

ORIGINAL RESEARCH

DESIGN AND IMPLEMENTATION OF CENTRALIZED LOAN ORIGINATION SYSTEM WITH AGILE DEVELOPMENT METHOD

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Abstract

Credit is a core business with the biggest income in the banking industry. Hundreds of customers come to the bank daily to get loan applications. Because there are a lot of customers, the loan application process can take a whole week, and some customers who can't wait too long go and come to another bank that can provide a quick loan application process. This paper proposes an application called the Loan Origination System that can facilitate the loan application process. Loan Origination System is expected to handle the loan application process from start to finish, including credit verification, risk analysis, document management, and loan processing. Agile methodology is used in developing a Loan Origination System. Agile methodology is expected to be quick and simple and have more iterative development cycles. The proposed method has been tested using functional suitability results combined with Goal Question Metrics consisting of functional appropriateness, functional correctness, and functional suitability compliances. It gets results with 83.02%, 86.43%, and 85.96%, respectively, for functional appropriateness, functional correctness, and functional suitability compliances. The result shows that the Loan Origination System application meets the requirements and is functionally suitable. The result shows that agile methodology gives the application high flexibility and adaptability, so it is possible to make changes and adjustments in a short time. The application is suitable for helping users process and review the loan application. The application is also user-friendly and, time by time can replace the manual processing of loan applications.

KEYWORDS:

Agile Methodology, Banking Industry, Design System, LOS, Software Engineering.

1 | INTRODUCTION

Since the start of the fourth industrial revolution, all enterprise-level businesses must work fast and effectively to achieve goals of survival, expansion, and profitability to sustain their operations for the foreseeable future^{[1][2][3]}. Information systems have evolved and expanded to various levels of the organization^{[4][5]}. Many companies need more information technology support to enable their business activities^[6]. A huge corporation, for instance, needs to be aware of its strengths and weaknesses to develop an effective strategy for competing^[7]. All industries, including the banking industry, are required to be fast-paced in meeting customer needs. The inclination toward more strategic information system implementation is a new trend in the field of bank digitalization^[8]. An information system is one of the most important things that can be used to compete in business and also contribute to the improvement of strength and efficiency of the company^{[9][10][11]}.

In the banking industry, credit is a core business that gives the biggest income. Every day, hundreds of customers come to the bank to get loan applications. Because there are a lot of customers, the loan application process can take a whole week or even more since the application still uses manual processes with Microsoft Excel. The impact of the slow application process is some customers who can't wait too long go and come to another bank that can provide a quick loan application process. That will cause the bank a loss, and the bank's reputation will not be good from the customer's point of view.

To meet all customers' needs, the bank needs to develop a system to facilitate the loan application process quickly. And LOS (Loan Origination System) is the answer. LOS is needed to manage the loan application process from start to finish, including credit verification, risk analysis, document management, and loan processing. This system can help financial institutions automate and optimize their loan processes, reducing human errors and increasing operational efficiency. In addition, LOS helps ensure compliance with banking and financial regulations. This system allows financing applications to be made within one working day, called "One Day Service," as long as the prospective customer can complete all financing requirements.

Based on all the bank's problems, it's really important to design a good LOS. Models and techniques used in software engineering should consist of structure to be systematic, repeatable, and ultimately more successful^[12]. In this research, the development process of the LOS application uses agile methods, which means 'to move fast and easily. Agile techniques emphasize generating a proven working product with each development cycle. They are defined by short, iterative development cycles, self-organizing teams, simplified designs, code refactoring, test-driven development, and more frequent customer involvement. These characteristics make agile methods considered lightweight methods^[12]. This research will show the development process of LOS applications using agile methodology. Using agile methodology, application development is expected to be quick and simple and have more iterative development cycles. By developing this LOS application, it is also expected to be more capable of handling the high load of loan application process.

2 | PREVIOUS RESEARCHES

Al-Nsour et al., in the paper titled *The Effect of Information Systems on Bank Performance: A Comparative Study between Islamic and Commercial Banks in Jordan*, aims to explore and analyze the implementation of Information System impact on business performance in the banking industry both for Commercial and Islamic Bank. According to the study, Commercial Banks are more advanced in using Information Systems. The study also shows that using Information Systems positively affects financial, economic, and marketing performance^[8].

Lubis et al., in a paper titled *Analisis Penggunaan Aplikasi LOS Terhadap Percepatan Aproval Kredit*, show that the loan process becomes easier, faster, and more effective. By using LOS, the analyst can work faster, and their job becomes easier to analyze loan applications and minimize human error when calculating the required data. The study also shows that using the LOS application gives positive results for Loan Application Approval^[13].

Kreecha Puphaiboon, in the paper titled *Case Study: The Use of Agile on Mortgage Application: Evidence from Thailand* presents a SCRUM Agile paradigm, Business Process Management, and Business Rule Management System to examine a case study of a mortgage loan origination project which suited more and better for rapid business requirements^[14]. Using the SCRUM Agile paradigm efficiently affected team collaboration and communication and improved user satisfaction. However, a lot of requirement modifications, unskilled project management, and a politically influenced timeline cause the budget to exceed^{[15][16][17][18]}.

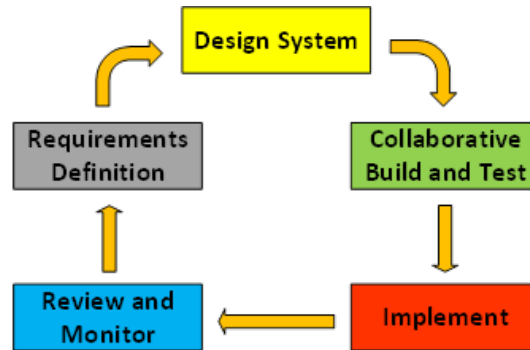


FIGURE 1 The Research Agile Method.

TABLE 1 LOS Requirement Definition

Requirement Definition	Descriptions
Process Form Loan Application	User can input, edit, and delete all the aspects of user form loan application, starting from plafond data, personal data, workplace data, salary data, and upload all required documents.
Loan Application Analysis Process	Application can calculate all the specific formulas to find the installment and other calculation data.
Loan Application Approval	User can approve the loan application online, not only just from the office.
Loan Application Settlement	User can print all the data to process the settlement of approved customers.

3 | METHOD

As mentioned, this research will use the agile method to develop the LOS. The flow of this research methodology (Figure 1) consists of 5 steps: requirement definition, design system, collaborative build and test, implement and review, and monitor.

3.1 | Requirement Definition

The first step of this research is defining the system requirements. All the problems with loan applications are discussed among the stakeholders. After all the problems are gathered, this step also discusses what the users need and what the user wants from the system to give solutions to all the problems. After defining the requirement, the development team will be more directed while developing the application. And the LOS Requirement Definition is shown in Table 1 .

3.2 | Design System

After gathering all the requirements, the next step is to design a system. In the agile method, the design system is focused on architecture and solution. This step ensures the application is of good quality and fulfills both functional and non-functional requirements. The development and business teams collaborate in this step to create the application’s main flow.

This step has two components: business flow design and application design. Business flow design is needed to make the application flow more effective, efficient, and integrated. The second is application design, which contains the application flowchart, user grouping, chosen database engine, table structure, user interface design, report design, and other information needed during the application development process. Figure 2 shows the workflow of the LOS application.

The LOS application is running at several user levels based on the workflow. User grouping is an essential process that divides users into distinct groups based on their behaviors or functionality. User grouping is needed to specify every user’s job description in the application. By understanding the job desc of each group, the developers can easily develop features and functionalities relevant to each user group. And the LOS grouping users are shown in Table 2 .

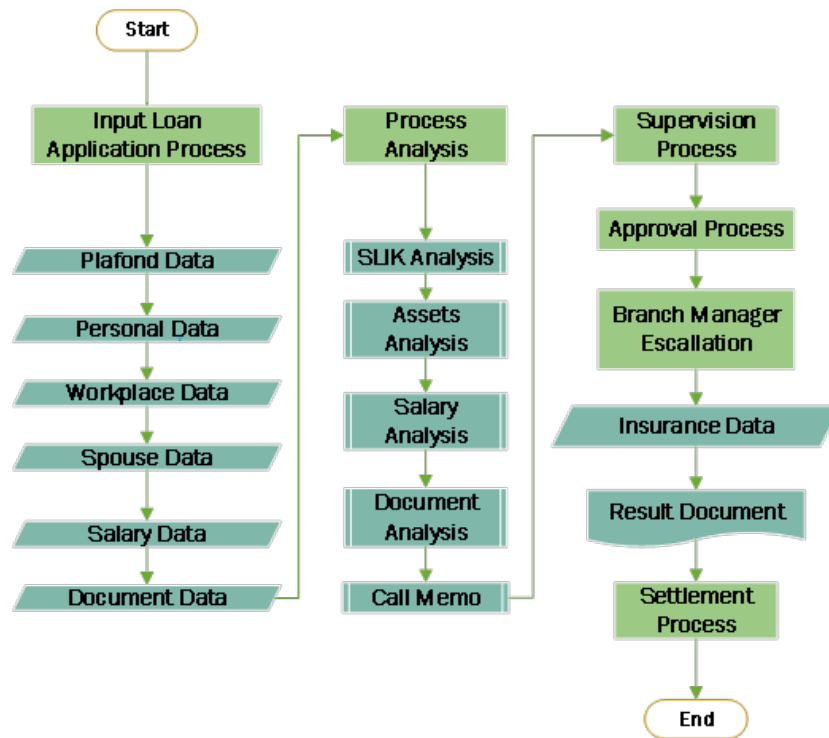


FIGURE 2 LOS Application Workflow.

TABLE 2 LOS User’s Grouping

Requirement	Descriptions
Sales	PIC to find prospective customers, collect the data and input all the customer’s requirements in e-form on LOS application.
Consumer Loan Analyst	PIC to analyses the data of the prospective customers, check all the requirements and verify all the customer’s documents.
Supervision	PIC to supervise the result of analysis data that have been done by the Consumer Loan Analyst.
Approval Manager	Decision maker PIC to give acceptances or rejection of the customer’s applications.
Branch Manager	Head of Bank Branches od the customers that has been accepted. The Branch Manager should check the application before settlement.
Settlement Administrator	PIC to process the settlement of the accepted customers.

3.3 | Collaborative Build and Test

In the Agile method, the process development enhances the interaction between customers (in this case, the business team) or stakeholders and developers^[10]. Collaborative building and testing are conducted to increase the efficiency and quality of the application. The collaborative build and test means that the developer’s application is continuously tested by either the QA engineer or the users. Every module, when they have

The developers’ designs are tested by the users, who tell the developer to fix the problem directly if they make any revisions. This method effectively develops a system that is quick and adaptive to changes.

In collaborative tests, the development and business teams work together to test the application continuously, ensuring that the application is executing according to the requirements that have been designed before and the functionality is running well.



FIGURE 3 The implementation steps.

There are two activities in this collaborative test: system integration test and user acceptance test. The system integration test ensures that all the functionality runs well and all the data is stored in the right database and tables. Users do a user acceptance test to ensure the application is user-friendly and meets all the functionality the users need.

The strength of collaborative building and testing is that the application developed by the team can be continuously reviewed and updated. This helps the application fulfill the user's needs and provide good quality.

3.4 | Implement

After all the functions and data have been tested, the application is ready to deploy in the production environment. There are four steps in the implementation phase: production environment preparation, code and database installation, re-testing, and application launching. The implementation step is shown in Figure 3 .

The first step is preparing the production environment. The environment must be set correctly to receive the application and ensure the application and database can run well and safely on the production server.

The second is code and database installation. After the production environment is set, previously developed applications and databases can be installed directly on the server. This step includes installing all the dependencies and configuration files that the application needs.

The third is re-testing the application. The application deployed on the server environment will be tested again by the users and the QA team. This step ensures that all the functions and data are correct and the application runs smoothly as expected from the server environment. This process is the final test before launching the application to the user.

The last step is application launching. After all preparation, configuration, and testing steps have been done, the application is ready to use. Usually, before the application is officially used, the business team will schedule a training session to train the user about how to use the application correctly.

3.5 | Review and Monitor

Last but not least, there are steps for reviewing and monitoring. In this step, the stakeholders conduct an application review. They review the application flow, application results data, and effectiveness. Based on this review, they give the pros and cons of developing the next application version. The IT teams monitor system maintenance, including hardware or software, backup, and recovery, to keep all data safe and maintain the data archive.

The user's point of view on the application is also important. To measure the effectiveness and the achievement of the goal of developing a LOS application, we will use the Goal Question Metric (GQM). For software development processes, the GQM methodology identifies essential process metrics. The GQM paradigm is described as a method that aids organizations in focusing their measuring effort on their objectives^[14]. Based on its name, GQM begins with defining goals, and the goals should suit the LOS application measurement. Then, after defining the goals, the questions are defined next. The questions are created by outlining what the bank would get as their achievement. The last step is defining metrics objectively, measurable, and relevant to designed goals and questions. The result data is gathered from the questionnaire filled by the LOS users and quantitatively measured with the Likert Scale.

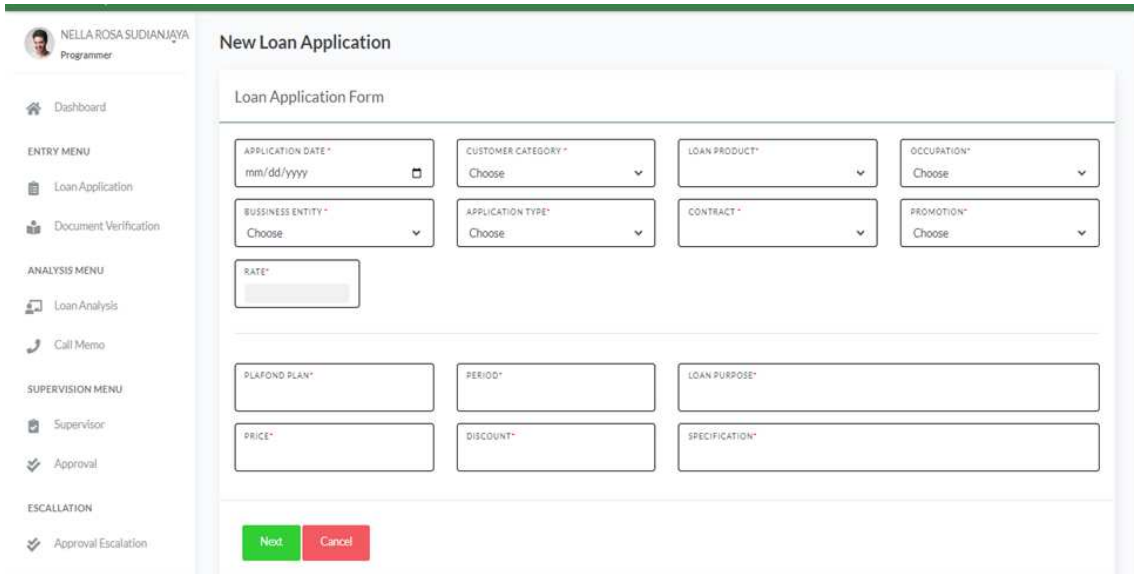


FIGURE 4 Plafond data user interface.

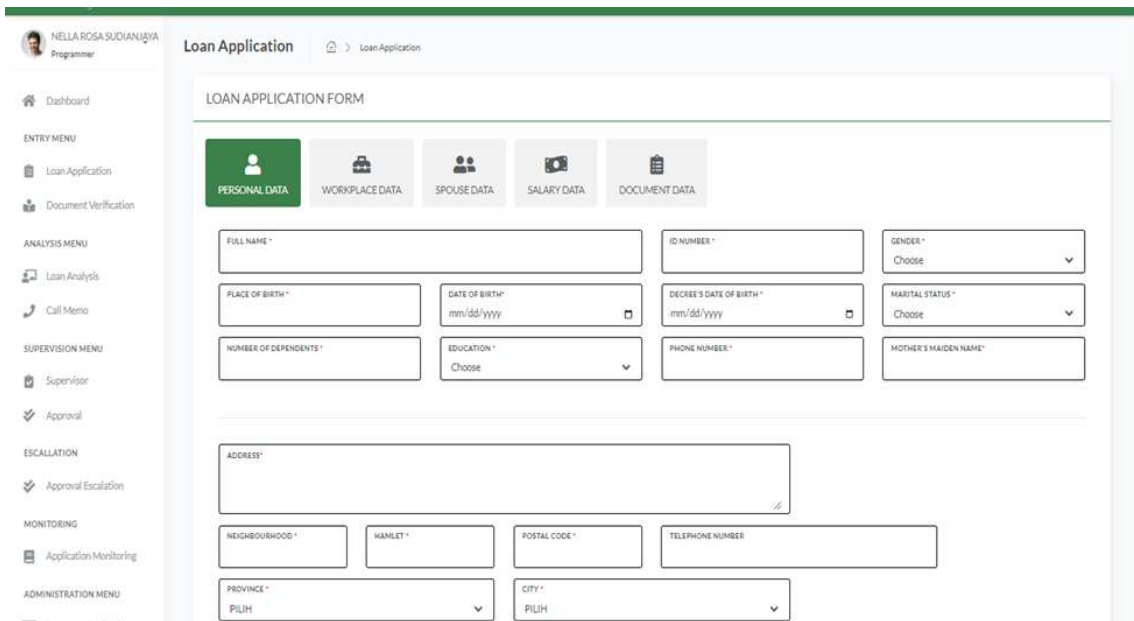


FIGURE 5 Personal data user interface.

4 | RESULT AND DISCUSSION

This section will describe the result of LOS application development using agile methodology. The final user interface of LOS application of loan application starts from plafond data, personal data, workplace data, spouse data, salary data, and document data are shown in Fig 4 , Fig. 55 , Fig. 6 , Fig.7 , Fig. 8 , and Fig. 9 , respectively.

Table III shows the questionnaire results about user satisfaction after using the LOS application. This questionnaire defines functional suitability based on ISO 25010, which includes functional appropriateness, functional correctness, and functional suitability compliance. It consists of 10 questions related to functional suitability and is combined with the GQM method. The

The screenshot displays the 'Loan Application' form with the 'WORKPLACE DATA' tab selected. The form includes the following fields:

- PERSONAL DATA: COMPANY NAME *
- WORKPLACE DATA: EMPLOYEE NUMBER *, AGE OF RETIRED *
- SPOUSE DATA: PANGKAT / JABATAN * (Choose), SUPERVISOR'S NAME *
- SALARY DATA: TREASURER'S PHONE *
- DOCUMENT DATA: COMPANY ADDRESS *

FIGURE 6 Workplace data user interface.

The screenshot displays the 'Loan Application' form with the 'SPOUSE DATA' tab selected. The form includes the following fields:

- PERSONAL DATA: SPOUSE NAME *
- WORKPLACE DATA: PLACE OF BIRTH *
- SPOUSE DATA: DATE OF BIRTH * (mm/dd/yyyy)
- SALARY DATA: ID CARD NUMBER *
- DOCUMENT DATA: PHONE NUMBER, OCCUPATION

Navigation buttons: Next (green), Cancel (red).

FIGURE 7 Spouse data user interface.

measurement uses a Likert scale from 1 to 5, with a maximum score of 5.57. Users complete the measurement from across the bank branches.

After collecting the data, we measured the questionnaire's validity and reliability using the Cronbach Alpha method to determine the questions' feasibility. The validity testing is about whether there is a similarity between all the collected data and the actual data that occurred in the research objects. Meanwhile, reliability testing is conducted to measure the stability and consistency of respondents in answering the questions^[14]. For the validity test in each question will using factor lading criteria with the criteria is more than 0.2201 (>0.2201) for 57 respondents based on R table and the reliability test is must meet the criteria more than 0.6 (>0.6)^[4]. And the result of Cronbach Alpha is show in Table 3 .

The result in Table 3 shows that all the questions listed on the questionnaire are valid because they all get over 0.2201. So, all the questions can be used in the final measurement. The reliability score was 0.9300, which shows that the questionnaire used in this research is reliable in measuring all the needed metrics.

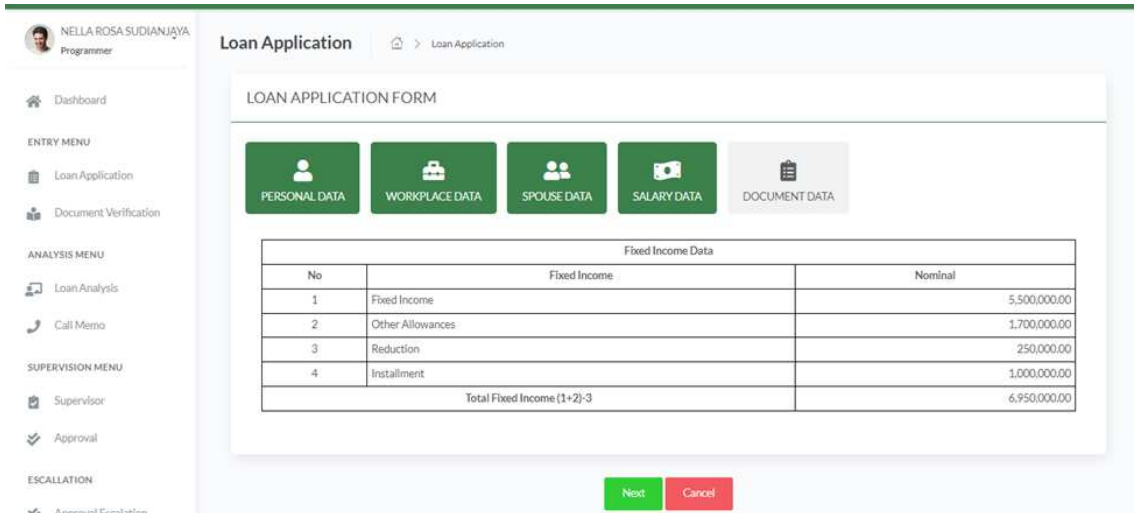


FIGURE 8 Salary data user interface.

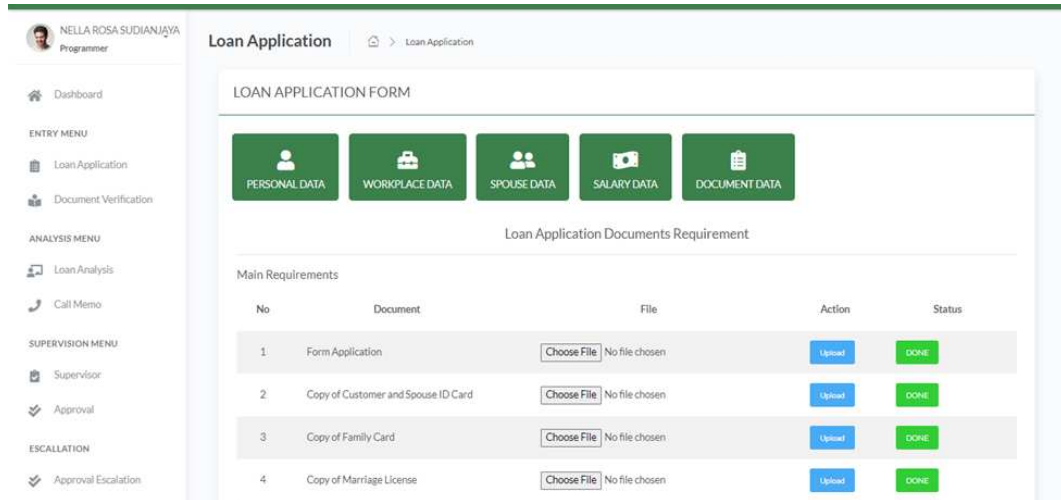


FIGURE 9 Document data user interface.

TABLE 3 Questionnaire validity and reliability test results with Cronbach’s Alpha

Dimensions	Metric	Result	Cronbach’s Alpha Criteria	Desdriptions
Validity	Q1	0.4941	0.2201	Valid
	Q2	0.6476	0.2201	Valid
	Q3	0.7806	0.2201	Valid
	Q4	0.8173	0.2201	Valid
	Q5	0.8448	0.2201	Valid
	Q6	0.7819	0.2201	Valid
	Q7	0.8214	0.2201	Valid
	Q8	0.7716	0.2201	Valid
	Q9	0.7449	0.2201	Valid
	Q10	0.8225	0.2201	Valid
	Q11	0.7690	0.2201	Valid
	Q12	0.6763	0.2201	Valid
	Q13	0.7133	0.2201	Valid
Reliability	All the questions	0.9300	0.6000	Reliable

TABLE 4 Functional Suitability Measurement

Attributes	Average Results	Percentage
Functional Correctness	4.1513	83.02%
Functional Correctness	4.3216	86.43%
Functional Suitability Compliances	4.2982	85.96%

The functional suitability result combined with GQM consisting of functional appropriateness, functional correctness, and functional suitability compliances get results of 83.02%, 86.43%, and 85.96%, respectively, showing that the LOS application still meets the requirement, and all the functional suitability that shown in Table 4 . After all this implementation, testing, and review, the application has been successfully used in all bank branches.

The results show that agile development can meet all the application requirements to build the application effectively. Besides that, the agile methodology can make the application more actively updated based on yearly requirements and regulations. The application has greatly increased its effectiveness and efficiency. The loan application process, which previously took up to weeks, can now be completed in just a day with LOS.

But sometimes, it is difficult to make users change from their old behavior to the new one. Some users don't want to keep using the application because they feel more comfortable with the manual process; even the LOS makes them feel more comfortable. On the other hand, some users also exited using the new application, which greatly helped them. They also want the application to have a wider range and more product categories to improve efficiency.

5 | CONCLUSION

The agile method implemented in the LOS development process is expected to make the development process more quick, efficient, effective, and iterative. The result shows that agile methodology gives the application high flexibility and adaptability, so it is possible to make changes and adjustments in a short time. The method also gives good coordination between the development and business teams when developing the application.

From the users' point of view, the application is suitable for processing and reviewing loan applications. It is also user-friendly and can gradually replace manual processing of loan applications. This research's primary goal is to process the loan application within one day of service, which can be managed with LOS.

CREDIT

Nella Rosa Sudianjaya: Conceptualization, Data Curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Writing - Original Draft, Resources. **Umi Laili Yuhana:** Conceptualization, Methodology, Validation, Visualization, Supervision, Writing - Review and Editing, and Supervision,

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