

# Incorporating Business Process Reengineering (BPR) into Information System (IS) Development: Case Study at Universiti Teknologi Malaysia (UTM)

Supiah binti Selamat<sup>1</sup>  
e-mail: sofya6184@yahoo.com

Suraya Miskon<sup>2</sup>  
e-mail: suraya@utm.my

---

## *Author(s) Contact Details:*

<sup>1,2</sup> Faculty of Computing, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia

---

**Abstract**—Information System (IS)/Information Technology (IT) is playing crucial role in the business world. There is numerous success stories demonstrate that IS/IT have high potential Business Process Reengineering (BPR). BPR concept is used in the organization to stay and enhance competitiveness. It is said that IS/IT is the enabler to the BPR and cannot be integrated due to different perspective. However, BPR method and IS development lifecycle shared some elements that can incorporate the BPR method into IS development environment. Realizing the elements in BPR method can be incorporated into IS development, this article proposes the new framework model that will be implemented in the Study Leave System (SLS) in Universiti teknologi Malaysia (UTM). SLS is a progress report system for staff that further study to improve teaching skills. However, the system needs to improve due to some problems faced by the staff such as repetitive notification, misunderstand the flow of the system, lack of login page, lack of status of progress report page and lack of viewing the previous progress report. In order to solve the problem, the new framework will be used as the guideline to improve the SLS and to proof that some of the element in BPR method can be integrated into the IS development. This paper examines how BPR method can be incorporated into IS development environment through a review of relevant literature.

**Keywords** –Business Process Reengineering (BPR); Information System (IS); Software development; Software Development Lifecycle (SDLC); Study Leave System (SLS); framework; methods

## 1. INTRODUCTION

The emergence of Business Process Reengineering (BPR) concept was first introduced in 1990s by Davenport, Hammers and Short which they talked about Information Technology (IT) helps in the redesigning business processes with the aimed to assist organization fundamentally rethink on how they perform their work in order to reduce the cost and enhance the quality and service dramatically [1]. However, the description of the BPR concept has various interpretations based on researchers and practitioners views that suit to their needs. In the views of other researcher, BPR can be describes as the modernism trend in management knowledge that attempts to gain and increase the performance of the organization by concentrating on redesigning of several parts such as the strategies, processes, guidelines and organizational structure. But, the BPR principles can have different forms depending on one project to another project [2]. Since IT helps in the redesigning of business process [1], Information System (IS)/Information Technology (IT) also leads to competitive advantage [17] and enhance organization performance which is used everywhere in the business world. In addition, IS/IT is beneficial to ease employee's work in the organization as IS/IT assist them on the business operation. Information technology always gains beyond the effectiveness by the time and will change the technology in the organization towards the future [3]. Hence, the way people work will change prior to the effectiveness of IT. Therefore, reengineering the IS/IT is needed to support the change in the business processes [13].

For this research paper, the case study is referred to Study Leave System (SLS) in Universiti Teknologi Malaysia which the system manage the progress report for staff that further study to enhance teaching skills. However, the system needs to improve due to some problems faced by the staff such as repetitive notification, misunderstand the flow of the system, lack of login page, lack of status of progress report page and lack of viewing the previous progress report. The users feel frustrated when receiving the notification to fill the progress report via email eventhough after filling up the progress report in SLS and misunderstanding the flow of the system since the current SLS closed the application after submits the progress report. The users also mentioned that SLS lack of several requirement that may satisfy them to use the system such as lack of login page where the current system only notify user with the link to open the progress report form, lack of status of progress report which users not inform whether the supervisor received the progress report or not and lack of viewing previous progress report that help users to show the evidence of fulfilling the progress report. With the acknowledgement of the problems, the system needs to enhance in order to satisfy the users of SLS. Redeveloping the system by using integrated BPR method [8, 9] and IS development method [10, 11] will increase the performance of staff of UTM.

This paper aims to propose new framework that incorporate BPR method into IS development environment through a review of relevant literature and implementing the model into the case study. The paper is organized as follows. Section 2 presents the literature review describing the overview regarding on the integrating the BPR method into the IS development environment. Section 3 explains the methodology used in the study while section 4 describes the findings of the topic plus the implementation of the new framework for the case study. Lastly, section 5 presents the discussion and conclusion of the topic.

## 2. LITERATURE REVIEW

### A. *The Relationship between BPR Method and IS Development*

Many researchers and practitioners believed that IS/IT is an enabler to BPR [4, 5, 6, 7, 12, 13]. Majority of the organizations usually supported by IS/IT. The use of IS/IT in BPR can be seen in the area of work flow analysis system [12] which IS/IT show promising result in business performance. The potential of BPR can be fully realized by combining the IS/IT with BPR which improved the profitability in the organization [14, 15, 16]. Other researchers reported that IS/IT system development is just an enabler to BPR because of the IS/IT bringing the concept of redesigning at the first place and due to the organization use IS/IT to reengineer the processes. However, the relationship between IS/IT and BPR has not been fully exploited eventhough many organization already benefited enormously [4].

Many researchers focusing on the relationship between BPR and IS/IT based on IT as enabler to the BPR [5, 6, 7]. But, both of the BPR and IS/IT approaches cannot be combined due to the different concept and perspective. However, Weerakkody and Currie have different ideas which they found that both BPR and IS development lifecycle share some elements [3] which incorporating BPR method into IS development is possible. IS development lifecycle also known as System Development Lifecycle (SDLC) and widely used in the organizations. SDLC is used to design Information System following the system analysis phases. A comparison of SDLC steps and BPR methodologies from the literature indicates that both approaches shared some elements which are based on the same principles. To justify on the view of these phases, the representation of the BPR and SDLC phase is placed in a perspective of decomposed techniques to select the most suitable step in the new integrated BPR method into the IS development environment [8]. Table 1 show the decomposed generic stage, BPR methodologies and SDLC steps to see the different guidelines used by the researchers.

TABLE 1: Decomposed generic stage, BPR methodologies and SDLC steps

Generic stage	BPR methodology by Grau et al. [9]	BPR methodology by Palma Mendoza et al. [8]	SDLC model by Ruparelia [10]	System lifecycle by Whitten et al. [11]
Strategic vision and business understanding	-	<ul style="list-style-type: none"> <li>• Top management commitment and vision</li> <li>• Business understanding</li> </ul>	-	<ul style="list-style-type: none"> <li>• Scope definition</li> </ul>
Process definition and business objectives	-	<ul style="list-style-type: none"> <li>• Identification of relevant processes and selection of target for redesign</li> <li>• Definition of objective for improvement</li> </ul>	<ul style="list-style-type: none"> <li>• Requirement analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Requirement analysis – logical design</li> </ul>
Understanding business process AS IS	<ul style="list-style-type: none"> <li>• Analysis of the current process</li> <li>• Construction the model of the current process</li> </ul>	<ul style="list-style-type: none"> <li>• Analysis of process AS IS</li> </ul>	<ul style="list-style-type: none"> <li>• Design</li> <li>• Coding</li> </ul>	-
Design process TO BE	<ul style="list-style-type: none"> <li>• Reengineering the current process</li> <li>• Generation of alternatives</li> </ul>	<ul style="list-style-type: none"> <li>• Design of process TO BE</li> </ul>	-	-
Implementation of changes	-	<ul style="list-style-type: none"> <li>• Implementation</li> </ul>	-	-
Evaluation of changes	<ul style="list-style-type: none"> <li>• Evaluation of alternatives</li> <li>• Specification of the</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation of changes</li> </ul>	<ul style="list-style-type: none"> <li>• Testing</li> <li>• Installation maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• System evaluation</li> <li>• Adoption</li> </ul>

	new system			(installation) • Operation and maintenance
--	------------	--	--	---

### B. The Implementation of BPR and IS Development Methods to The Study Leave System (SLS) in UTM

Before implementing the BPR and IS development methods to the Study Leave System (SLS), study about the system and the workflow is needed in order to improve the system without having any misunderstanding of the purpose of the system. SLS is a progress report system for the staff especially lecturers in UTM who further study to improve the quality of teaching skills. The aim of the study leave program to ensure key areas in UTM can be continued and new areas can be drive for the success of the university. The progress report system is the tool to keep track on the student's performance which manages to alert the lecturer by sending notification to update their research study. Basically, the SLS help the lecturer to update the progress report on time.

Figure 1 indicates the basic workflow of current SLS. The functionality of SLS enables the student to send progress report via online to the supervisor. The supervisor will receive the link to evaluate student's performance and send the progress report to the dean after evaluating. Same as supervisor and student, the dean also receive the link to recommend the progress report. Furthermore, at each stage after submission of the progress report, the form will be closed (no update is allowed). It is a simple system yet gives frustration to the user while facing the difficulties to save and update the report progress before submission.

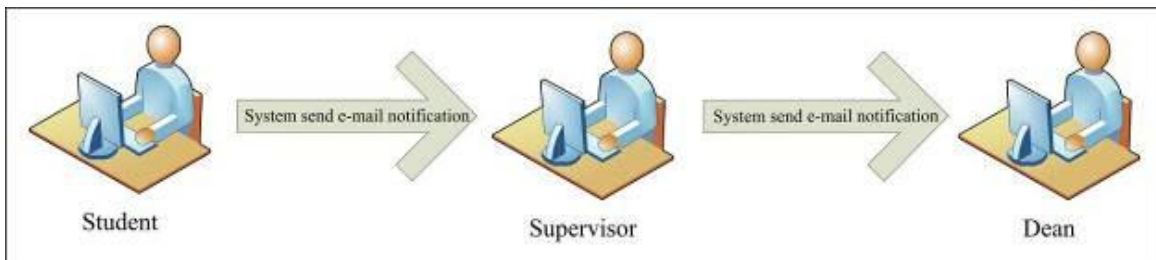


FIGURE 1: Workflow of current Study Leave System

Once the current system is analyzed, reengineering of the current process [8, 9] is applied, where the BPR method is implemented in this stage. Reengineering the workflow of SLS takes the major and essential part in this research since the IS development part will depend on the reengineered workflow of the system. In order to develop the new SLS system, IS development method is implemented so that the end product will satisfy the staff of UTM.

### 3. METHODOLOGY:

The study on the previous paper is conducted to identify the relationship between BPR methods and IS development analysis steps. There are several keywords that are used in the searching process in the online library such as “Incorporating BPR method into IS development environment”, “BPR methodologies”, “Information system development” and “Software Development Lifecycle”. From the searching process, there are many different methodologies suggested by the practitioners and researchers but only methodologies ranging from year 2000 to 2014 are selected.

The interview is conducted to examine that the BPR methodology can be incorporated into IS development. Five users of SLS have been interviewed to get the problems related to SLS, the current flow of the system and the suggestion of the new design of the system. Then, the data will be analyzed to ensure that the problems are catered wisely and to include the suggestion into the new design system. From the review of the literature, the BPR method is incorporated into IS development analysis to build new framework. Then, the new framework will be implemented to the new SLS development.

### 4. FINDINGS

#### A. Incorporating BPR into IS Development Environment

In order to develop the prototype of SLS, the methods that leads to incorporating the BPR method into IS development environment need to be identified first. The design and development of the new framework is based on the comparison in Table 1. It is step by step guideline to redevelop SLS using both of BPR method and SDLC. Figure 2 shows the reader where the BPR method located in the IS development steps and the new integrated model. There are seven core steps that

are defined in the new framework. From figure 2, to elements of BPR method, analysis of the current process phase and reengineering the current process phase [8, 9] are replaced the design of process phase in the IS development method [10, 11]. These two steps of BPR method are selected to suit the redevelopment of new SLS prototype which is one kind of simple system yet important system in UTM.

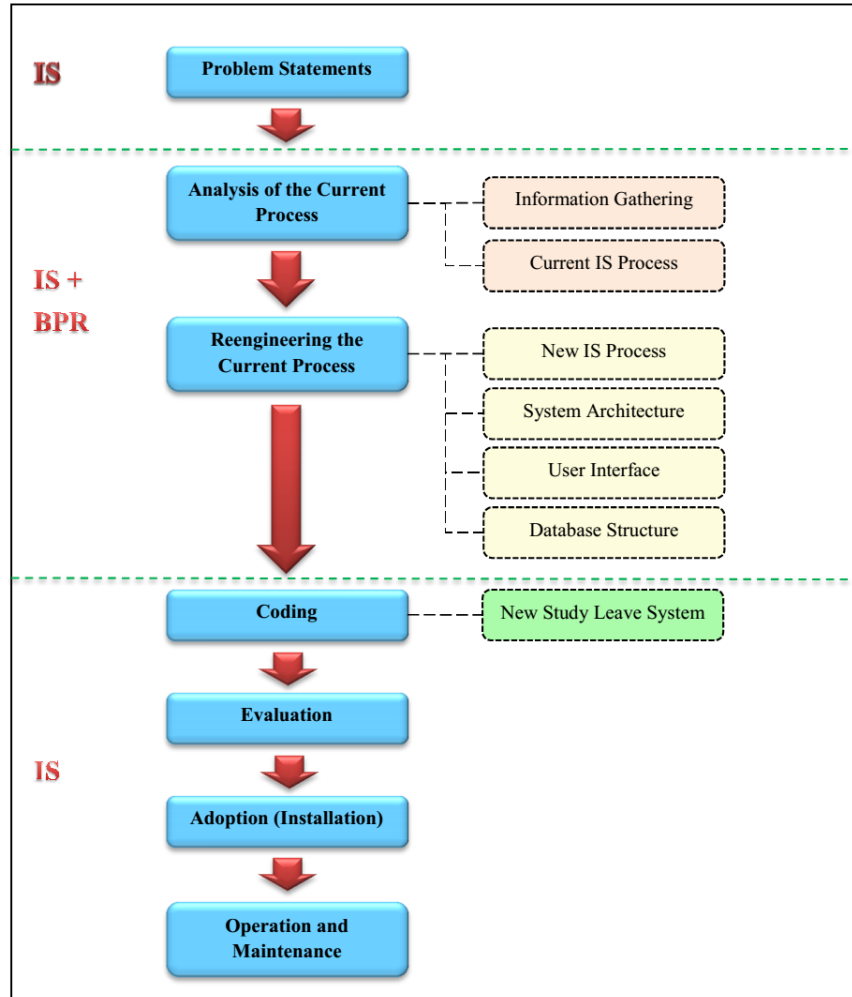


FIGURE 2: Framework of Incorporating BPR into IS Development

### B. Problems and Suggestions

From the interview session with five participants, the problems of SLS have been found. The participants also give the opinions and suggestions on how they want the system look likes in terms of functionality and appearance. Table 2 shows the problems occurred in SLS while Table 3 presents the list of suggestions from the users during the interview session for the new SLS that can be grouped into six groups of issues with suggestions which are:

1. Repetitive notification
  - There are about 60% of users reported that they keep receiving notification to fulfill and submit the progress report eventhough they have filled up the progress report in SLS. This problem cannot be catered easily without knowing the coding of the program. So, the users really hoped that the problem can be tackled when the new improved SLS is produced.
2. Misunderstand the flow of the system
  - After submit the report, the system closed the application where user cannot edit and see any input that has been written. 80% of users are blurred with what have happened to the page after submission and misunderstand on where the application is sent and saved, even there are about 80% of supervisors are also did not receive any notification after users of SLS submit the progress report. To avoid any

- misunderstanding of the flow of the system, the new reengineered system will be design to give message such as “The progress report is successfully sent to supervisor” after clicking the sent button.
3. Lack of login page
    - It is about 60% of users claimed that they received notification with link to open, fulfill and submit the progress report without any login page. If the user deleted the notification without knowing the importance of the notification, the user cannot trace where to find the link anymore. Since the problem is clearly understood, there is about 60% of users suggested that having login page is better rather than clicking the link from the notification message.
  4. Lack of status of progress report page
    - 40% of users did not know whether the application already submitted to the supervisor or supervisor is in the process of evaluating the application or supervisor already submitted to the dean or not. Because of the users eager to know on the status of the progress report, 40% of users suggested that the new SLS should provide the status of the progress report page and notify user through email when the status change.
  5. Lack of viewing the previous progress report
    - There is 60% of users cannot view the previous progress report because there is no such function in SLS and cannot download the previous progress report as the evidence of fulfilling the progress report. To solve this issue, 60% users suggested that reengineered SLS should be provided with the function to view and print or download the previous progress report.
  6. Lack of functionality button
    - 80% users reported that they cannot edit and save the progress report while 60% users reported that they cannot print or download the application due to edit is not allowed because of the application is closed after submission. Thus, the user suggested the new SLS should have more functionality button such as edit button (80%), save button (80%) and print or download button (80%) to satisfy the need of the user.

**TABLE 2: SLS problems**

No.	Problems	Percentage
1.	Repetitive notification	60%
2.	Supervisor receive no progress report	80%
3.	Confused with the system’s flow	80%
4.	Unstable system (e.g.: form is reset if the system hang)	40%
5.	No edit is allowed after click the save button	80%
6.	Lack of login page (e.g.: link will be provided to fulfill the progress report)	60%
7.	No print button (to print the progress report as evidence)	60%
8.	Cannot see previous progress report	60%
9.	No status notification (did not know whether the supervisor already evaluate the progress report)	40%

**TABLE 3: Suggestion for new SLS**

No.	Suggestion	Percentage
1.	Provide login page	60%
2.	Provide status of the progress report	40%
3.	Can view/download previous progress report	60%
4.	Print button	60%
5.	Edit button (Allow to edit before submit)	80%
6.	Save button to save report and not yet submit to the supervisor	80%

### C. Flow chart of Current Process

In this research, the author will focus on the BPR and IS development that shared elements which are analysis of the current process step and reengineering the current process step [8, 9]. Flow chart or workflow of the system is essential to demonstrate on how the system is actually worked and to improve business process performance [18, 19, 20]. Figure 3 illustrate the current process of the SLS in UTM. Based on Figure 3, the flow and the function of the system are easy and able to understand quickly. However, too simple function sometimes may lead to the confusion in the perspective of the user. This current SLS process is obtained from the admin user in the interview session. The data and the information are

gathered to analyze the functionality of the current system using Unified Modeling Language (UML) [21, 22] to show the business process or workflow of SLS.

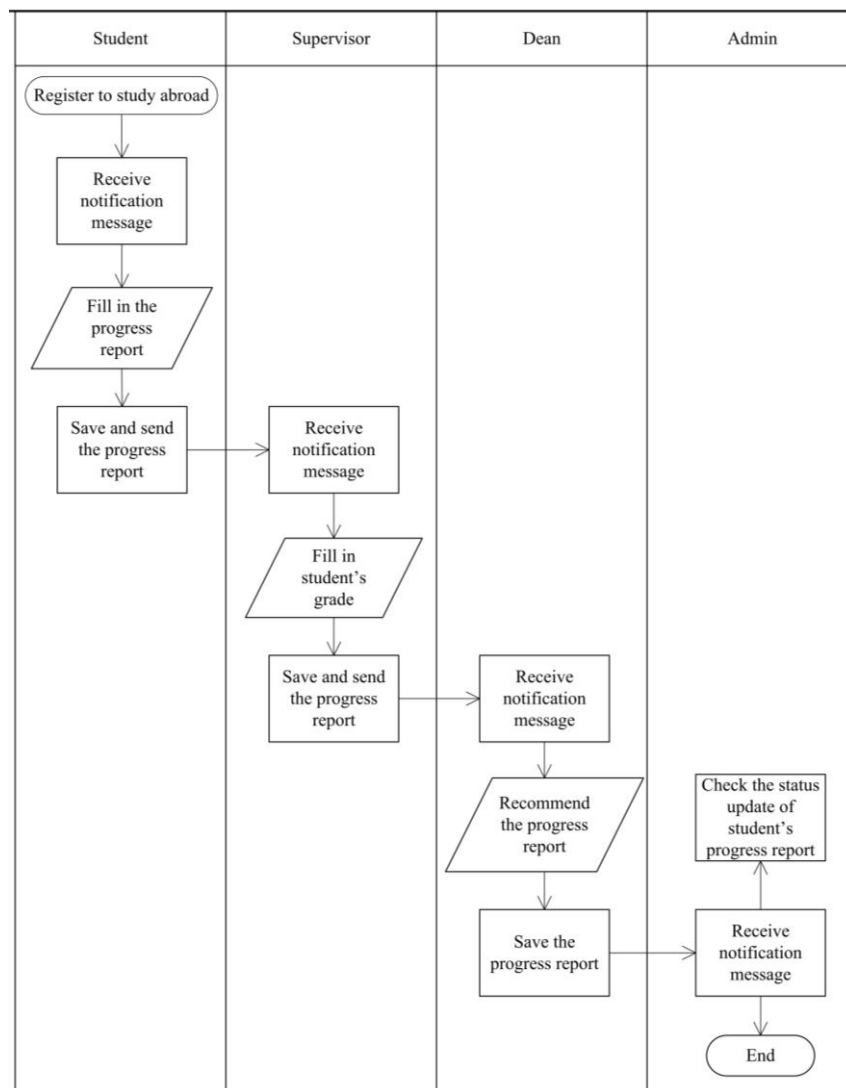


FIGURE 3: Flow chart of SLS current process

From Figure 3, there are four users involved in SLS which are student (staff of UTM), supervisor, dean and admin. The current process of SLS system describe as per TABLE 4:

TABLE 4: Explanation of current SLS

Actors/Users	Activities
Student	1. Student submits further study to improve teaching skills. 2. After 6 months, student receives notification message with a link of progress report application. 3. Student clicks the link and fills in the progress report. 4. Student clicks save and submit button to send the progress report to supervisor.
Supervisor	5. Supervisor receives notification message with a link to evaluate performance of students. 6. Supervisor clicks the link and fills in the application. 7. Supervisor clicks save and send button to submit the progress report to the dean.
Dean	8. The dean receives notification message with a link to recommend the progress report. 9. The dean clicks the link to fill in the application. 10. Then, the dean makes approval whether to agree or disagree with the grade. 11. The dean clicks save button to save the data into the database.



Admin	12. The admin receive the notification message after the dean recommended the progress report. 13. The admin checks the status of progress report. 14. The admin monitor the status of the progress report application at every stage.
-------	--

#### D. Flow chart of New Process (Reengineered)

With the problems collected during the interview sessions, the current system is analyzed and the new process is designed to resolve the issues reported by the users of SLS in UTM. In this phase, the UML [21, 22] is used to design the new workflow of SLS. Figure 4, Figure 5 and Figure 6 indicate the reengineered SLS process based on users flow which are student, supervisor and dean. From these three figures, the user need to login o the system first before fill in the progress report. The different between the users is the type of fill in the application where student fills in the progress report, supervisor evaluates the performance of students and dean recommends the progress report of the students. Then, the user can download and update the progress report after save the progress report. The save button will save the data in the database. After user satisfy with the progress report, the user can submit the progress report by clicking the submit button. Then, the admin will be notified by the status of each application. Apart from that, student also can view the status of progress report application in order to inform student that the progress report is still in the process towards the dean recommendation.

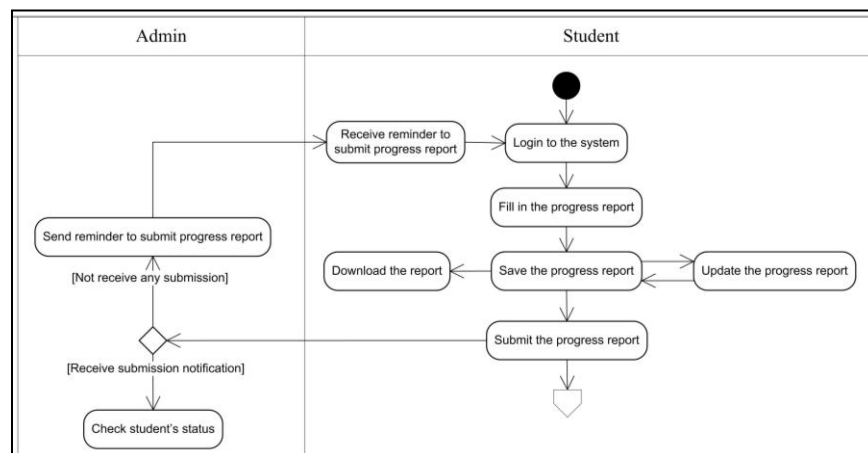


FIGURE 4: Reengineered SLS process (Student)

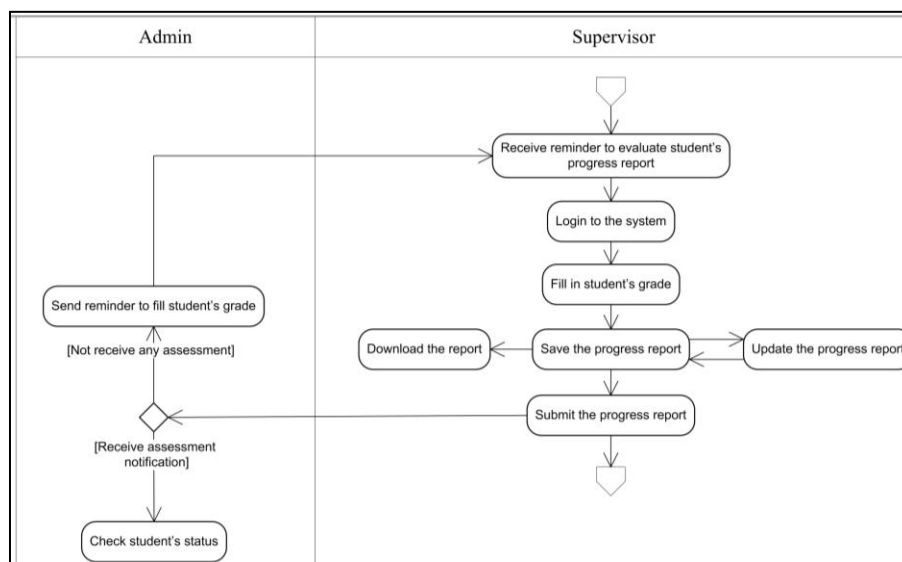


FIGURE 5: Reengineered SLS process (Supervisor)

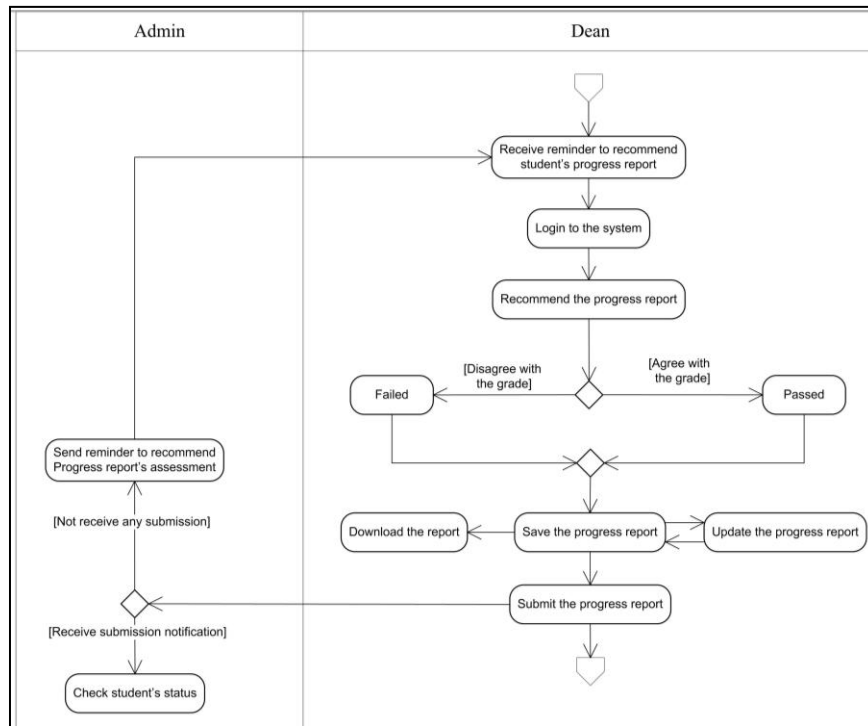


FIGURE 6: Reengineered SLS process (Dean)

### E. SLS System architecture

System architecture is important for every information system development project in order to describe the hardware, software and network environment of the system [23]. Figure 7 shows the system architecture for SLS in UTM. It is the simple structure that playing the role client-server network. Here, users of the systems are categorized into four types which are student, supervisor, dean and admin. But, the terms client means that the user started to use SLS using the computer that which request the data or information from the client. Then, once computer connected to the internet, the server received the request and sends back the requested data from the client. At that moment, user can see the interface of the SLS and fulfill the progress report as per stated in procedure from the university.

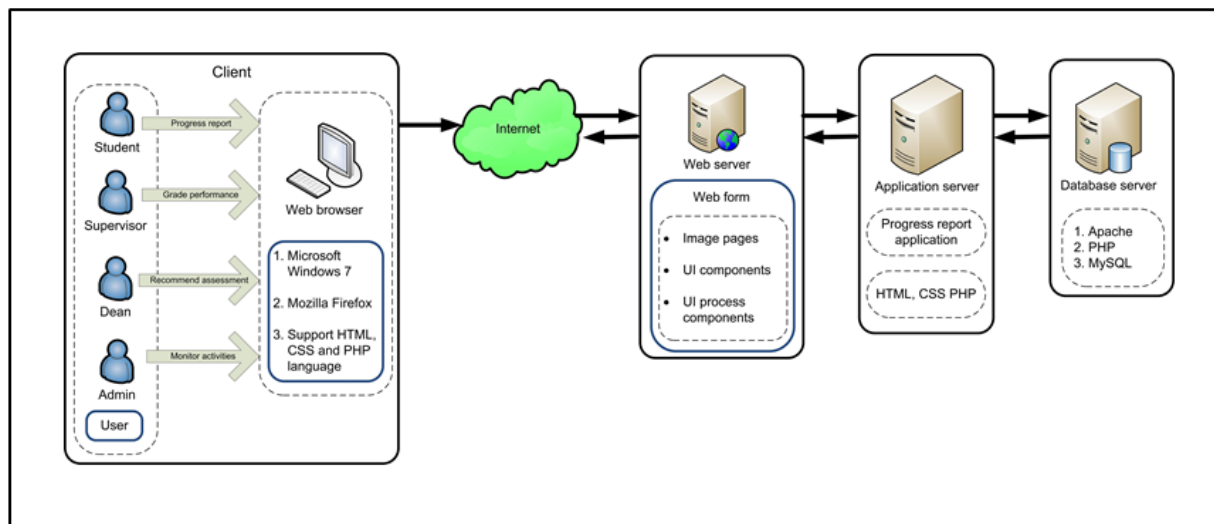


FIGURE 7: System architecture for SLS in UTM



## 5. DISCUSSION AND CONCLUSION

From the findings, the current SLS is redesigned based on problems and solutions encountered during the interview session. The crucial part that has been highlighted is the analysis phase which is divided into two which are analysis of the current process and reengineering the current process. Reengineering the current process of SLS changes the system into the new improved system in terms of processes, functionalities and appearances.

As a concluding remarks, the proposed framework of BPR methods are incorporated in IS development environment can be used to implement for the system that need to be enhanced just like SLS in UTM. The finding proved that some elements in the BPR method can be integrated in the IS development lifecycle without any problem and can be implemented to any other system that need any modification or improvement in order to increase the performance of the users.

## REFERENCES

- [1] Hammer, M. and J. Champy, *Reengineering the Corporation: A Manifesto for Business Revolution*. 2001: Nicholas Brealey.
- [2] Eftekhari, N. and P. Akhavan, *Developing a comprehensive methodology for BPR projects by employing IT tools*. Business Process Management Journal, 2013. **19**(1): p. 4-29.
- [3] Weerakkody, V. and W. Currie, *Integrating Business Process Reengineering with Information Systems Development: Issues & Implications*, in *Business Process Management*, W.P. van der Aalst and M. Weske, Editors. 2003, Springer Berlin Heidelberg. p. 302-320.
- [4] Attaran, M., *Information technology and business-process redesign*. Business Process Management Journal, 2003. **9**(4): p. 440-458.
- [5] Weerakkody, V., W.L. Currie, and Y. Ekanayake, *Re-engineering business processes through application service providers*. Business Process Management Journal, 2003. **9**(6): p. 776-794.
- [6] Al-Mashari, M. and M. Zairi, *Revisiting BPR: a holistic review of practice and development*. Business Process Management Journal, 2000. **6**(1): p. 10-42.
- [7] Chan, S.L., *Information technology in business processes*. Business Process Management Journal, 2000. **6**(3): p. 224-237.
- [8] Palma-Mendoza, J.A., K. Neailey, and R. Roy, *Business process re-design methodology to support supply chain integration*. International Journal of Information Management, 2014. **34**(2): p. 167-176.
- [9] Grau, G., X. Franch, and N.A. Maiden, *PRiM: An i\*-based process reengineering method for information systems specification*. Information and Software Technology, 2008. **50**(1): p. 76-100.
- [10] Ruparelia, N.B., *Software development lifecycle models*. ACM SIGSOFT Software Engineering Notes, 2010. **35**(3): p. 8-13.
- [11] Whitten, J.L., L.D. Bentley, and K.C. Dittman, *Systems Analysis and Design Methods*. 2004: McGraw-Hill.
- [12] Subramoniam, S., M. Tounsi, and K. Krishnankutty, *The role of BPR in the implementation of ERP systems*. Business Process Management Journal, 2009. **15**(5): p. 653-668.
- [13] Lee, I., *Evaluating business process-integrated information technology investment*. Business Process Management Journal, 2004. **10**(2): p. 214-233.
- [14] Davern, M.J. and R.J. Kauffman, *Discovering potential and realizing value from information technology investments*. Journal of Management Information Systems, 2000: p. 121-143.
- [15] Hammer, M., *Reengineering redux*. CIO Magazine, 2000. **13**(10): p. 143-156.
- [16] Devaraj, S. and R. Kohli, *Information technology payoff in the health-care industry: a longitudinal study*. Journal of Management Information Systems, 2000: p. 41-67.
- [17] Carr, N. G. (2004). Does IT matter. *Information technology and the corrosion of competitive advantage, 1*.
- [18] Holl, Sonja, Zimmermann, Olav, Palmblad, Magnus, Mohammed, Yassene, & Hofmann-Apitius, Martin. (2014). A new optimization phase for scientific workflow management systems. *Future Generation Computer Systems, 36*, 352-362.
- [19] Reijers, Hajo A, & Van Der Aalst, Wil MP. (2005). The effectiveness of workflow management systems: Predictions and lessons learned. *International Journal of Information Management, 25*(5), 458-472.
- [20] Chengjun, Wang. (2009). *The Research and Design of Workflow Management System Based on WEB*. Paper presented at the Knowledge Engineering and Software Engineering, 2009. KESE'09. Pacific-Asia Conference on.
- [21] Doomun, Razvi, & Jungum, Nevin Vunka. (2008). Business process modelling, simulation and reengineering: call centres. *Business Process Management Journal, 14*(6), 838-848.
- [22] Sinogas, Pedro, Vasconcelos, André, Caetano, Artur, Neves, João, Mendes, Ricardo, & Tribolet, José M. (2001). *Business Processes Extensions to UML Profile for Business Modeling*. Paper presented at the ICEIS (2).
- [23] Dennis, A., Wixom, B.H., & Roth, R.M. (2008). *Systems Analysis and Design*: John Wiley & Sons.

**APPENDIX**

Instruments of this research: Interviews

Interviewer: Interviewee reference: Date: Time: Place:
--

Thank you for agreeing to this meeting. This interview is conducted with the purpose to identify the issues or problems faced by Study Leave System. Other than that, the workflow of the current process also will be identified in this interview session.

**Questions:**

1. Do you experience any problems/difficulties while using the Study Leave System? If yes, can you explain in detail?  
Example:
  - Repeated notification even after submit the progress report
  - Supervisor not receive any notification at all regarding on the progress report
  - No notification on the progress report's status update
2. Are the difficulties will affect your work? If yes, can you explain in detail?
3. Do you know the flow of Study Leave System? Please explain.
4. Do you get any notifications after submit the progress report?
5. Do you get any notifications on your progress report's status update?
6. Do you think that the flow of Study Leave System needs to change? If yes, which part? Can you explain in detail?
7. Do you want to add any functionality or others in order to improve Study Leave System? If yes, can you state your suggestion?
8. Do you agree if the Study Leave System need to be reengineered?