed. Subsequently, the questionnaire instrument was employed in two phases: pre-test and post-test. The pre-test phase was conducted before users operated the web-based Management Information System (MIS) to measure perceptions, experiences, and obstacles within the conventional system, while the post-test phase was conducted after system implementation to evaluate improvements in effectiveness, ease of use, accuracy, and user comfort levels.

2. Data Analysis

Data obtained through questionnaires were then analyzed using a descriptive statistical approach. This analysis aimed to describe the distribution of responses, trend tendencies, and user satisfaction levels toward the system (Hardianti et al., 2025). The analysis results were presented in the form of frequency tables, graphs, and mean values to facilitate easier understanding of the obtained information. Through this stage, the researcher endeavored to present a comprehensive

overview of the extent to which the web-based management information system has met user expectations and needs within the company environment.

3. Test of Significant Differences

To identify significant changes in user experience before and after system implementation, the researcher employed the Wilcoxon Signed Rank Test method. This test was selected because it is appropriate for paired data that do not meet the assumption of normal distribution. Through this analysis, it can be determined to what extent the implementation of the web-based MIS influences improvements in efficiency during the license borrowing and return processes, data access speed, information accuracy, ease of use, as well as work transparency and user comfort (Hardianti et al., 2025).

4. System Testing

In addition to analyzing user data, the researcher also conducted technical testing on the system using the Black Box Testing method. The objective of this testing is to ensure that all main features, such as the login process, borrowing, returns, and report generation, function according to the designed specifications. Additionally, user satisfaction measurement, such as the System Usability Scale (SUS), was also conducted to validate non-functional aspects including ease of use, interface clarity, and interaction comfort. This step is important to ensure that the system not only functions correctly but also provides a good user experience before full deployment.

3. Result and Discussion

A. Implementation Results

The implementation phase produced a web-based SPD Training License Borrowing Management Information System, developed using the C# programming language with the ASP.NET Core MVC framework and SQL Server as the database management system. The system is accessible by three user roles: Master Admin, Staff, and Employee.

1. Home Page

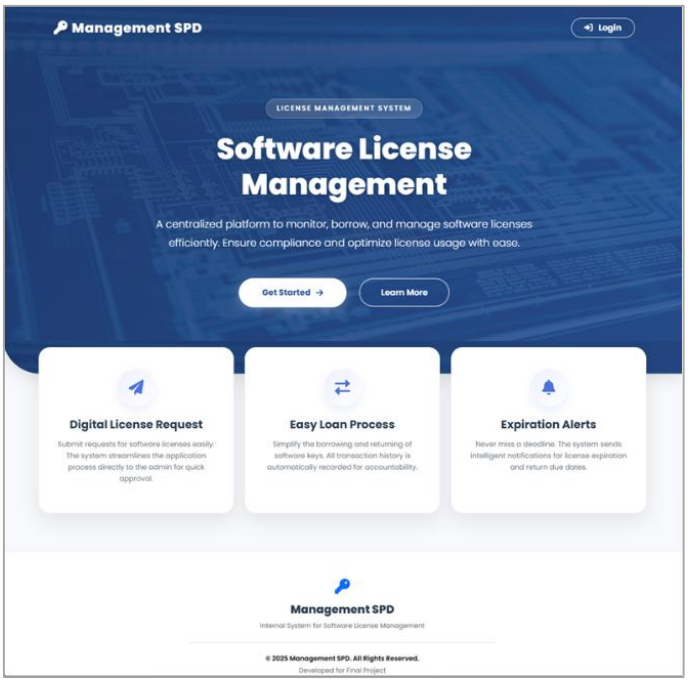

Figure 6. Home Page

2. Login Page

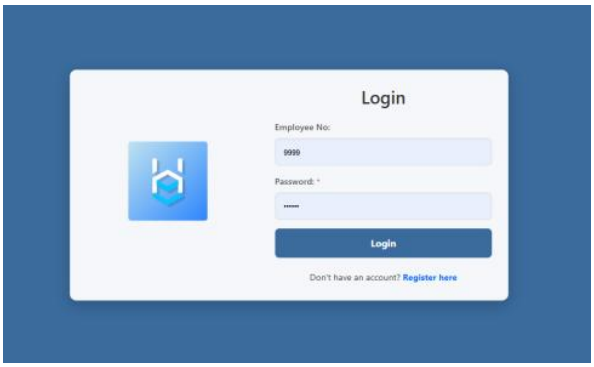

Figure 7. Login Page

3. Dahsboard Page

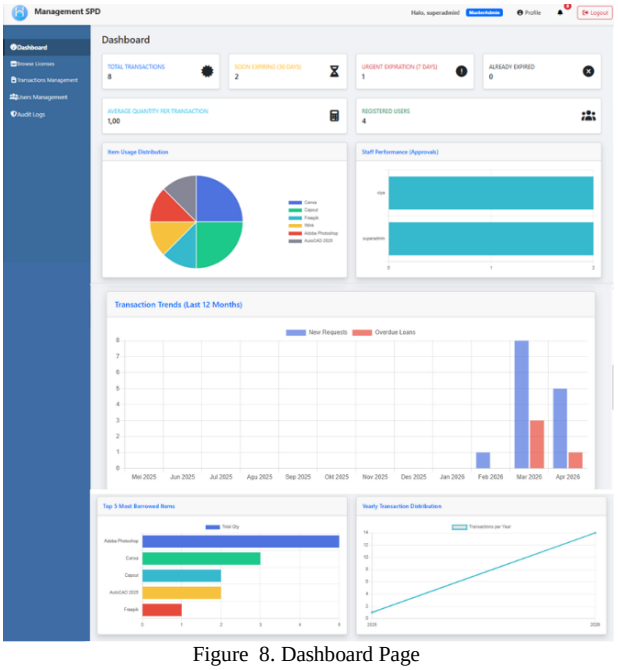

Figure 8. Dashboard Page

4. Browse Licenses Page

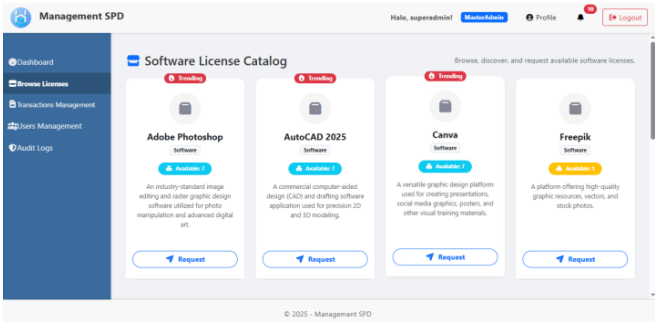

Figure 9. Browse Licenses Page

5. Transaction Management Page

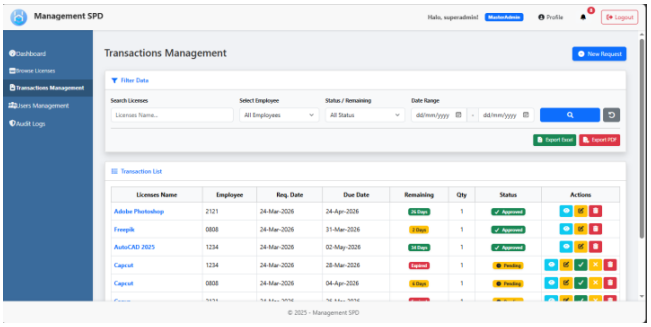

Figure 10. Transactions Management Page

6. Borrowing Form Page

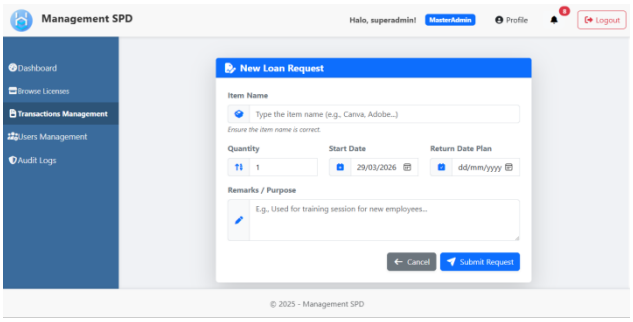

Figure 11. Borrowing Form Page

B. Analysis Results

This section presents the analysis results based on the plan established in Section H, including qualitative findings from interviews, descriptive statistical results, Wilcoxon Signed Rank Test, and System Usability Scale (SUS) measurement. The integration of various data sources was conducted to obtain a comprehensive overview of the effectiveness of the web-based SPD Training License Borrowing Management Information System.

1. Qualitative Findings: SPD Staff Interview Results

Prior to system development, the researcher conducted in-depth interviews with representatives from the SPD Department to understand the workflow and constraints of the conventional Microsoft Excel-based system. The interview results identified three main problems in the conventional system:

1. Inefficient manual recording process
2. High risk of human error
3. Limited transparency and access

Respondents emphasized the importance of a new system that is fast, accessible from anywhere, ensures data security, and provides information transparency. These qualitative findings formed the basis for formulating the functional requirements of the developed web-based system.

2. Descriptive Statistical Analysis: Pre-Test vs Post-Test

Quantitative data were obtained through pre-test and post-test questionnaires distributed to 30 respondents. Each aspect was measured using 5 Likert-scale items (1–5), resulting in total scores per aspect ranging from 5 to 25. The descriptive statistical results are presented in Table 3.

Table 3. Descriptive Statistical Analysis: Pre-Test vs Post-Test

Descriptive Statistics

	Valid	Missing	Median	Mean (arithmetic)	Std. Deviation	Minimum	Maximum
Kecepatan_Pre	30	0	7.000	6.867	1.456	5.000	10.00
Akurasi_Pre	30	0	7.000	6.933	1.461	5.000	10.00
Kemudahan_Pre	30	0	8.500	8.367	1.847	5.000	10.00
Kenyamanan_Pre	30	0	6.000	6.500	1.925	5.000	10.00
Kecepatan_Post	30	0	24.50	24.37	0.718	23.00	25.00
Akurasi_Post	30	0	25.00	24.40	0.932	22.00	25.00

Descriptive Statistics

	Valid	Missing	Median	Mean (arithmetic)	Std. Deviation	Minimum	Maximum
Kemudahan_Post	30	0	25.00	24.70	0.651	23.00	25.00
Kenyamanan_Post	30	0	25.00	24.87	0.346	24.00	25.00

Source of the calculation in the JASP 0.96.0.0 software

Based on Table 3, the descriptive statistical analysis results indicate significant differences between pre-test and post-test scores across the four tested aspects (speed, accuracy, ease of use, and comfort).

In the pre-test phase, the mean scores for the four aspects ranged from 6.500 to 8.367 out of a maximum score of 25. The comfort aspect had the lowest mean score (6.500) with a standard deviation of 1.925, while the ease of use aspect had the highest mean score (8.367) with a standard deviation of 1.847. The relatively high standard deviation values (1.456–1.925) indicate considerable variation in respondents' assessments of the conventional Excel-based system. Pre-test scores ranged from 5 to 10, indicating negative user perception toward the legacy system.

The highest percentage increase occurred in the comfort aspect at 282.6% (from 6.50 to 24.87), followed by speed at 254.7% (from 6.87 to 24.37), accuracy at 252.4% (from 6.93 to 24.40), and ease of use at 195.6% (from 8.37 to 24.70). These results demonstrate that the implementation of the web-based license management system successfully enhanced user perception and experience significantly.

3. Wilcoxon Signed Rank Test

The Wilcoxon Signed Rank Test was conducted to examine the significance of differences between pre-test and post-test scores across the four aspects (speed, accuracy, ease of use, and comfort). This test was selected because the paired data did not meet the assumption of normal distribution. The hypotheses tested were:

H_0: There is no significant difference between pre-test and post-test scores.

H_1: There is a significant difference between pre-test and post-test scores.

Decision criteria: H_0 is rejected if $p < 0.05$. The Wilcoxon test results for the four aspects are presented in Table 4.

Table 4 wilcoxon Signed Rank Test

Paired Samples T-Test

Measure 1		Measure 2	W	z	df	p	Rank-Biserial Correlation	SE Rank-Biserial Correlation
Kecepatan_Pre	-	Kecepatan_Post	0.000	-4.782		< .001	-1.000	0.206
Akurasi_Pre	-	Akurasi_Post	0.000	-4.782		< .001	-1.000	0.206
Kemudahan_Pre	-	Kemudahan_Post	0.000	-4.782		< .001	-1.000	0.206
Kenyamanan_Pre	-	Kenyamanan_Post	0.000	-4.782		< .001	-1.000	0.206

Note. Wilcoxon signed-rank test.

Source of the calculation in the JASP 0.96.0.0 software

Based on Table 4, all aspects showed $p < .001$, which is much smaller than the significance level $\alpha = 0.05$. Therefore, H_0 is rejected and H_1 is accepted for all tested aspects. This statistically proves that the implementation of the web-based SPD Training License Borrowing Management Information System had a highly significant impact on improving users' operational efficiency.

The W statistic value of 0.000 for all aspects indicates that all 30 respondents experienced score improvements from pre-test

to post-test without any decrease. The negative z-value of -4.782 indicates a consistent direction of difference toward improvement. Additionally, the Rank-Biserial Correlation value of -1.000 indicates a very large and perfect effect size, with the negative correlation showing consistent direction of change from low scores (pre-test) to high scores (post-test).

4. System Usability Scale (SUS)

The measurement of system usability was conducted using the System Usability Scale (SUS) method. Descriptive analysis results from 30 respondents indicated that the developed system possesses a very high level of usability. The list of SUS questions is presented in Table 5 below.

Table 5. System Usability Scale Questions

Code Q	Question	Type
Q1	I think that I would like to use this system frequently.	Positive
Q2	I found the system unnecessarily complex.	Negative
Q3	I thought the system was easy to use.	Positive
Q4	I think that I would need the support of a technical person to be able to use this system.	Negative
Q5	I found the various functions in this system were well integrated.	Positive
Q6	I thought there was too much inconsistency in this system.	Negative
Q7	I would imagine that most people would learn to use this system very quickly.	Positive
Q8	I found the system very cumbersome to use.	Negative
Q9	I felt very confident using the system.	Positive
Q10	I needed to learn a lot of things before I could get going with this system.	Negative

The following are the detailed results:

1. Statistic Descriptive

Table 6. System Usability Scale (SUS) - Descriptive Statistics

Descriptive Statistics

	Valid	Missing	Mean (arithmetic)	Mean (geometric)	Std. Deviation	Minimum	Maximum
skor sus	30	0	99.83	99.83	0.913	95.00	100.0

Source of the calculation in the JASP 0.96.0.0 software

Based on Table 6 (Descriptive Statistics output from JASP), the following data were obtained:

1. Mean: 99.83 out of a maximum score of 100.
2. Standard Deviation (SD): 0.913.
3. Minimum: 95.00.
4. Maximum: 100.00.

Interpretation: The mean score of 99.83 indicates that, overall, all respondents rated the system as having near-perfect ease of use. The very low standard deviation (0.913) indicates that assessments among respondents were highly consistent; there were no significant differences in perspectives regarding system usability. The narrow score range (between 95 and 100) further strengthens the evidence that the system was exceptionally well-received by all users.

2. Frequency Distribution (Frequency Tables)

Table 7. System Usability Scale (SUS) - Frequency Tables

Frequencies for score SUS

skor sus	Frequency	Percent	Valid Percent	Cumulative Percent
95	1	3.3	3.3	3.3
100	29	96.7	96.7	100.0
Missing	0	0.0		
Total	30	100.0		

Source of the calculation in the JASP 0.96.0.0 software

Table 7 provides a more detailed overview of the score distribution:

1. Score 100: Given by 29 respondents (96.7%).
2. Score 95: Given by 1 respondent (3.3%).

Interpretation: The fact that 96.7% of respondents gave perfect scores (100) is a primary indicator of the success of the system interface. Only one respondent gave a score of 95 (still in the excellent category), possibly due to minor subjective preferences or individual factors. However, aggregately, this proves that the system is truly user-friendly.

3. Grade Classification

Referring to the System Usability Scale grade classification shown in Figure 12, the SUS score of 99.83 falls into the category "Best Imaginable" with Grade A+ (score >90).

Angka SUS	Nilai	Adjektif	Persentil
84.1-100	A+	Best Imaginable	96-100
72.6-84.0	B- — A	Excellent	65-95
62.7-72.5	C- — C+	Good	35-64
51.7 – 62.6	D	OK	15-59
25.1 – 51.6	F	Poor	2-14
0-25	F	Worst Imaginable	0-19

Figure 12. SUS Grade Scale

Source: Medium - System Usability Scale (SUS): A Metric for Measuring Usability

This category represents the highest satisfaction level in SUS standards, indicating that the SPD Training License Borrowing Management Information System possesses exceptional usability and was very well-received by all respondents.

5. Black Box Testing Results

A summary of the Black Box Testing results indicates that all system features functioned properly, with no significant errors detected. The testing covered critical functionalities including user authentication, license borrowing workflow, approval/rejection processes, return confirmation, data export features, and notification systems. All 20 test scenarios passed validation, confirming that the system operates according to its specified requirements.

4. Conclusion

This research successfully developed and evaluated a Web-Based SPD Training License Borrowing Management Information System using ASP.NET Core MVC and SQL Server. Based on quantitative analysis of 30 respondents, the system demonstrated statistically significant improvements in work performance across all measured aspects: speed increased by +254.7%, accuracy by +252.4%, ease of use by +190.6%, and user comfort by +282.6%, with significance values of $p < 0.001$ for all aspects. Usability testing yielded an average System Usability Scale (SUS) score of 99.83 (Grade A+, Best Imaginable), indicating an exceptionally high level of user acceptance. The system is deemed feasible for implementation to replace the conventional Excel-based recording method.

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