

Verification And Validation Of Business Process Modeling Using Petri Nets (Case Study of Telkom University FRI Laboratory Business Architecture Domain)

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ABSTRACT

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Enterprise Architecture is an approach that is presented to form a sustainable organization. However, the average company that has implemented Enterprise Architecture does not see and does not know whether the existing business processes in the company are currently running well and have been effective and efficient in achieving company goals or not. These conditions make validation and verification of business processes important. In this research, business process testing using the Scrum method with Petri Nets supported by WoPed tools is considered to verify and validate the business architecture design. Testing using the Scrum method is carried out through six stages, namely product backlog, sprint planning, sprint backlog, sprint review, and sprint retrospective. The test results show that several requirements are not met. This condition will have an impact on the efficiency and effectiveness of business processes. Furthermore, gap analysis is carried out with dependencies analysis, there are business processes that have not been verified and validated due to errors in the process that cause time constraints to work on more than one task simultaneously optimally, there is a process stage that is too long so that it hampers the efficiency and effectiveness of business processes.

1. INTRODUCTION

Enterprise Architecture is an approach that is present to align the business field and the field of information technology by integrating business processes, information systems, organizational functions, and stakeholders in an organization to form a sustainable organization[1][2]. Enterprise architecture (EA) aims to provide structured guidance for the planning, design and implementation of information systems and technology in an organization. Enterprise Architecture design is needed to provide standardization and guidance to realize company goals[3][4][5]. Therefore, choosing the right framework can be a decisive thing for the success of a business goal. In practice, many factors often trigger failure in the implementation of EA[6][7][8]. Among them are business processes that run inappropriately and even incorrectly in their use and application, and have not been verified and validated which results in company activities not running effectively and efficiently by the desired targets [2][9][10]. Several studies have discussed verification and validation as one of the methods that can be used to implement Enterprise Architecture. Conducted by [11] with the research title Survey of Formal Methods in Verification and Validation which says that verification and validation are formal and suitable methods for conducting research and the success rate is higher if using these methods. As well as according to research [12] with the title Enterprise Architecture Planning Academic Information Systems with TOGAF ADM concluded that designing EA in the togaf used still verifies and validates the proposed blueprint, the blueprint is successful and suitable in carrying out the design carried out. Based on some of these explanations, it can be said that the method of ensuring or verifying and validating a business process that exists in the company has been running effectively and efficiently needs to be done[13][14].

2. LITERATURE REVIEW

2.1 Enterprise Architecture

It is a logical, comprehensive, and holistic approach to designing and implementing systems and system components together[15][16]. Enterprise Architecture aims to optimize all processes in a fragmented enterprise (both manual and automated) into an integrated environment that is responsive to change and supports the delivery of business strategies [17][18].

2.2 Business Architecture

Describe the structure, strategy, business processes, and also the information needed (The Open Group, 2011) This will describe how all the organization's business components (Business Strategy, Governance, Business Processes) are targeted and their interactions with each other[19][20].

2.3 Verification

It is a confirmation that is carried out by checking and providing objective evidence that it meets the requirements specified for the development phase. In the scope of business process management, verification is an action to ensure the syntactic quality that the process modeling under the rules of the modeling language used[21][22].

2.4 Validation

Validation can help ensure the process model is correct and makes sense. This technique is useful for checking semantic annotations so that a process can run consistently[23]. Validation of process models is done to determine the semantic quality of real-world business processes and prove that a process/method can provide consistent results according to well-defined specifications.

2.5 Business Process Model and Notation (BPMN)

Business Process Model and Notation (BPMN) is a standard notation that can be in the form of icons or images that will be used in modeling business processes. The main purpose of BPMN models is to facilitate communication between domain analysts and to support technically based decision-making such as cost analysis, scenario analysis, and simulation[24][25].

3. RESEARCH METHODS

In this research, verification and validation of the business architecture in the Laboratory of the Faculty of Industrial Engineering, Telkom University is carried out by adopting the working principles of the Scrum method which are then adapted to the research needs.

A. Product Backlog

Product Backlog in this study is a collection of information obtained through interviews that have been conducted in the form of, information about business processes that are currently running in the laboratory and also identification of problems that often occur in each business process contained in the Laboratory of the Faculty of Industrial Engineering Telkom University.

B. Sprint Planning

At this stage, an analysis of the problems to be solved is carried out. From these problems, a supporting business process plan is made from the existing business process. The supporting business process is expected to be a solution to the problems that occur in the existing business process.

C. Sprint Backlog

Sprint backlog is a list of tasks that will be carried out when the sprint stage begins. The sprint backlog will detail the list of tasks from each sprint carried out on all business processes to be discussed.

D. Sprint

The sprint in this research is the stage where all the task lists on the sprint backlog will be executed. At the sprint stage, modeling and analysis of verification and validation of each existing business process will be carried out.

E. Sprint Review

A Sprint review is carried out to review the results of the sprints that have been carried out and make what improvements are needed in the business processes that have been analyzed at the sprint stage.

3 RESULTS AND DISCUSSIONS

Modeling and testing are conducted using the Sprint method. The Sprint method is implemented for each business process, which includes product backlog, sprint planning, sprint backlog, sprint execution, and sprint review to make improvements. Subsequently, gap analysis is carried out along with dependency analysis, emphasizing the importance of user satisfaction in driving engagement [26]. This phenomenon becomes evident as the increasing popularity raises concerns about violations. Furthermore, by conducting sentiment analysis [27], we can delve deeper and reveal communication methods that can further enhance the chances of success , [29], [30].

A. Product Backlog

Based on the results of interviews with the Laboratory of the Faculty of Industrial Engineering Telkom University, 5 business processes exist and run until now, namely practicum registration, assistant recruitment, assessment administration, remedial exam submission, and studio borrowing.

- a. Practicum registration aims to provide standardized registration procedures and provide an overview before practicum activities begin. Practicum registration is done manually or by an information system. Practicum registration is an important business process and is one of the main functions of the FRI laboratory. Based on interviews, it is known that the problem that often occurs is information that is not conveyed properly to all students who must take practicum. This

- condition causes students not to register and miss important information related to practicum and even causes students not to take the initial module. In addition, many upper-level students repeat and do not know the practicum registration.
- b. Laboratory assistant recruitment is a new assistant recruitment activity carried out by each laboratory in the Faculty of Industrial Engineering to work in the laboratory by first following the flow and also the requirements given by the Faculty of Industrial Engineering. Assistant recruitment is a very important activity for FRI laboratories. In this process, FRI laboratories must be able to ensure that prospective assistants understand the required qualifications and can follow each stage that has become a recruitment procedure. Based on the interview, it was obtained that the requirement for prospective assistants is to pass the practicum course with a minimum grade of AB. Furthermore, the obstacle in the assistant recruitment process is the lack of information related to recruitment. This obstacle is caused by a less thorough and systematic socialization process so that recruitment information is not conveyed optimally to all students.
 - c. Assessment administration aims to standardize practicum assessment and make standard rules for assessment administration. In the assessment administration, there are several rules, among others, the assessment is carried out after the shift in the practicum is carried out, the value issued by the laboratory is in the form of a number and not a value index, the weight of the practicum assessment is determined by each practicum course instructor, the results of the practicum assessment must be reported to the faculty no later than one week before the score entry deadline. Assessment administration is one of the important activities in the FRI laboratory so it must be carried out effectively, efficiently, and accurately. Based on interviews, information was obtained about the problems that occur, namely that assistants often make wrong value input so that the value must be reset and requires the signature of the laboratory supervisor. This condition certainly hampers the assessment administration process and makes assessment administration time inefficient.
 - d. Submitting remedial exams is a student need based on interviews, it is known that the problems that occur in the remedial submission process are problems in the payment process. In the payment process, there is often miscommunication at the time of payment which causes misrecording of payments made by students when making payments. This condition requires re- checking the account which makes activities ineffective and inefficient.
 - e. The studio loan process is one of the important business processes in the laboratory. Based on interviews, it is known that currently there is no SOP regarding studio borrowing. The problem that often occurs in the studio loan process is the borrowing time which is done suddenly by the borrower. This means the laboratory does not have enough time to prepare the studio. To overcome this, the H-3 flow is made, which means that new loans can only be made if submitted three days in advance and carried out during operational hours. However, borrowers generally do not know and understand these rules, therefore a business process is needed to support the studio loan process.

B. Sprint Planning

Based on the product backlog that has been made, a plan will be prepared that will be implemented to overcome the problems contained in each existing business process. In this research, 5 sprints will be conducted, where each sprint will represent each business process that has not been verified and validated and respond to existing problems.

- a. In the practicum registration business process, some problems occur, namely the existence of students who do not take practicum due to the lack of information being conveyed properly. From these problems, a business process supporting practicum registration is needed so that the laboratory can ensure that practicum information is conveyed properly to students to take practicum. The recommended business process to support the practicum registration business process is the practicum participant validation process. In the business process of validating practicum participants, good coordination is needed between the super admin, laboratory, front desk, practitioners, and scouts. The Super Admin is in charge of dividing the registration session, then the laboratory must ensure that students have joined the Facebook group. If the number of students is incomplete, the laboratory provides the incomplete data to the front desk so that the front desk can announce students who have not joined. Furthermore, registration validation is needed to ensure that all students have registered.
- b. In the assistant recruitment business process, the obstacle that occurs is that there is no detailed explanation of the initial socialization process for assistant recruitment, even though this process is very important so that prospective assistants can really understand the importance of participating in assistant recruitment and understand the requirements and prepare these requirements so that the recruitment process can run more effectively and efficiently in time. Additional business processes that can support the assistant recruitment process include socialization activities to provide information related to recruitment, an explanation of the media that can be used by prospective assistants so that assistants can obtain information about recruitment requirements both document requirements and recruitment procedures. The process is useful for increasing the understanding and readiness of prospective assistants in participating in assistant recruitment.
- c. Based on the problems that occur in the assessment administration business process, a supporting business process is needed to minimize value input errors. The suggested supporting business process is assessment validation by re-checking the value before inputting or checking the value that has been inputted. The check is carried out by the laboratory assistant after the assessment is made, and then the value that has been checked by the assistant is checked again by the assistant coordinator. then after the practicum value is validated by the assistant coordinator, the laboratory assistant enters the practicum value and checks the inputted value again, and then the value is checked again by the assistant coordinator.
- d. In the process of submitting a remedial exam, the problem that occurs is that there are often incorrect payment inputs made by students, therefore a business process is needed to support the submission of remedial exams that focuses on

the payment process. In the payment process, the role of students to read and understand the payment procedures is very important before making payments to minimize errors when making payments. In the payment process, the assistant's role is to check the registration requirements submitted by students so that data recording errors can be minimized.

- e. Based on the problems that occur in the studio loan process, namely the borrowing time which is often sudden, where the laboratory becomes rushed or does not have time to prepare the room, a supporting business process is needed, namely the approval of the borrowing time. In this business process, the borrowing time approval will emphasize the important role of the borrower in understanding the borrowing requirements before contacting the FRI secretariat to make a loan. This is useful to improve the effectiveness and efficiency of the studio loan process.

C. Combined Business Process

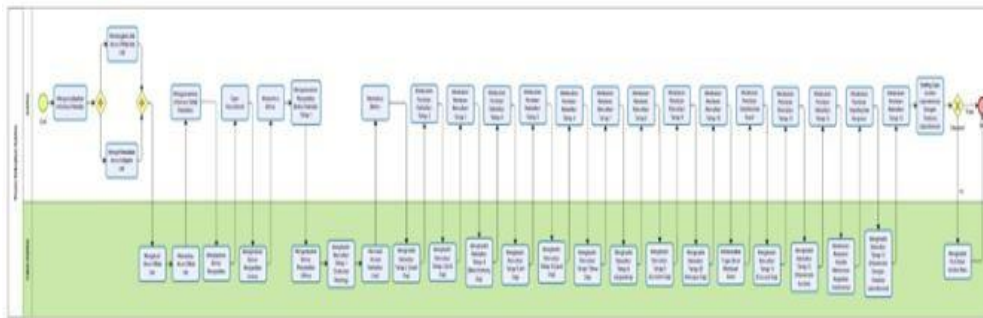


Figure 1. Combined Business Process Of Asisstant Recruitment

The recruitment socialization business process which is a supporting business process for assistant recruitment is in the initial business process before the assistant recruitment process. The initial stage of the recruitment socialization process aims to socialize assistant recruitment to prospective assistants, providing information media so that prospective assistants can truly understand the recruitment procedures and requirements and can prepare the required files properly and completely. When assistants conduct open recruitment, prospective assistants can immediately send the required files as conveyed in the recruitment socialization process.

D. Petri Nets Modeling

At this stage, business process modeling will be carried out by transforming from BPMN to Petri Nets modeling. The results of the Petri Nets transformation modeling of the next assistant recruitment business process are presented in the following figure.

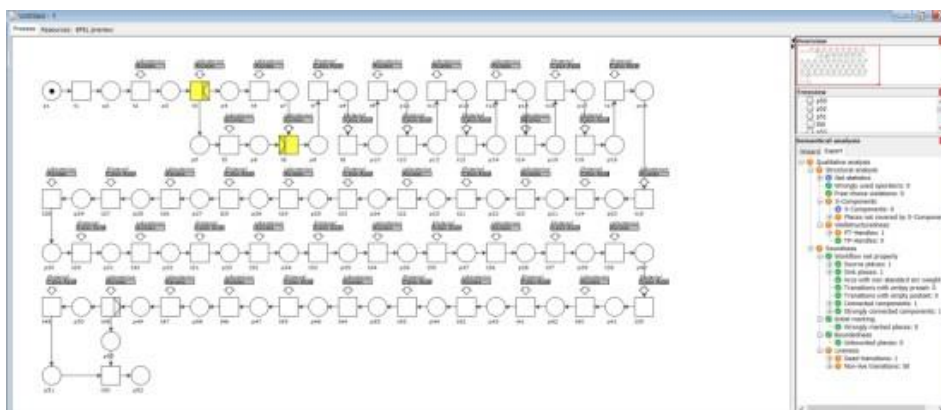


Figure 2. Assistant Recruitment Petri Nets Modeling

E. Cycle Time

The dependencies test results show that there is one error in the assistant recruitment business process shown by the red arrow indicator. The proportion of errors in the assistant recruitment business process is $1/37 \times 100\%$, which is 3%. The error in the assistant recruitment business process is located in the activity "submitting online requirement files which is indicated by predecessor SS or Start to Start, meaning that activity 1 starts simultaneously with activity 2. The business process shows that when "open recruitment" starts, prospective assistants can immediately submit online requirement files, but the dependencies test results show that there is an error in the activity dependencies. This means that there should be another activity before the prospective assistant sends the

online file, the activity is an activity to inform the file requirements that are fulfilled by the prospective assistant so that when sending the required files the prospective assistant understands what to prepare and can minimize errors.

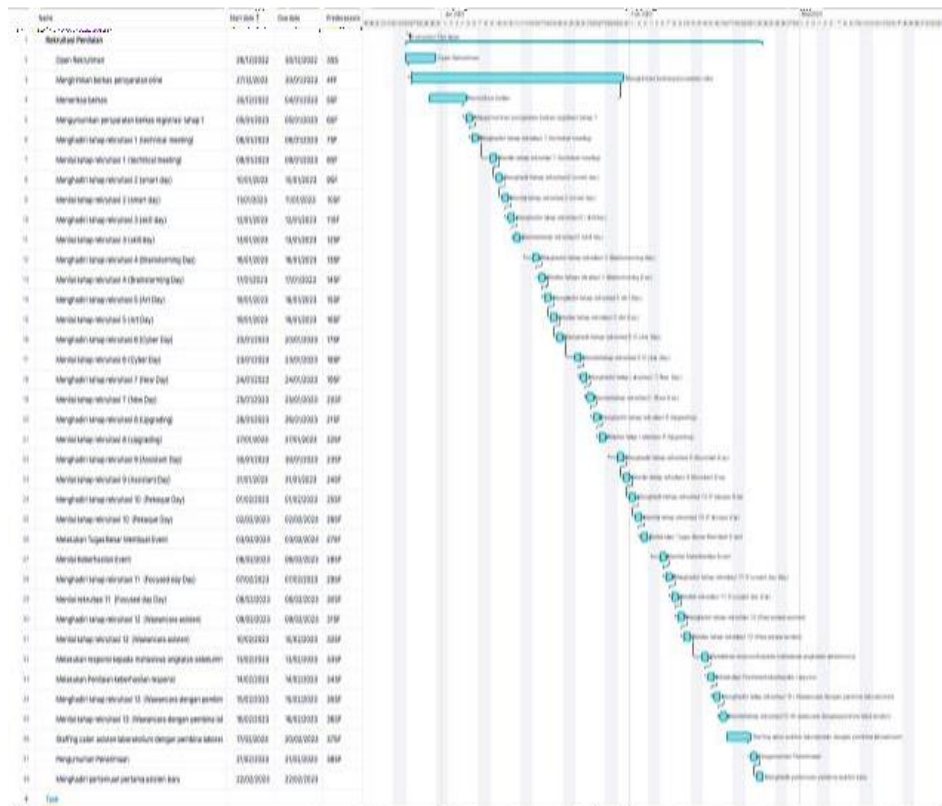


Figure 3. Assistant Recruitment Dependencies

4 CONCLUSION

Validation and verification testing of business process models can be done with the Scrum method which is part of the Agile method. The Scrum method is carried out through five stages, namely product backlog, sprint planning, sprint backlog, sprint, and sprint review. In the product backlog, details are made about the main activities in each business process and then the problems of the business process are identified. At the sprint planning stage, the results of problem identification in the product backlog are analyzed as a basis for creating supporting business processes. In the sprint backlog stage, a list of tasks that will be carried out in the next stage will be detailed. Sprint review is done by modeling the business process followed by testing the business process using Petri Nets. The sprint results show that there are several unmet requirements contained in the S-Components, namely the existence of places that are not covered by the S-Components, then there are unstructured business processes and there are processes that experience dead transition and non-live transition. These conditions will have an impact on the efficiency and effectiveness of business processes, so improvements are made to all existing business processes so that they do not experience problems anymore. Furthermore, based on the results of the gap analysis carried out by analyzing dependencies, there are business processes that have not been verified and validated due to errors in business processes. These errors include errors in the predecessor SS or Start to Start which causes time constraints to work on more than one task simultaneously optimally, the Finish to Start process is too long so it hampers the efficiency and effectiveness of the business process.

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