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# Analysis of a Bank's Lending Approval System using Process Mining

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***Abstract*—The main objective of this research is to analyze a bank's lending approval system to improve the total efficiency of the bank's lending process by using the Fuzzy Miner algorithm technique. The data included complex processes that were related to loan requests of the clients of the bank. the system has received a loan request. The primary motivation of the study was based on several complaints regarding handling the request cases with delays. The use of the Fuzzy Miner technique helped us recognize and identify the bottleneck areas and investigate the resources causing the delays. The study results can lead to the development of the bank's lending systems by reducing problems that cause delays in the Bank's operations.**

**Keywords – Process mining, Event log, Sequential algorithm**

## I.INTRODUCTION

In order to analyze the bank lending process and to optimize the performance of the bank's lending system, each step of the bank's lending process needs to be understood in terms of the borrower's behavior, including the workload of the lending system to ensure clarity of lending standards and improve the system to be more comfortable.

Banks have changed in terms of transactions through many channels, such as through the system. Mobile Banking and bank websites can handle financial transactions through various channels, and such services are done in a way very similar to that of at a bank counter. However, the new approaches are even more convenient and can reach customers quickly since the bank's customers do not need to queue up to receive services, they can do it by themselves wherever they are. However, manual transactions are complicated as some groups of customers cannot do transactions on their own. This may cause the system to lag because of incorrect data entry or being unable to verify identity due to incomplete documents. The study's findings obtained from process mining have shown that it can be used to enhance understanding of the bank's borrowing system processes, and it can be used to plan an efficient lending process in a more quick approach.

## II.RELATED LITERATURE

### A. Process Mining

*1)* Process mining is a relatively recently emerging technology. It is a technique used to find values from the actual data in the event log. Process mining has three objectives: discovery of the processes, conformance checking, and improving the working overview of the mining processes through enhancement [1].


Figure 1Introducing the sublime [1]

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## III. METHODOLOGY

In this research [3], 3 criteria are discussed and presented as the following:1. Event log2. Collect data3. Data Analysis with Process Mining

### 3.1 Event Log

In this study, collecting data is related to the behavior of the bank's lending system that delays the transmission of customer information, and there are records of actual events that are not yet available, and they divided into 3 states as follows:

A – The application status has changed.

O – Propose a change of status.

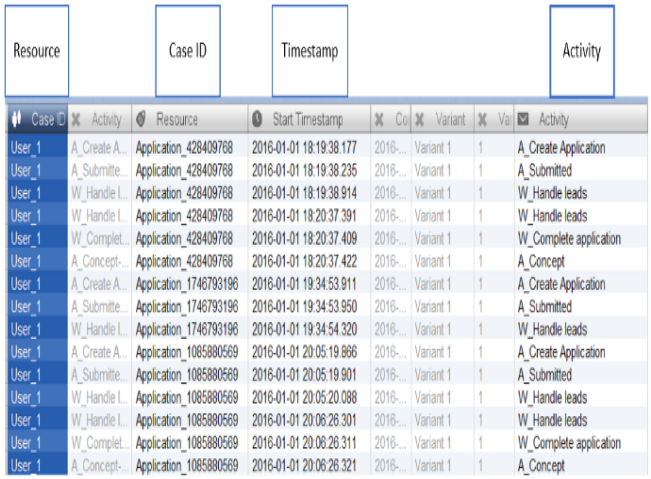
W – workflow event

### 3.2 Collecting the data

The data used in this study includes the records of the credit application processes. These processes are based on the application of the loan requests. The lending bank data used in this paper has been collected from January 2016 to February 2017 from Business Process Intelligence (BPI) 2017

### 3.3 Data Analysis with Process Mining

Using the Fuzzy Miner algorithm technique, the data in .CSV format is imported into the Disco program by selecting a set of events (Figure 2).




| Case ID | Activity | Resource | Start Timestamp | Co | Variant | Va | Activity |
|---|---|---|---|---|---|---|---|
| User_1 | A_Create A... | Application_428409768 | 2016-01-01 18:19:38.177 | 2016-... | Variant 1 | 1 | A_Create Application |
| User_1 | A_Submitte... | Application_428409768 | 2016-01-01 18:19:38.235 | 2016-... | Variant 1 | 1 | A_Submitted |
| User_1 | W_Handle l... | Application_428409768 | 2016-01-01 18:19:38.914 | 2016-... | Variant 1 | 1 | W_Handle leads |
| User_1 | W_Handle l... | Application_428409768 | 2016-01-01 18:20:37.391 | 2016-... | Variant 1 | 1 | W_Handle leads |
| User_1 | W_Complet... | Application_428409768 | 2016-01-01 18:20:37.409 | 2016-... | Variant 1 | 1 | W_Complete application |
| User_1 | A_Concept-... | Application_428409768 | 2016-01-01 18:20:37.422 | 2016-... | Variant 1 | 1 | A_Concept |
| User_1 | A_Create A... | Application_1746793196 | 2016-01-01 19:34:53.911 | 2016-... | Variant 1 | 1 | A_Create Application |
| User_1 | A_Submitte... | Application_1746793196 | 2016-01-01 19:34:53.950 | 2016-... | Variant 1 | 1 | A_Submitted |
| User_1 | W_Handle l... | Application_1746793196 | 2016-01-01 19:34:54.320 | 2016-... | Variant 1 | 1 | W_Handle leads |
| User_1 | A_Create A... | Application_1085880569 | 2016-01-01 20:05:19.866 | 2016-... | Variant 1 | 1 | A_Create Application |
| User_1 | A_Submitte... | Application_1085880569 | 2016-01-01 20:05:19.901 | 2016-... | Variant 1 | 1 | A_Submitted |
| User_1 | W_Handle l... | Application_1085880569 | 2016-01-01 20:05:20.088 | 2016-... | Variant 1 | 1 | W_Handle leads |
| User_1 | W_Handle l... | Application_1085880569 | 2016-01-01 20:06:26.301 | 2016-... | Variant 1 | 1 | W_Handle leads |
| User_1 | W_Complet... | Application_1085880569 | 2016-01-01 20:06:26.311 | 2016-... | Variant 1 | 1 | W_Complete application |
| User_1 | A_Concept-... | Application_1085880569 | 2016-01-01 20:06:26.321 | 2016-... | Variant 1 | 1 | A_Concept |

Figure 2 Event Set Selection

Then the program shows the mining processes from the start of the processes until the end of the bank lending processes, as shown in Figure 3.

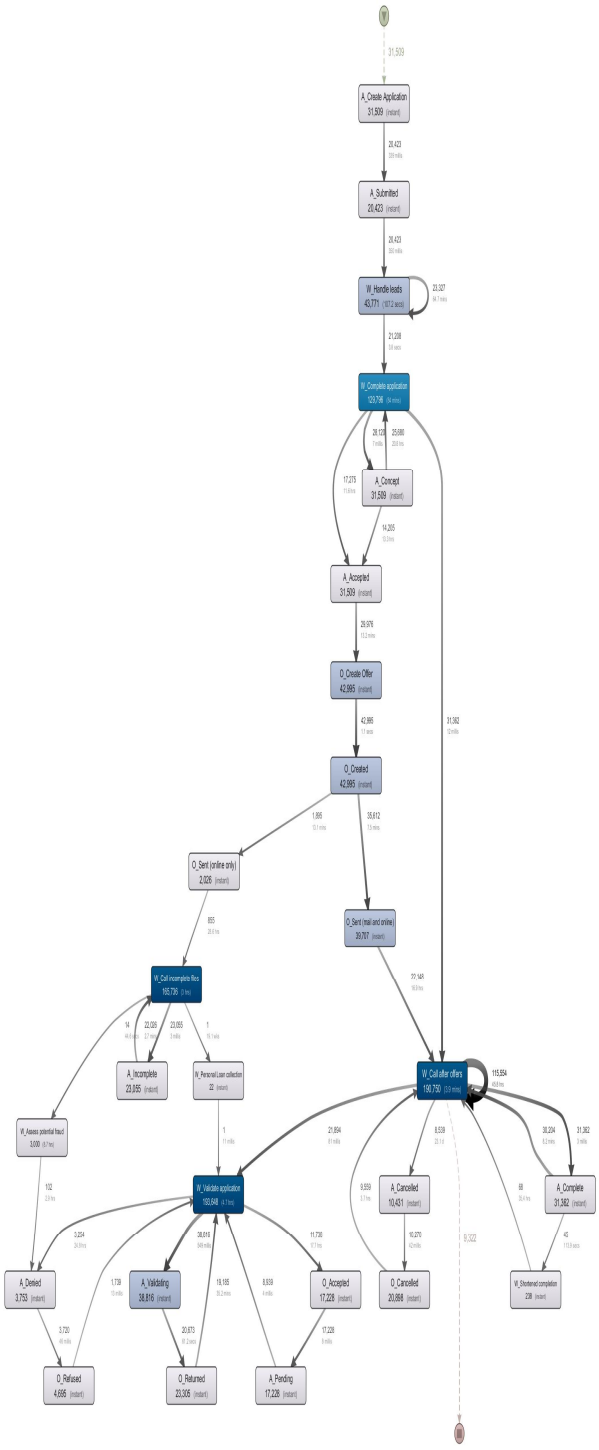


Figure 3 Process mining from the Disco program.

## IIII. THE RESULTS OF RESEARCH.

Figure 3 shows the data model after filtering it through Disco. By selecting the Performance Analysis View of the tool, events with high-performance duration are obtained. As a result, it was evident that the loan approval had been significantly delayed.

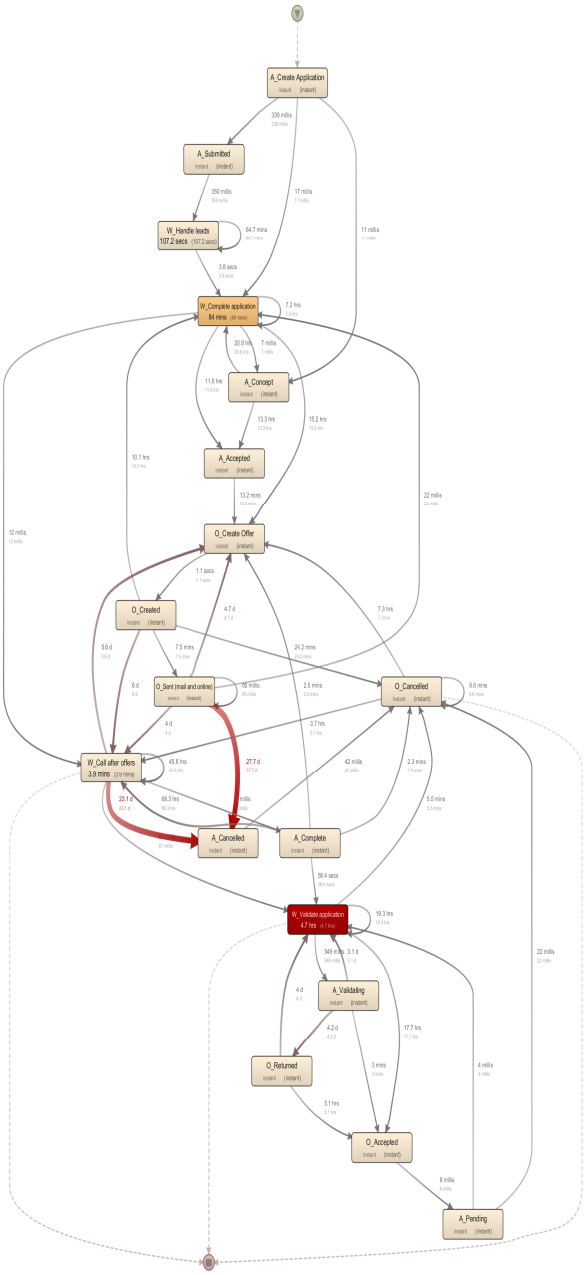



Figure 4 An overview of the running time of all events.

Figure 4 shows that there are two events with a high execution time consumption. Event 1 is the step from O state to W state. Overall, the maximum run time is 6 days. It can also be seen that from the O_Created event to the W_Call after offers event is the longest duration event.

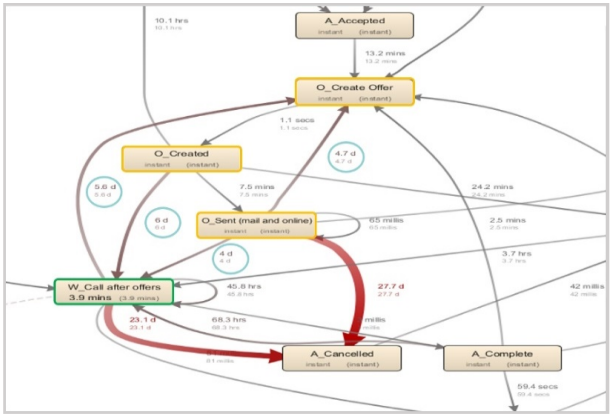



Figure 5 Long activities (Event 1)

The second event is a procedure from A_Validating sent to O_Returned and returned to the W_Validate application, which takes 8 days.

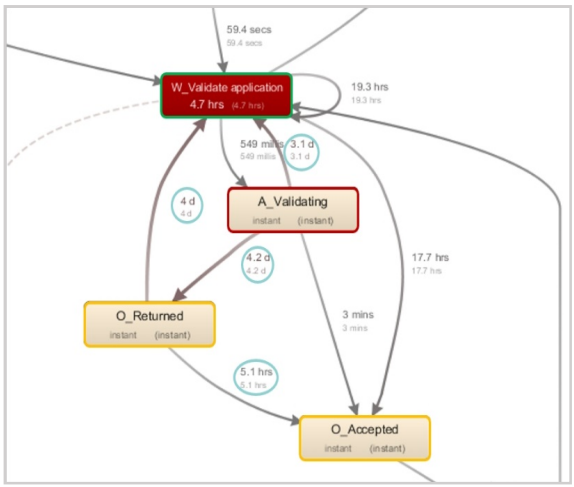



Figure 6 Long activities (Event 2)

## V. CONCLUSION

Process mining analysis using algorithmic technique Fuzzy Miner enabled us to visualize and investigate the bank lending process, including various events occurring in the borrowing process, from the start to the end of the loan process. The incidents mentioned caused the borrowing delay caused by the complicated process of the loan offer document. For example, forwarding information between borrowers and banks or bank-to-bank, which takes time to verify, and contacting back to check for more information makes the loan approval take longer than it should be. It can be summarized as follows:1. The bank should adjust employees' work to be consistent with the work in the document verification process to be more expedient. 2. The application system should make the borrower understand the documents required for loan approval and provide more precise details to ease submitting new

documents. and double-checking of documents 3. The bank should set a time limit for delivering new documents to the borrower if the borrower submits incomplete documents for the speed of bringing documents back to check again.

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