

Complexity Evaluation with Business Process Modeling and Simulation

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Abstract: To stay in the competition and to make a stand in the market, companies have to make the quick changes. Business Process Modelling (BPM) has made an impact in the respect to capture the process and to make the changes accordingly for improvement in business operations. Modeling and simulation is the process of making a process simple to reduce complexity. However, modellers or researchers still making the complex models. Modeling and simulation are the areas which need to be addressed, despite only a few researchers worked in the respective areas of modelling and simulation. The paper addresses the complexity issue of cloud performance criteria of time and cost. To this end, this paper has evaluated the domain of financial services in the cloud with Business Process Modeling Notation (BPMN) and simulation. Two different scenarios have been created to demonstrate the result of performance complexity of cloud services. Finally, the conclusion has been derived to help and guide further research.

1 INTRODUCTION

Due to its existence importance not because of descriptive nature of the process, but also the characteristics representation for the activities such as business process improvement, business process re-engineering and process standardization, business process modeling is the first stage to success the organizational targets or objectives (Succi, Predonzani & Vernazza, 2000).

Different stakeholders such as Business process analyst, domain experts, technical analyst and software developers are included in the activities of the business process modeling. Thus, the communication between these stakeholders is the main aim of the business process modeling. Moreover, business process should be simple and uncomplicated to maintain and understand. The business process with the high complexity and unclear message can possibly result in defects, errors, unsatisfactory results and adverse understandability. Consequently, it can increase the development time, testing time and maintenance of the business process.

Modeling and Simulation are the processes to reduce the complexity of the real world business process. The main aim of the business process modeling and simulation is to review the complexity

of a process directed to make it with fewer efforts, accordingly to ease the complexity of the business process and to make it simple and understanding. However, the main objective of the process modeller is to make the process understanding and to reduce the complexity in the practical world, are designing the complex models (Henriksen, 2008; Chwif et al., 2000).

Though, to understanding the business process complexity and to find out responsible aspects to make the process complex and big, gives the impression of less interest to elucidate the complexity. Moreover, sporadically no one asked this question that process complexity has a direct impact on the performance attributes such as cost and time. Consequently, the question comes that how a process complexity can be measured? Does it really important for modellers or the researchers to measure the process simulation model complexity? And how it would help if modellers can find out the factors for increased complexity?

The objective of this paper is to find out the concept behind the simulation model and complexity. Two scenarios with the different complexity of the process have been created to conclude the results and to describe how complexity can directly influence the performance (Time and Cost).

Next section will discuss the literature finding and gaps which have motivated for this research. Then after discussion related to BPMN and simulation will be described with a complexity evaluation framework. Section 4 will detail the case study of a financial cloud application in which two scenarios have been created to validate the results. At the end, the paper will conclude the results which can helpful for another researcher to endeavour other research.

2 RELATED WORK

According to Robinson (2002), there are series of factors to make a process large and complicated. Additionally, simulation as a software engineering term has been in some of the simulation situations where the simulation models are very large and complex (Robinson, 2002). Moreover, due to the insufficient experience in the respective field can also lead a process to make big and increase the complexity which can affect the required performance resources and can increase the development time (Chwif et al., 2000).

As per described by the Henrikson (2008), the complexity of the business process bad effect on the performance and cost. Similarly, Arthur et al., (1999) noted that the large model size and the complexity are upbringing the new issues as well. Additionally, large and complex models are problematic for verification and validation process and also increase the cost of testing the simulation model (Arthur et al., 1999). Moreover, Astrup et al., (2008) advised that large model and complexity models can affect the predictive capability of a simulation model as well and also stated that predictive ability of the large and complex models are deprived instead of simple or intermediate complexity models (Astrup et al., 2008).

3 COMPLEXITY EVALUATION FRAMEWORK WITH BPMN FOR CLOUD COMPUTING APPLICATION

Below Figure 1 illustrates the list of processes which BPMN uses for cloud computing to reduce or evaluate complexity. The process starts with gathering performance requirements which need to get all the resources get collected to achieve the

desired results for the business. Next step leads the process of designing process. Modeller designs the business process in keeping mind the current aspects of the business, with help of business stakeholders. After designing the process next step is to provide parameters to all the task or subtask to simulates the process and illustrate the results as per the parameters provided. Different scenarios can be created in the simulation and execution phase of the process. Finally, the last phase is to validate and test the process with the performance requirements provided.

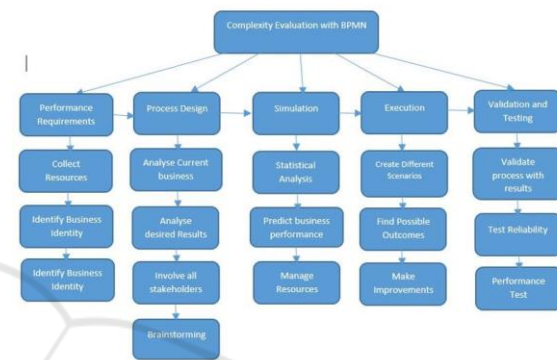


Figure 1: Describes the Framework to Evaluate Complexity.

The next subsection will describe the BPMN and simulation processes and there steps in detail.

3.1 Business Process Modeling

The communication of ideas is very important for business and stakeholders. Numerous techniques are available for the communication purpose such as documentary description and graphical representation. Graphical techniques used charts, diagrams, pictures etc. for communication and exploration. As it is relating to pictorial art, provides a spontaneous understanding of the ideas or concepts. According to Lodhi et al., (2014), the concept of addressing the problems related to business management operations in the graphic flora is known as business process Modelling. Business process Modelling helps the stakeholders and business operations to design and understand the business process, subsequently follow the analysis and improvement process to until implementation.

Business Process Modelling (BPM) is the process of collection of tools and methods to get the in-depth understanding of a business process to manage and improve the performance of an organization. Business process modelling is the activity of demonstrating the internal procedures of the

business to find out the current situation in order to improve in future. There are different graphical models available for the business process management like flow charts and (Unified Modeling Languages) UML diagrams.

According to Havey (2009), business process modelling forces a business to get the better understanding and formalise the existing process in the way to make potential improvements. The main inspiration to use the BPM is as follows:

- Well-organized process flow
- Spontaneous improvement when needed.
- Reengineering of a process flow when required.

Getting work faster with fewer people will increase productivity and reduce cost.

3.2 BPMN

The Business Process Modeling Notation (BPMN) process includes the different cyclic phases shown in figure 2. The process always starts with a green round notation that is called the client or user. The user sends a message which contains a task to a particular process. According to the particular processes defined by the experimenter, the process ends with the finishing red end circle. (Creation of BPMN process with green and red round notations are shown in Figure 3. After the creation of the whole process, the next task for the experimenter is to provide appropriate notation and assign variable to each process. Subsequently, the next task is to manage resources and load profiles. And then finally, run the simulation. The experimenter can run the simulation multiple times according to the requirement of the process. The experimenter can change the variables and resources accordingly in order to enhance the performance.

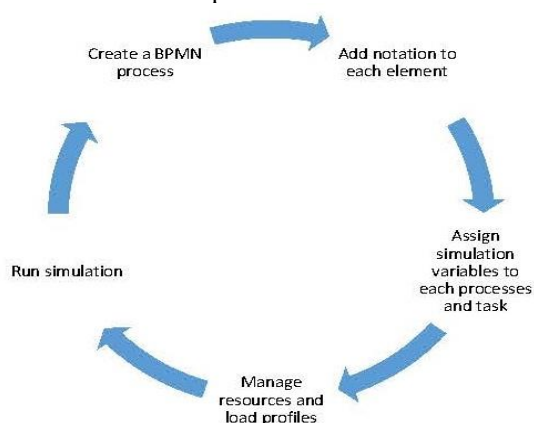


Figure 2: BPMN Simulation Process Cycle.

3.3 Simulation

According to Naim (1996), simulation involves a series of processes for building a computerised model so that particular results can be achieved through the observation of the model. Simulation process includes assumption making and parameterization (Siddiqi & Shekaran, 1996). Once the process has been developed and documented, it worth to simulate the process. Simulation of the process can help to categorize the resources used by the process and can provide the insight of the duration of the process. Simulation of the process will provide you with the performance level, but also gives you the opportunity to validate the existing process without affecting the current business manoeuvres.

4 CASE STUDY OF FINANCIAL CLOUD APPLICATION

To understand how the complexity of a business process can be measured and how it can directly impact on the performance aspects of time and cost of a business process. Two scenarios have been created for a loan process of a financial cloud business which describes the two different ways to complete a loan process and it will also explain how the time and cost has changed. The main purpose of the research is to classify the performance requirement and to explain the resources that can be used in the In-house banking and cloud-based banking to increase the performance with fewer resources and reduced complexity.

4.1 Scenario 1

The below figure 3 shows a loan process of a financial business, which includes all the different processes and sub-process used by the loan department. The process starts with the login authentication where Customers ID and passwords are required. If the id or password is wrong, it will not allow the user to proceed further. If id and password are valid then the user can go ahead with the loan request process. Then the next process is to identify the risk of the customer, which has subcategories such as higher risk, Lesser Risk, Premium customers and other customers. Thereafter, the process is called the check credit rating which is divided into two sub-processes (bad credit rating and good credit rating). The customers with the bad credit rating have two parallel task, first to reject loan and the other one is to notify the customer that

your loan has been rejected and the process completed. On the other hand, the customers with good credit ratings follow the process of the request has been approved and loan granted where the process completed.

The next step for the researcher is to provide parameters to every process and subprocess to evaluate the performance as a result of minimum, average and maximum time taken to complete one process, furthermore, simulation results also evaluate the total cost to complete 100 incoming counter arrivals or processes.

Through this BPMN model, an experimenter or modeller or researcher can evaluate the performance by changing the parameter according to the situation of the business processes and can also check the factors making a process more complex and big.

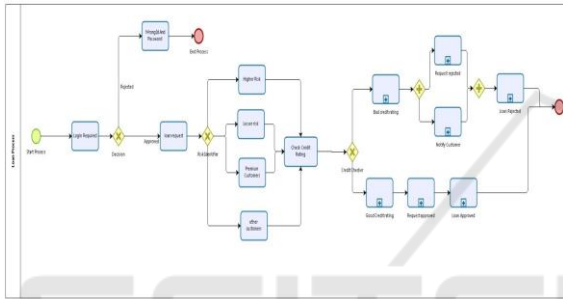


Figure 3: Loan Process Scenario 1.

4.2 Scenario 2

In this scenario below figure 4, all the process are same but to make it more secure, a user task process has been added just after the risk the identified and before check credit ratings, which is completed by the bank manager to validate the customers and the decision of the manager leads the process to reject or approved decision. After approval, the process continues the same process of credit check rating to follow on and the rejected decision informs the customers and ends the process there only. However, the adding the task completed by the manager increases the complexity of the process and increased the cost and time respectively.

The next section will compare the results of both scenarios.

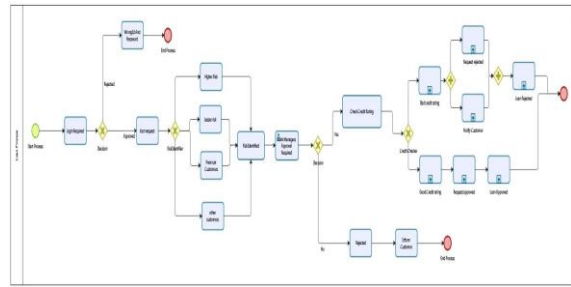


Figure 4: Loan Process Scenario 2.

5 RESULTS

This section of the paper compares the results of scenario 1 and scenario 2. Results show the minimum, average and maximum time taken to complete one process and also evaluates the total cost of all the resources to complete 100 instances or processes.

5.1 Scenario 1 Results

Figure 5 confirms the time is taken to complete a process, which is 10m 40s, 27m 10s and 24m 10s as a minimum, maximum and average respectively to complete one process, and to complete the 100 process, the total time has taken is 1 day 16hours 29 minutes and 47 seconds.

Scenario information							
Name	Scenario 1						
Time unit	Minutes						
Duration	020:00:00:00						
Name	Type	Instances completed	Instances started	Min. time	Max. time	Avg. time	Total time
Loan Process	Process	100	100	10m 40s	27m 10s	24m 10s	1d 16h 29m 47s
Start Process	Start event	100					
loan request	Task	88	88	10m	10m	10m	1d 0h 10m

Figure 5: Shows the Minimum, Average and Maximum time to complete a Process.

Underneath Figure 6 illustrates the total cost used by all the resources of the process to complete the 100 processes, which is £232.20. This results also depict the resource utilization of all the resources.

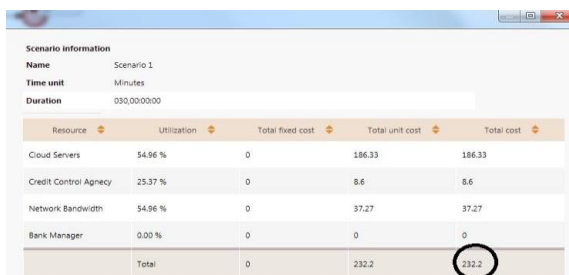


Figure 6 shows the total cost to complete 100 processes.

5.2 Scenario 2 Results

After changing the processes to make it more secure and authentic has increased the complexity, which has directly amplified the time to finish one process and also increased the total cost of the process. The below figure 7 clearly shows that the minimum time is same as before but the maximum and average time has changed to 30m 20s and 25m 54s respectively.

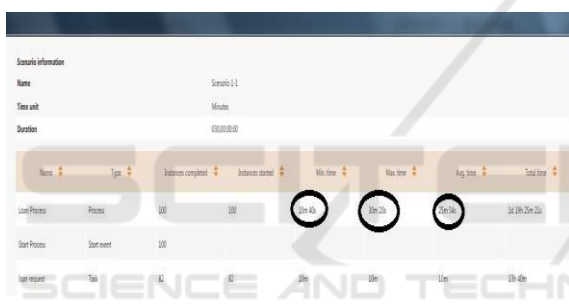


Figure 7: Shows the Minimum, Average and Maximum time to complete a Process.

Figure 8 clearly indicates after including a human task into the cloud to make a decision and to make the process more secure, the total cost of all the resources has been changed to £310.21 from £232.20.



Figure 8: shows the total cost to complete 100 processes.

6 CONCLUSION

This paper has provided the Insight of the BPMN modeling and simulation process to reduce the complexity of the business process to improve the performance with fewer resources and reduced cost. The research used BPMN modeling to design a business process for financial cloud application and tried to achieve the maximum performance from two different scenarios. The research also guides us about the size and complexity of the business process. Understanding of the increased sized model and more complexity may also help modellers and researchers to complete the process within in the budget (Jacobson and Yücesan, 1999).

The results of the research have also argued and concluded that how to identify the complexity of the process and how to make full utilization of resources to increase the performance in terms of time and cost. Results also validate adding more elements or processes may increase the complexity of the business process and can reduce the performance.

The research has also noticed that while using the cloud banking there should be some security aspect or firewall to be addressed for security purpose which can be addressed in the future work.

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