BUSINESS PROCESS REENGINEERING - CASE STUDY ON COMPUTER CENTER SERVICE

Mr. Soontorn Phiphopsuthipaiboon

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Computer Science and Information Technology
Department of Mathematics and Computer Science
Faculty of Science
Chulalongkorn University
Academic Year 2016

การปรับโครงสร้างใหม่ของกระบวนการธุรกิจ – กรณีศึกษาการบริการของศูนย์คอมพิวเตอร์

นายสุนทร พิภพสุทธิไพบูลย์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
สาขาวิชาวิทยาการคอมพิวเตอร์และเทคโนโลยีสารสนเทศ ภาควิชาคณิตศาสตร์และวิทยาการคอมพิวเตอร์
คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2559

Thesis Title	BUSINESS PROCESS REENGINEERING - CASE STUDY ON COMPUTER CENTER SERVICE
By	Mr. Soontorn Phiphopsuthipaiboon
Field of Study	Computer Science and Information Technology
Thesis Advisor	Assistant Professor Dr.Somjai Boonsiri

Accepted by the Faculty of Science, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the Faculty of Science
(Associate Professor Dr.Polkit Sangvanich)

THESIS COMMITTEE

.....Chairman
(Associate Professor Dr.Peraphon Sophatsathit)

.....Thesis Advisor
(Assistant Professor Dr.Somjai Boonsiri)

.....External Examiner
(Assistant Professor Dr.Waralak Vongdoiwang Siricharoen)

สุนทร พิภพสุทธิไพบูลย์ : การปรับโครงสร้างใหม่ของกระบวนการธุรกิจ – กรณีศึกษาการบริการของศูนย์คอมพิวเตอร์ (BUSINESS PROCESS REENGINEERING - CASE STUDY ON COMPUTER CENTER SERVICE) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: ผศ. ดร.สมใจ บุญศิริ, 61 หน้า.

วิทยานิพนธ์ฉบับนี้มีวัตถุประสงค์ เพื่อลดระยะเวลาในการให้บริการของศูนย์บริการคอมพิวเตอร์ เนื่องจากในกระบวนการปัจจุบัน ใช้ระยะเวลารอคอยในการรับบริการนาน ดังนั้น การปรับโครงสร้างทางธุรกิจ (Business Process Reengineering) จึงถูกนำมาใช้เพื่อปรับปรุงประสิทธิภาพในการให้บริการ และลดกระบวนการที่ไม่ก่อให้เกิดคุณค่า หรือ ไม่เกิดประโยชน์ ซึ่งในวิทยานิพนธ์ฉบับนี้ได้ทดลองนำกระบวนการใหม่ที่ได้จากการใช้การปรับโครงสร้างทางธุรกิจมาใช้กับศูนย์บริการคอมพิวเตอร์

ในวิทยานิพนธ์ฉบับนี้แบ่งการปรับปรุงกระบวนการออกเป็น 4 ขั้นตอน ได้แก่ 1) ระบุกระบวนการปัจจุบัน เพื่อให้ได้กระบวนการดำเนินงานที่ชัดเจนและถูกต้อง 2) วิเคราะห์กระบวนการปัจจุบัน โดยการวิเคราะห์หาสาเหตุและรวบรวมข้อมูลของปัญหาทั้งหมดโดยใช้ แผนผังก้างปลา (Fishbone Diagram) 3) ออกแบบกระบวนการใหม่ โดยนำกรอบดำเนินการมาช่วยตัดสินใจในการปรับปรุงกระบวนการในแต่ละขั้นตอน และ 4) นำกระบวนการใหม่ที่ได้ทดลองใช้กับศูนย์บริการคอมพิวเตอร์ คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ผลลัพธ์ที่ได้แสดงให้เห็นว่ากระบวนการใหม่มีจำนวนการดำเนินงาน 11 ขั้นตอน ซึ่งน้อยกว่ากระบวนการปัจจุบันที่มี 17 ขั้นตอน สามารถลดระยะเวลาเฉลี่ยในการส่งเอกสารขอรับบริการ 1,133 นาทีต่องาน และลดระยะเวลาเฉลี่ยในการให้บริการทั้งหมด 1.21 วันต่องาน นอกจากนี้จำนวนงานที่ต้องทำซ้ำในกระบวนการใหม่คิดเป็น 1.20% เมื่อเปรียบเทียบกับกระบวนการปัจจุบันที่คิดเป็น 10.47% ซึ่งแสดงให้เห็นว่ามีจำนวนงานที่ต้องทำซ้ำลดลง

ภาควิชา	คณิตศาสตร์และวิทยาการคอมพิวเตอร์	ลายมือชื่อนิสิต .....
		ลายมือชื่อ อ.ที่ปรึกษาหลัก .....
สาขาวิชา	วิทยาการคอมพิวเตอร์และเทคโนโลยีสารสนเทศ	
ปีการศึกษา	2559	

5772630223 : MAJOR COMPUTER SCIENCE AND INFORMATION TECHNOLOGY
KEYWORDS: BUSINESS PROCESS REENGINEERING / COMPUTER CENTER / SERVICE

SOONTORN PHIPHOPSUTHIPAIBOON: BUSINESS PROCESS REENGINEERING - CASE STUDY ON COMPUTER CENTER SERVICE. ADVISOR: ASST. PROF. DR.SOMJAI BOONSIRI, 61 pp.

The objective of this thesis is to reengineer process of the computer service center to reduce the cycle time of service process since the waiting time is long. This research uses Business Process Reengineering (BPR) to improve the performance and reduce non-value added activities of the current process. The practical BPR framework and BPR theories are applied in this thesis.

In this thesis, the BPR framework can be divided into four steps, which are 1) Identification process to identify the current process correctly and clearly, 2) Review to update and analyze the As-Is process, to find the root problems, and to collect all problems via Fishbone Diagram, 3) Design the To-Be process framework to support redesign decision on each step until finishes creating the new process, and 4) Test and Implement the To-Be process in the computer service center.

The results show that the new process has 11 steps, which is fewer than the current process that consists of 17 steps. Waiting time of request documentation reduces to 1133 minutes/job, while the cycle time of service reduces to 1.21 days/job. Moreover, the ratio of rework in the new process is 1.20% which is better than the current process of 10.47%.

Department:	Mathematics and Computer Science	Student's Signature .....
		Advisor's Signature .....
Field of Study:	Computer Science and Information Technology	
Academic Year:	2016	

ACKNOWLEDGEMENTS

Upon the completion of this thesis, I would like to share the success of this thesis with the following persons because without great support from them the thesis would not be possible:

Firstly, I would like to thank my thesis advisor, Assistant Professor Dr. Somjai Boonsiri, who provided me guidance, support, and encouragement to accomplish this thesis. I would also thank the members of this thesis committee, Associate Professor Dr. Peraphon Sophatsathit and Assistant Professor Dr. Waralak Vongdoiwang Siricharoen for their excellent and valuable suggestions.

Secondly, I would like to thank all members in computer service center, Faculty of Science, Chulalongkorn University, who are very cooperative, supporting this thesis to its success, especially for top manager, who has provided a very good support and suggestions on this project.

Thirdly, I would like to thank my sister, Miss Sujinda Phiphopsuthipaiboon, who helps suggest and support all aspects of this thesis successfully.

Finally, I would like to thank my parents for all their endless and tireless support towards my education, without them I would not be able to make it to these days.

CONTENTS

Page

Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

This chapter presents the duty and responsibility of computer service center, Faculty of Science, Chulalongkorn University. It describes background about Business Process Reengineering, problem statements, contributions and scope of the work.

1.1 Introduction

Since 1980, the influence of Neoliberalism caused the public sector to increase the efficiency of managing to reach the same quality as the private sector. Under the principle of Government, the new public administration, management or simply restructuring [1] for private sector management have been advocated to reduce public sector costs. In the business aggressive world especially in today's economy, every advantage counts to establish business at the top of the industry. Gaining all competitive advantages will provide higher ability to have effective strategic planning, extensive research and marketing investment. The main purpose is to respond to customer's needs.

For the last 20 years, information technology is a key to success in every business. But it is not always a success, it depends on each organization factor. Information technology is the technology which provides an opportunity to analyze specific data and operational plan of the organization.

Chulalongkorn University is a higher education organization that uses information technology to support various services in order to achieve the organization mission. Although information technology is not an educational task, it encourages the task to have efficiency education in practical situations. When information technology

system crashes, it will affect various aspects of operations, causing delays. It requires a responsible agency for the followings:

1. Supports network infrastructure for more connection and higher speed;
2. Provides hardware based on current technology and environment of the organization;
3. Supports new software that is suitable for hardware and user requirements; and
4. Creates an application to reduce workload and make the management easier.

The problems found in the computer service center are as follows:

1. Waiting time, customers were waiting for a long time after the request document has been sent, and
2. The complicated process, for each task, had a lot of steps and took a long time until customers sent the request document to the computer service center through the approval process for corrective action.

From above problems, researcher will applying reengineering to the current process. The process is a collection of activities across time and space from start until finish that identifies one or more kinds of input and creates an output that is of value to the customer [2][3].

Business Process Reengineering (BPR) is a powerful approach to improve the output of an organization [4]. This approach focuses on business process optimization by improving performance such as speed, cost, stakeholder value, customer orientation, quality and service [5][6][7]. BPR is used in many organizations for increasing customer satisfaction to gain advantages over the rival company. There are many types of quality of service. This study focuses on cycle time and performance of service. BPR cycle can be illustrated in the following way (Figure 1-1).

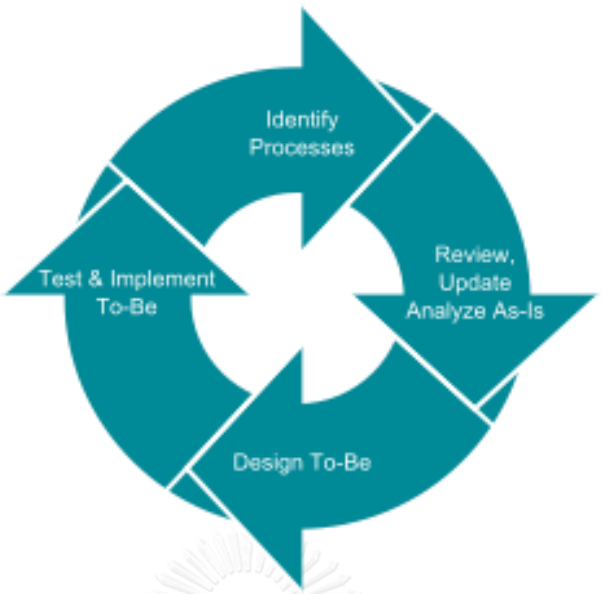

Figure 1-1 Business Process Reengineering Cycle

From Figure 1-1, it starts with identifying the current process, then analyzing the As-Is process to identify problems. Once it's done, the process can be identified for updating or reviewing. Next the To-be process can be designed so that the organization staffs know the strategy and achievement of the new process. The last step is implementing and improving the new process.

This study finds problems about the current process such as handling request documentation and waiting time for computer service. The process of the request documentation has many unnecessary steps by data analysis. When the officer could not solve say virus problem in time, the problems would have transformed into complicated problems of computer virus that damaged on the computer and infected other computers. It affected the performance of the organization. Thus, it was necessary to create the new process to solve these problems.

The progress of information technology affects the performance of the organization. It reduces the work process, allows decision making and coordinates between divisions effectively. If the information technology system crashes, the divisions will not be able to provide the service. The computer service center should

be a part of the organization for preventing the impact of information technology system crashes.

1.2 Problem statements

This study focuses on the following research issues

1. The request documentation process takes a long time because the customer sent the request document to general service officer (customer) for generating department/division number and transfer the request document to the computer service center via messenger (faculty).
2. The current process has unnecessary steps because some steps take a long time.
3. The workload is increasing because of more complicated problems due to prolong waiting time of service.

1.3 Contributions

This research benefits the followings:

1. Reduce unnecessary steps in the current process
2. Reduce cycle time of the computer center service
3. Reduce the number of rework

1.4 Scope of the work

The scope of this study is as follows:

1. Focus on service process of computer service center, Faculty of Science, Chulalongkorn University
2. Emphasize on time and rework of service process for computer service center
3. Contain only 4 factors of 6 factors (6M method) in the Fishbone diagra

CHAPTER 2

LITERATURE REVIEW

This chapter gives information on process improvement, business process reengineering, Fishbone diagram, framework, and research reviews.

2.1 Business process reengineering

The Business Process Reengineering (BPR) is a powerful approach to improve the output of an organization [4]. BPR are used in many organization for increasing customer satisfaction. In BPR, information technology is generally considered as playing a role as an enabler of new forms of organizing and collaborating rather than supporting existing business functions.

The key elements essential for business process reengineering are radical changes in orientation of the organization that lead to improving customer service [8].

The principles of reengineering that would streamline work processes [8] are:

- Organizing around outcomes and not tasks
- Identifying and prioritizing processes in an organization on the basis of urgency
- Capturing information at source
- Processing and integrating all organization's data warehouse
- Removing non-value-added activities and undertaking parallel activities for better customer service
- Linking parallel activities rather than just pipelining the results
- Avoiding over-sophistication; not relying too much on technology
- Considering geographically diverse resources as a centralized pool of resource

2.2 Fishbone diagram

Fishbone or Ishikawa diagram was first created in 1943 as a thinking tool by Kaoru Ishikawa, an engineering professor at the University of Tokyo, who pioneered quality management processes in the Kawasaki shipyards in the 1960s [9].

Fishbone diagram identifies many possible causes of an effect or problem. The head of the fish represents the summative effect or outcome of the information presents in the fish skeleton. Each of the fish's ribs represents a cause that contributes to the final effect, shown as Figure 2-1.

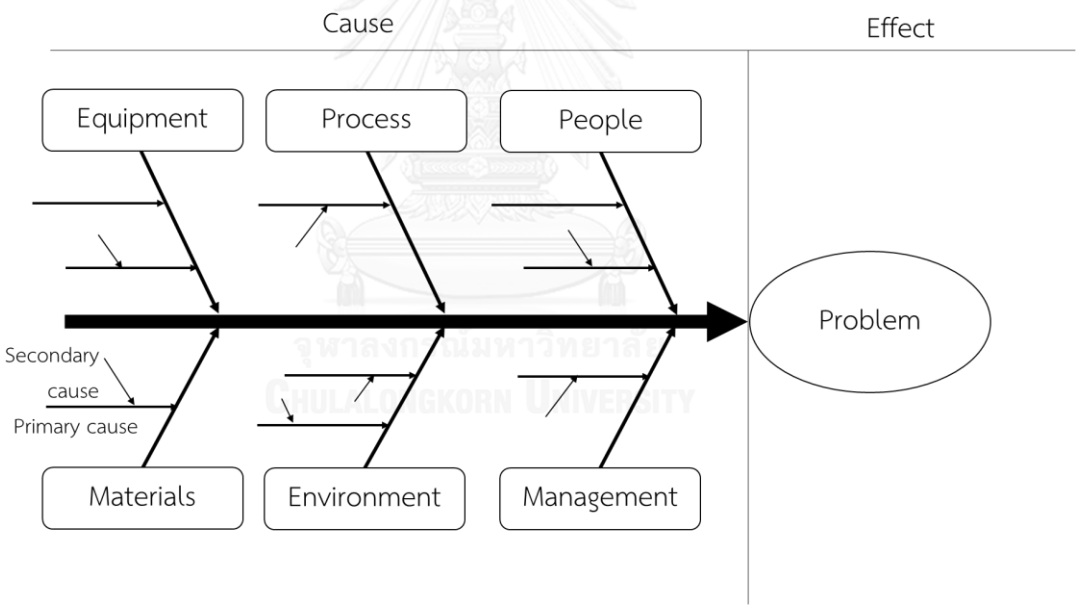

Figure 2-1 Fishbone diagram

From Figure 2-1, the 6 causes in picture are called 6M, The 6M method is widely used in cause and effect analysis and proved to be effective. That 6M can be explained as follows;

1. Manpower (People) - The staff has sense of responsibility and disciplines.
2. Machinery (Equipment) - Check the facility, stability, functionality.
3. Materials - Think about the material's components, physical and chemical properties.
4. Method (Process) - The methodology, methods or techniques will affect the action's result. Other factors concerned are workflow, choice of technical parameters, technical guidance and the preciseness and execution of the workflow.
5. Mother-nature (Environment) -The environment in the production field, including temperature, humidity, noise disturbance, vibrancy, lightening, and indoor pollution influence the products or service.
6. Measurement (Management) - When it comes to measurement, the following factors need to be considered for correct results: measurement gauge, measurement method, calibration, measurer's fatigue, and readability of the results.

The primary cause is one that could lead directly to the effect. For example, a process for computer service took a long time. The primary cause is sending the request documentation to computer service center takes at least 1 day.

A secondary cause is a cause that could lead to a primary cause but does not directly cause the end effect. For example, delays are the result of the way a document is sent twice a day. It is not a primary cause but increases waiting time.

2.3 Framework

A framework is a set of principles, standards, and rules which provide the support system. It might not be the whole picture but it provides a strong base to build upon [10]. It is inspired by two main sources: a retrospective analysis of

organization's experience in reengineering several internal processes, and the existing business process reengineering literature.

A theoretical framework is formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge within the limits of critical bounding assumptions. The theoretical framework is the structure that can hold or support a theory of a research study. The theoretical framework introduces and describes the theory that explains why the research problem under study exists [11].

A good construction of the framework composes of the following:

1. Simplicity - This simplicity is achieved by giving the parts of the framework clear and consistent interfaces. All objects of the same lineage should have the same interface. The overall structure of the framework must be easy to understand. A well designed framework can be taught to a new developer in a few days at most.
2. Clarity - The public interface for the classes in the framework should be as simple as possible. The framework is important to keep interface no more complex than is necessary to achieve the desired functionality.
3. Boundaries - A framework has clear and succinct responsibilities; it should meet those requirements and nothing more. It provides the skeleton upon which that functionality is built.
4. Expandability - It should be easy to expand the framework by either adding new classes or subclassing the existing classes.

2.4 Research reviews

This research focuses on business process reengineering. The literature reviews of business process reengineering are shown as Table 2-1.

Table 2-1 The literature reviews of business process reengineering

Reference	Objectives	Methods	Results	Strong Points	Weak Points
Eric S. K. Yu, et al.(1993) [12]	Presents a model which characterizes a work organization in terms of the network of dependencies among organizational actors.	Reviews literature on the example of business process reengineering.	Presents basic features of the Actor Dependency model.	Illustrates how the model could be used in the context of organization redesign.	A particular set of features proposes in the model need to be tested in practice.
Bill Schwartz, et al.(1995) [13]	Proposes startup activities design to assist the organization in addressing	Gathering data from organization to support proposesworkplan.	Presents solution for the challenge to use business process reengineeri	Organization's staff fully understands the cultural issues which they are addressing.	Should be used to determine process toward goals and

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	"soft" issues and barriers common to reengineering projects in early stages.		ng in the organization.		level of success.
Angappa Gunasekaran, et al.(2002) [14]	Studies the modeling, analysis and tools/techniques used for modeling of BPR with the help of a survey on the recently (1993-2000) employed methods and tools used for	Reviews literature on the example of business process reengineering both simulation and implementation.	Presents a framework for modeling and analysis, and guidelines for the selection of tools/techniques of business process reengineering	Modeling not only helps plan to reengineer, but also makes implementation of necessary changes to the organization and other related resources easier.	Definition of a business process is present with the help of a conceptual model. Not to be tested in practice.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	BPR modeling and analysis.				
Yongchun WU, et al.(2008) [15]	Studies BPR and its developme nt, analyzes the problems exist in manufactur ing enterprises as well as the deficiency in implementi ng BPR, and proposes an integrate process	Creates a framework of CABPR based on J2EE technology. Then benchmarkin g processes by Benchmarkin g Controller Servlet.	Expounds the the process of the system's designing and implementi ng based on UML and J2EE technology	Tool for process reengineerin g is one of them. The JSP, Servlet, EJB components are based on J2EE platform, combining with the thinking of the three-tier structure and the design mode, which can simplify the developmen	The model needs to be tested in practice.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	reengineering system			t process, rapidly build the CABPR of a good scalability, maintainability, reliability and high availability	
Sonia Ayachi Ghannouchi, et al. (2010) [16]	Aims to set out the relationship between business process reengineering (BPR) and data warehouse (DW) and identify the advantages brought by the integration of DW technology in	Primarily based on a case study which conducts in a Tunisian hospital and allows some lessons to learn.	Changes in the field of healthcare services have become a necessity to provide better satisfaction to patients and to offer faster services and of better quality	BPR approach can be applied to introduce these changes and provides better satisfaction to recipients of services, i.e. the hospital patients.	New corresponding process have not yet been implemented in the real life of the considered services.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	BPR projects.				
Hope N. Nzewi, et al.(2015) [17]	Explores the effect of BPR on performance Courier Service Organizations in Anambra State.	Data can be obtained from primary sources and analyzed using Principal Component Analysis and Multiple Regression Analysis	Finds significant relationship between BPR factors (change management, process redesign, management commitment, and IT infrastructure) and overall organizational performance of the selected Courier Service Organizations.	Shows that there are positive relationships between the explanatory variables and organizational performance.	Change Management has a negative relationship.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
Mohsen M. Fathee, et al.(1998) [18]	Argues that the value of simulation and modeling technology tends to be contingent on creating models that can offer a systematic.	Uses theory and hypotheses to define a solution for improving the process of firm's business processes.	Defines way of representing the structure of a firm's business processes.	The behavior of the stable systems can be predicted through modeling and simulation.	Complex and dynamic systems tend to add less value in the predictability of such systems.
Razvi Doomun, et al.(2008) [19]	Develops a flexible framework through which business processes can be a model, simulate and reengineer in a cost-	Reviews of the literature and the methodology are discussed in the context of a typical call center business.	Presents flexible business process modeling, simulation and reengineering (BPMSR) approach.	This approach is reliable for future process improvement or reengineering endeavor due to its flexible configuration, which can	The approach needs to be tested in practice.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	effective way.			be adapted to both radical and incremental change.	
Sung J. Shim, et al.(2010) [20]	Seeks to model the emergency care process in a hospital and evaluate the effects of some proposed changes to improve patient wait times in the process.	Based on a case study conducts at the hospital and uses historical data provided by the hospital to simulate the emergency care process.	The changes proposes can shorten patient wait times in the emergency care process. The proposes changes involve adding another payment station and a new short-stay ward in the process.	Shows that computer simulation can be an effective decision support tool in modeling the emergency care process and evaluating the effects of changes in the process.	The approach needs to be tested in practice.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
Michael Albers, et al.(1994) [21]	Argues that business process reengineering ought to be regard as a radical, administrative, process orients organizational innovation.	Uses suggestions for process redesign generating representation of a radical departure from existing practice, the organization has elected to implement the ideas in an incremental fashion.	Presents the approach which is taken by an IS organization to reengineer one of its key business processes – change management -- and the issues and challenges that surface during the reengineering exercise.	This strategy is consistent with the nature of the innovation and it allows potential adopters to view the benefits associated with ovation adoption more clearly.	The approach needs to be tested in practice.
James W. Candler, et al.(1996) [22]	Describes the Federal Express ORION project.	Presents approach in designing the project, which allows	This change makes it necessary for project sponsors to	Creates an optimal document processing system.	Technology is not adopted only for its own

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	Federal Express has experienced impressive improvements in organizational flexibility and responsiveness by reengineering	the company to manage huge amounts of change as well as to embrace new and emerging technologies.	continually identify and evaluate new products as they become available. At times, it might even be necessary to seek specific products unique to project needs or to encourage vendors to develop such products.		sake or for its ostensible benefits.
Rajiv Kohli, et al.(2006) [23]	Reports on a case study of three firms which	A theoretical framework is proposed and provisionally	The firm's project is considered successful and how	1. The project focuses of the BPR dictates	Implications for businesses as well as for

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	examine the organizational-level measures and process-level measures that are used to identify the effects of IT-enabled BPR (Business Process Redesign) projects.	confirmed demonstrating the link between IT-payoffs and BPR payoffs and the creation of intermediate assets that are identifiable and measurable.	the firm has made the determination.	which measurements are appropriate. 2. Businesses engaged in IT-enabled BPR concentrate on components within their own links in the overall value chain to create strategic advantage. 3. By targeting the industry value chain elements within their direct control, firms enable specific	academic research only. For businesses, the process model of measuring organizational impact help managers understand the conflicting results of IT-enabled BPR

Reference	Objectives	Methods	Results	Strong Points	Weak Points
				business strategies. 4. Those firms that measure intermediate process variables are more successful in improving overall organizational impact measures such as productivity and customer value. 5. The process approach is more helpful in guiding the project to successful completion	

Reference	Objectives	Methods	Results	Strong Points	Weak Points
				than the strategy process alone.	
Chien-wen Shen.(2007) [24]	Discusses the effect of BPR on the performance of logistics processes such as receiving, storage, picking, order processing, and shipping.	A total of 250 questionnaires is distributed to the logistics companies listed on the Taiwan Association of Logistics Management to understand interests of this research.	Shows that the average performance of respective logistics processes from the companies having adopted BPR projects are significantly better than the ones from the firms having not executed BPR projects before	Superior performance on individual and overall logistics processes than firms without BPR implementation.	Could collect more samples for better reliable results.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
Linda L. Zhang, et al.(2010) [25]	Provides a methodology to industry and academia on how to reengineer the order fulfillment process (OFP) by capitalizing on integration and coordination across the entire supply chain to sustain supply chain management.	A case study at a semiconductor equipment manufacturer in Singapore is undertaken.	Confirms that the traditional OFPs present companies a challenge to satisfy the demanding customer requirements while achieving performance optimization of each supply chain partner; and it is imperative to reengineer the OFPs to stay competitive.	Shows the new process from methodology can demonstrate to resolve the ground problem and presented the better performance.	The use of a single case study may limit the generalizability of the findings.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
SyafraniFithri, et al.(2012) [26]	Explains the phases in more detail and presents the conceptual model for MS Company's BPR model.	implementing four main phases: 1. Building vision and objective 2. Identification of existing process 3. Identifying process improvements 4. Building of a prototype	Shows that WRM (Workflow Reengineering Methodology) promises to be a methodology that can be used successfully to improve an organization's business processes.	The method can be applied to different processes and is designed to be easy for all personnel to learn and understand.	1. Suitable for small and medium-sized companies 2. A conceptual model of BPR for SME has been proposed in this paper and currently is at the stage of being evaluated
Ying-Chyi Chou, et al.(2012) [27]	Finds solution for applying process reengineeri	Applies the methods of a time study to measure field	Shows that the pharmacists are hindered in	Not only in a reduction in outpatients' waiting time	The practical are only one need more

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	ng to medical centers. This study is an outpatient pharmacy in a medical center.	observations and as an analytic tool in process reengineering.	filling prescriptions for the following reasons: the preparation of certain prescription units, the menial sorting of medicines and also storage issues related to medicines.	but also enhanced the quality and competitiveness of the Hospital's medical treatment.	practical in another medical center for ensuring the result.
Dipali Biswas.(2012) [28]	Brings the employees to that mental level of acceptability of a variety of customers' outlook,	Examines the extent to which Total Mental Revolution of employees can be brought about by the	Sustainable development of the employees' mental revolution through the effective implementation of	The production along with the productivity automatically spirals up, and with this also propels the other	Conducts in the Pune region by controlling environment of the implement.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	the HR departmen t uses the effective implement ation of Business Process Re-engineering (BPR) for the employees ' mental revolution.	HR Department.	BPR in such a way, that it enhances (business models) productivity as well as other values in manufacturi ng companies.	values needed for the organization al developmen t.	
Akhilkumar.(2014) [29]	Identifies the barriers to lean implement ation and then to develop the relationship s among these identified barriers	1. Literature reviews survey in the lean implementat ion 2. Discussions with the subject matter experts from the industry	Shows that one the major difficulties companies encounter in attempting to apply lean is not knowledge of particular tools and techniques,	Covers many barriers and strongly information about the relationship between barriers.	Complexit y preparatio n for implemen t this method.

Reference	Objectives	Methods	Results	Strong Points	Weak Points
		3. Questionnaires are then used to evaluate the importance of different lean implementation barriers.	perhaps lack of comprehensive and suitable lean knowledge related to probable problems within the companies by the managers, direction, gap and a lack of recognition of lean culture in whole of the organization and planning cause the falls within the		

Reference	Objectives	Methods	Results	Strong Points	Weak Points
			implement ations.		
Amin Mahjoor.(2016) [30]	Analyzes the methods of implementing business process reengineering methods in small and medium enterprises by library resources and content analysis.	There are many methods to run reengineering at the organizational level.	Implementing BPR on them will contribute to improved performance, increased competitive advantage and market share and economic development.	Successful in small and medium companies in circumstances where restructuring and innovation in the organizational structure, decision-makingprocedures, and supply chain management.	The extent of the contents in the open area of SMEs' BPR is too wide and practical experience in SMEs in the field of BPR in the country is limited.
Jill Esbenshade, et al.(2016) [31]	How cost cutting and quantitative efficiency are prioritized	Implements process reengineering in a California	Finds extensive work intensification and reduced	All collected information has more satisfaction by a number of responds	The research team is not able to interview

Reference	Objectives	Methods	Results	Strong Points	Weak Points
	over worker empowerment and service quality	welfare agency. Collected data from survey and interviews.	autonomy for the workforce, and deterioratin g service for the clientele.	and trustable person.	managers to see how they experienc e and prioritize these competin g pressures for quantitati ve efficiency versus service quality.

From the above literature reviews, they can be divided into three groups as follows:

1. A group of creating a model; it is a group that takes the idea of BPR and organization information to create a model for presentation in process improvement in various organizations. They have clear principles but take no experiments in practical processes or simulation processes.
2. A group of using the model in studying results; it is a group that takes the idea to improve processes by mixing the idea with simulation processes under controlled variables in the experiment. But the problem of using simulation processes is that their results will be unreliable because, in practical processes, there are many variables that cause their results yielding not in accordance with the results of simulation processes such as individual factors, unexpected events.
3. A group of using case studies; it is a group that takes idea of BPR to use with processes of one organization. The result is more reliable than the other two groups' results. But the result will not be an expected success because there are many uncontrolled factors in organization, and a way of process improvement is specifically used only in that organization.

From Table 2-1, the researcher reviews literature about BPR, surmises the appropriate guidelines for improve this study by analysis of strengths and weaknesses on each research. Therefore, this study adopts the third group as a guideline in the development of the new process

CHAPTER 3

METHODOLOGY

This chapter focuses on service process of the computer service center, Faculty of Science, Chulalongkorn University. It studies service process of the computer service center that is appropriate and efficient by developing the new service operation.

The BPR for improving operation of computer service processes in the computer center can be decomposed into a number of important phases, as shown in Figure 1-1, and in order as follows:

1. Identify the As-Is process
2. Review, update and analyze the As-Is process
3. Design the To-Be process
4. Test and Implement the To-Be process

1. Identify process

In this study, the researcher identifies the current process by interviewing the leader, old request document, and behavior observation. The current process are shown in Figure 3-1.

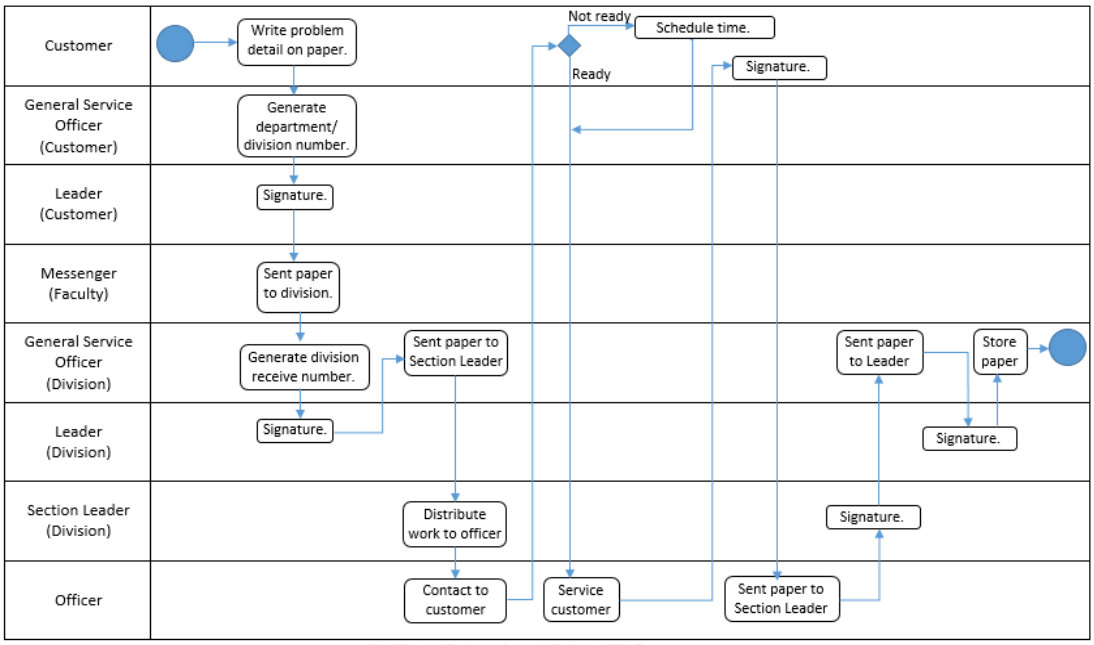

Figure 3-1 The current business process model

2. Review, update and analyze the As-Is process

The Fishbone diagram identifies many possible causes and problems [9] as shown in Figure 3-2.

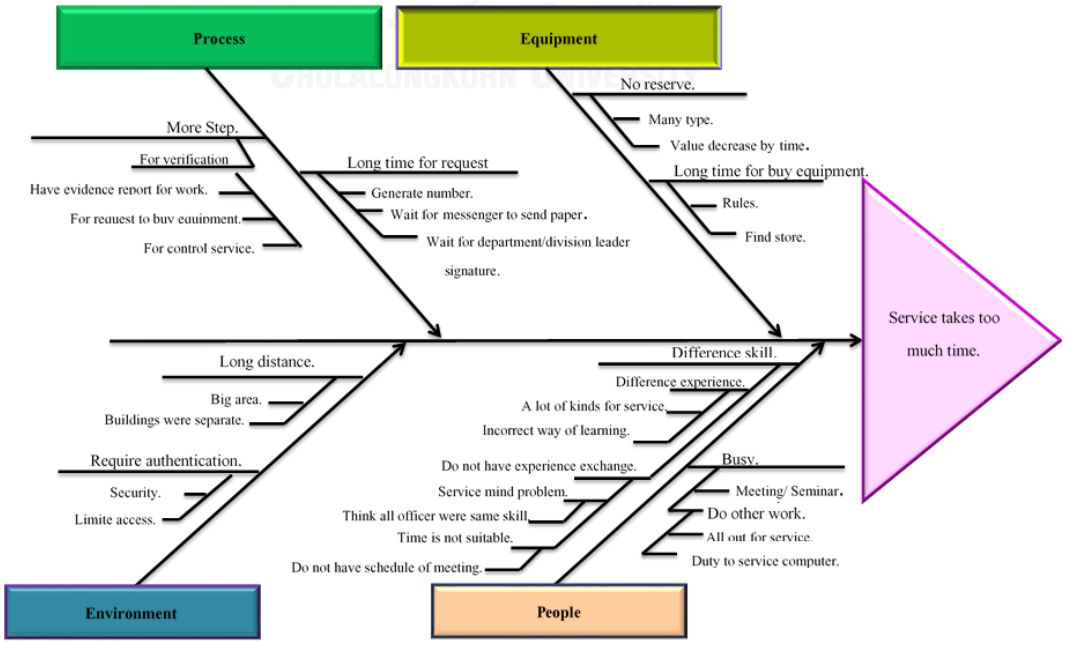

Figure 3-2 Cause of delay of computer service diagram

In Figure 3-2, the Fishbone diagram is based on 6M method but in this situation materials and management cannot be included in this diagram because they are controlled by the upper level of management in the organization.

1. Man
    - Different skills are required in different work experience and a lack of learning being exchanged among departments
    - Busy is organization staffs inflexibility, such as providing a specific staff a duty individually
2. Equipment
    - No reserved equipment
3. Method
    - Too many steps
4. Environment
    - Wide area for responsibility, in queuing service lack of planning services in nearby areas to reduce distances
    - Limitation of staffs rights for access to some area

The results of Fishbone diagram analysis can be summarized as follows:

1. There are several unnecessary steps
2. Certain regulations induce long cycle time

The solutions are shown as follows:

1. Eliminate unnecessary steps
2. Modify steps for reducing waiting time
3. Modify the regulatory restrictions on the current process

3. Design the To-Be process

3.1. Preparation

- Man :
    - Antagonism is a habit or routine of the same behavior, the unstable feels when it happens change and induce negative attitude against the new process. What is needed are
        - Training
        - Coaching
- Method:
    - Adjustment policy
        - Rules and policies– every organization has rules and policies on the effect of new process improvement. Therefore, the rules and policies of the organization should be considered first.
        - Organizational culture influences employee attitudes and behaviors. The staff are happy and less conflict. By developing the new process that does not conflict with organization culture will reduce negative attitude in the organization employees.
        - Customer's needs are the needs for fast service, resolving problems efficiently.
    - Job description for the new process is required in the new process for a flexible service.
    - Workflow to make the work systematic.
- Environment:
    - Setting area on the computer service center office.
- Equipment:
    - Prepare appropriate equipment for services. If the problems are not request before, the equipment cannot be prepared.

3.2. A framework for decision-making process as follows

1. Determine the duration time on each step that is recommended by the leader of computer service center, who is responsible for the effective and efficient functioning of that particular process. He should understand the step in the entire process and be able to predict how any proposed changes might affect both the process and organization. By data analysis from the current process, many steps take longer than 1 hour. The leader suggests from experience that, if every step takes more than one hour, there will be waste time. So any step that takes over 1-hour is suspicious of being an unnecessary step.
2. Identify the unnecessary steps which consider facts that impact the computer service process.
3. Verify all unnecessary steps by comparing with policies and rules of the organization. Every step, under the policies or rules, changes the status to necessary step.
4. Verify all necessary steps by three executives from the computer service center. If any necessary steps could be changed, then it would be an unnecessary step.

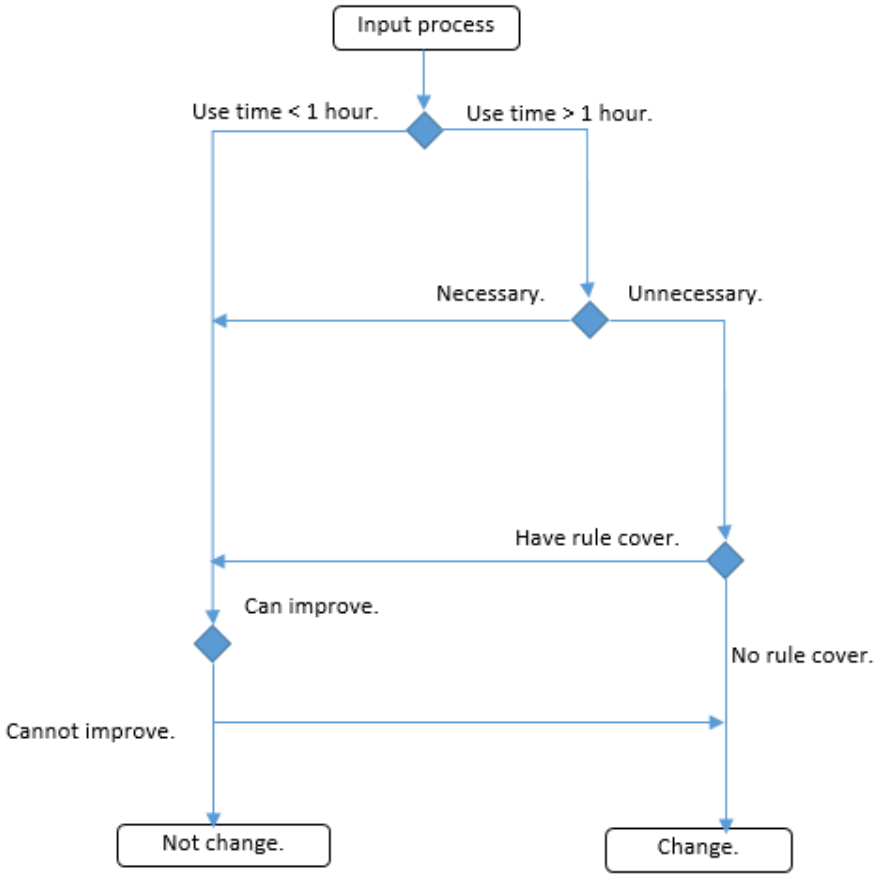

Figure 3-3 Framework for support redesign decision making.

Figure 3-3 shows a framework for redesign decision-making process at each step in the current process when considering the process task according to the framework, the results are shown in Table 3-1.

Table 3-1 The results of framework in the current process

No.	Process task	Time using over 1 Hr. (Y/N)	Necessary (Y/N)	Rules cover (Y/N)	Improve (Y/N)	Result	Process owner
1	Fill request documentation	No	-	-	No	Not change	Customer
2	Generate department/ division number	Yes	No	No	-	Change	General Service Officer (Customer)
3	Sign	Yes	No	No	-	Change	Leader (Customer)
4	Send the request document to the division	Yes	No	No	-	Change	Messenger (Faculty)
5	Generate division receive number	Yes	No	No	-	Change	General Service Officer (Division)
6	Sign	Yes	No	No	-	Change	Leader (Division)
7	Send paper to Section Leader	Yes	No	No	-	Change	General Service Officer (Division)

No.	Process task	Time using over 1 Hr. (Y/N)	Necessary (Y/N)	Rules cover (Y/N)	Improve (Y/N)	Result	Process owner
8	Distribute work to the staff	Yes	No	No	-	Change	Section Leader (Division)
9	Contact customer	No	-	-	Yes	Change	Staff
10	Schedule time	No	-	-	No	Not change	Customer
11	Service customer	Yes	Yes	-	Yes	Change	Staff
12	Sign	No	-	-	No	Not change	Customer
13	Send paper to Section Leader	Yes	No	No	-	Change	Staff
14	Sign	Yes	No	No	-	Change	Section Leader (Division)
15	Send paper to Leader	Yes	Yes	-	No	Not change	General Service Officer (Division)
16	Sign	Yes	Yes	-	No	Not change	Leader (Division)

No.	Process task	Time using over 1 Hr. (Y/N)	Necessary (Y/N)	Rules cover (Y/N)	Improve (Y/N)	Result	Process owner
17	Store paper	Yes	No	Yes	No	Not change	General Service Officer (Division)

3.3. Creation of the new process

The above results have led to the creation of the new process. (Figure3-4)

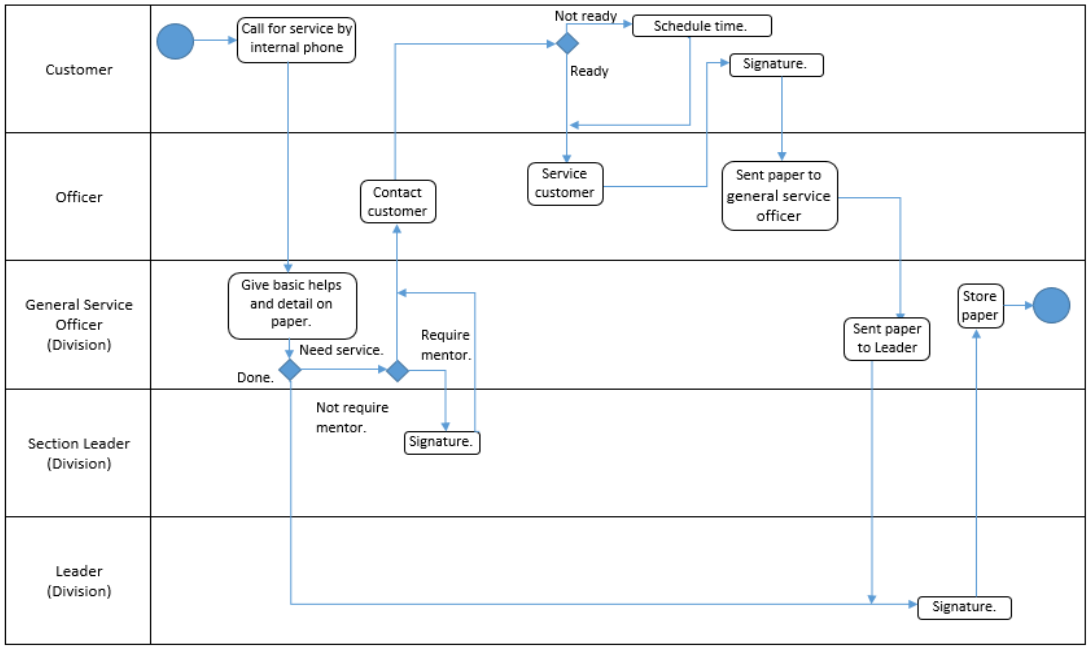

Figure 3-4 The new process model.

In Figure 3-4, customers call to general service officer through the call center. The general service officer fills the request document and gives general information

for basic service. The case does not require other service to send the request document to the leader. The case requires more service that becomes a complex issue. The general service officer sends the request document to the section leader for delegating the task. Since it is not complex, the general service officer sends the request document to the staff. The staff coordinates with the customer to schedule time of service. Customers sign the request document when the service finishes. The staff brings the request document to the general service officer. The leader signs confirmation results in the request document. Finally, the general services officer archives the request document.

4. Test and Implement the To-Be process

The researcher developed the new process by using BPR based on the relevant of rules and policies, focusing on the period of cycle time and rework after processing. The analysis of work was used as the framework for support redesign decision-making.

The new process had fewer steps than the current process, as shown in Figure 3-3 and replaced the request documentation with the call center to shorten the time of submission and recorded start and finish time of each job. The policy assignment mandated the management to service immediately. The process of operation control was evaluated by the finish time.

Table 3-2 Comparison operational service process between the current process and the new process

The current process	The new process	Method
1. Customer fills the request document	1. Customer calls to general service officer through the call center	Modification
2. Customer sends the request document to general service officer (customer) for generating department/ division number		Elimination
3. Leader (customer) signs in the request document		Elimination
4. Customer sends the request document to the division via messenger (faculty)		Elimination
5. General service officer (division) generates division receive number	2. General service officer (division) fills the request document	Modification
	2. General service officer (division)	Creation

The current process	The new process	Method
	gives general consultation	
6. Leader (division) signs in the request document		Elimination
7. General service officer (division) sends the request document to section leader	3. General service officer (division) sends the request document to section leader for delegating the task when additional service is a complex issue	Modification
8. Section leader delegates the task		Modification
	3. General service officer (division) sends the request document to the staff when additional service is not a complex issue	Creation
9. Staff coordinates with the customer	4. Staff coordinates with the customer	No change

The current process	The new process	Method
10. Customer schedules time in service	5. Customer schedules time in service	No change
11. Staff services customer	6. Staff services customer	No change
12. Customer signs the request document	7. Customer signs the request document	No change
13. Staff brings the request document to section leader	8. Staff brings the request document to general service officer (division)	Modification
14. Section leader signs confirmation results in the request document		Elimination
15. General service officer (division) brings the request document to leader (division)	9. General service officer (division) brings the request document to leader	No change
16. Leader (division) signs confirmation results in the request document	10. Leader (division) signs confirmation results in the request document	No change
17. General service officer (division)	11. General service officer (division)	No change

The current process	The new process	Method
archives the request document	archives the request document	

From Table 3-2 the new process has been modified as follows:

1. The new process reduces the need of people in the job for 3 persons who are not involved anymore including general service officer (customer), leader (customer), and messenger (faculty); and
2. The number of steps in the new process is lower than the current process 6 steps by eliminating 5 unnecessary steps and modifying 5 steps in the current process.

CHAPTER 4

IMPLEMENTATION AND RESULTS

This chapter describes implementation of the new process of computer service center and the comparative results between the current process and the new process.

4.1 Implementation

Implementation of the new process is taken as follows.

1. Preparation phase before the implementation, by operating in the following order:
   - Prepare a letter of approval to collect data in the area of computer service center, Faculty of Science, Chulalongkorn University.
   - Prepare documents to be used to collection.
   - Prepare the area to be implemented.
2. The data include users' general information, service categories, problem details, work assignment, starting time and terminated time, and a time of request documentation. This process took eight months to finish.
3. Training the staffs for two weeks.
4. A period of 2 weeks for implementing the new process.
5. Post-test phase after implementation for a period of 8 months. The same data items of pre-implementation were collected.

4.2 The comparative result between the current process and the new process

The computer service center provides information technology services as follows: software, network, and hardware.

Table 4-1 The quantity of computer service

Type of service	The current process (jobs)	The new process (jobs)
Software service	119	93
Network service	31	42
Hardware service	22	31
Total	172	166

Table 4-1 shows the amount of computer service between the current process and the new process for 172 jobs in 8 months and 166 jobs in 4 months, respectively. The numbers of service in both scenarios are similar. The results in Figure 4-1 show the quantity of software service in the new process that are lower than the current process, while the quantity of network service and hardware service of the new process are greater than the current process.

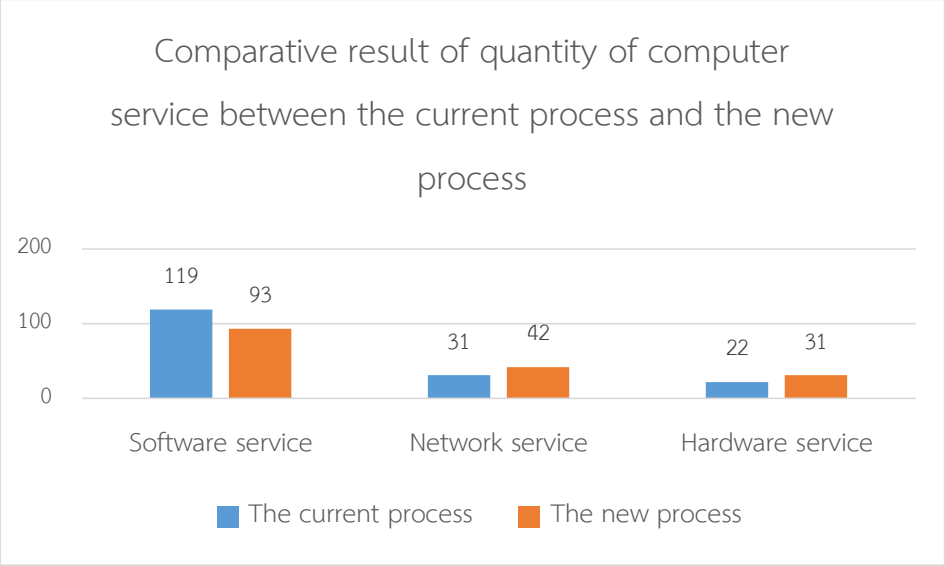

Figure 4-1 Comparative result of quantity of computer service between the current process and the new process

The new process (Figure 3-3) from a framework is used for decision-making process at each step in the current process (Figure 3-1). When considering the process task according to the framework, the result concludes with a reduction of 6 steps.

Table 4-2 Comparison of the total number of service processes

Service processes	Number of service processes (steps)
The current process	17
The new process	11

From Table 4-2, the total number of the current process and the new process are 17 steps and 11 steps, respectively. Therefore, the new process reduces non-value steps by approximately 35% after implementation.

The comparative results of waiting time for request documentation and cycle time for service processes between the current process and the new process are shown in Table 4-3 and Table 4-4.

Table 4-3 Waiting time for sending request documentation (minute/job) between the current process and the new process

Type of service	The current process (minutes)	The new process (minutes)
Software service	1234	30
Network service	1254	30
Hardware service	1003	30
Average	1163	30

Table 4-3 shows waiting time for sending request documentation is 1163 minutes/job for the current process (Sending the request documentation) and 30 minutes/job for the new process (Calling the call center). After implementation, it reduces waiting time for sending the request documentation by 1133 minutes/job. As shown in Figure 4-2 waiting time for sending request documentation in all types of service are reduced to 30 minutes/job.

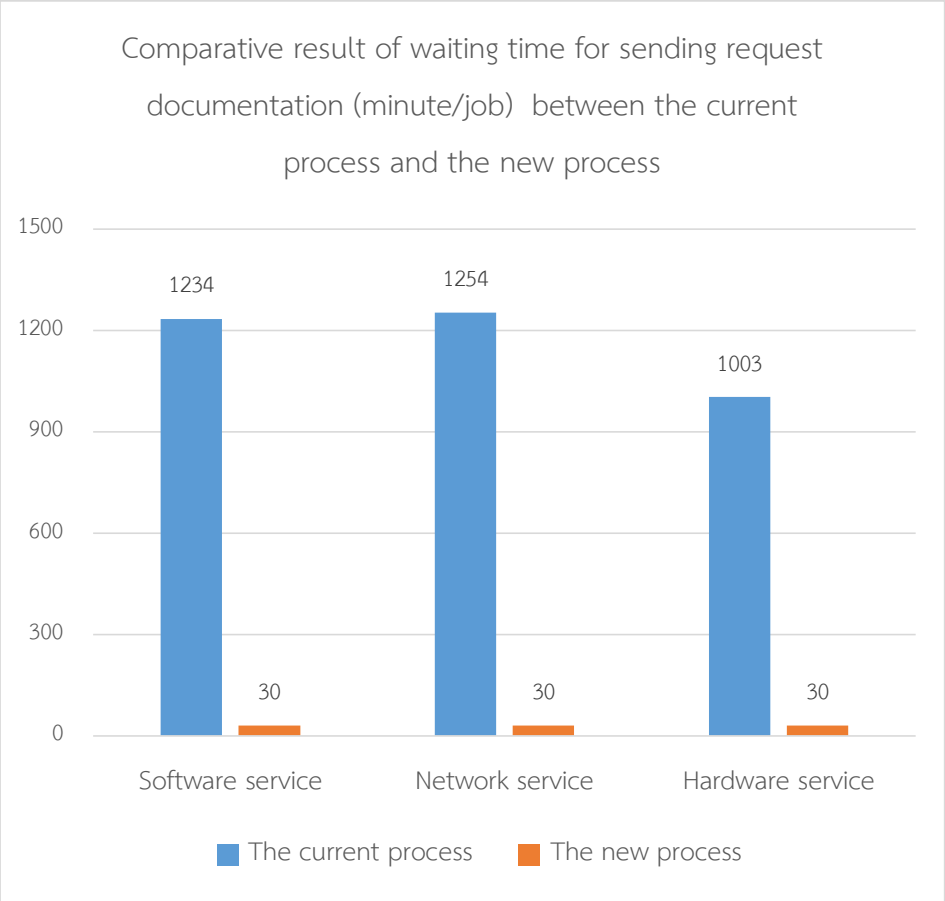

Figure 4-2 Comparative result of Waiting time for sending request documentation (minute/job) between the current process and the new process

Table 4-4 Cycle time for service process (day/job) between the current process and the new process

Service types	The current process (days)	The new process (days)
Software service	2.92	1.51
Network service	2.68	1.17
Hardware service	2.10	1.41
Total	2.57	1.36

Table 4-4 presents cycle time for service process is 2.57 days/job for the current process and 1.36 days/job for the new process. The new process reduces cycle time for service processes 1.21 days/job. Figure 4-3 shows the comparative result of cycle time for all types of service in the new process are lower than the current process.

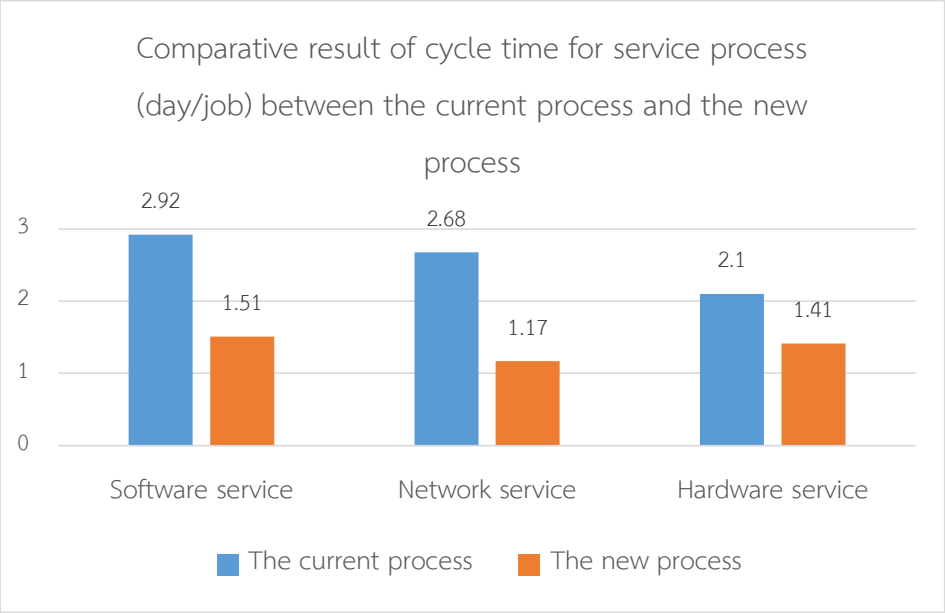

Figure 4-3 Comparative result of cycle time for service process (day/job) between the current process and the new process

The comparative results of the quantityof rework between the currentprocess and the new process are shown in Table 4-5.

Table 4-5 Quantity of rework between the current process and the new process

Service types	The current process (jobs)	The new process (jobs)
Software service	14	2
Network service	4	0
Hardware service	0	0
Total	18	2

From Table 4-5, an impact of time lags is the effect of the misplan operation, which has been reworked. The number of rework is 18 times (10.47%) in the current process and 2 times in the new process (1.20%). The results in Figure 4-4 show that the number of software service rework in the new process is reduced to 2 jobs from the current process of 14 jobs. The network service has no rework in the new process compares with 4 jobs in the current process. For hardware service, it does not change because both of them do not have rework.

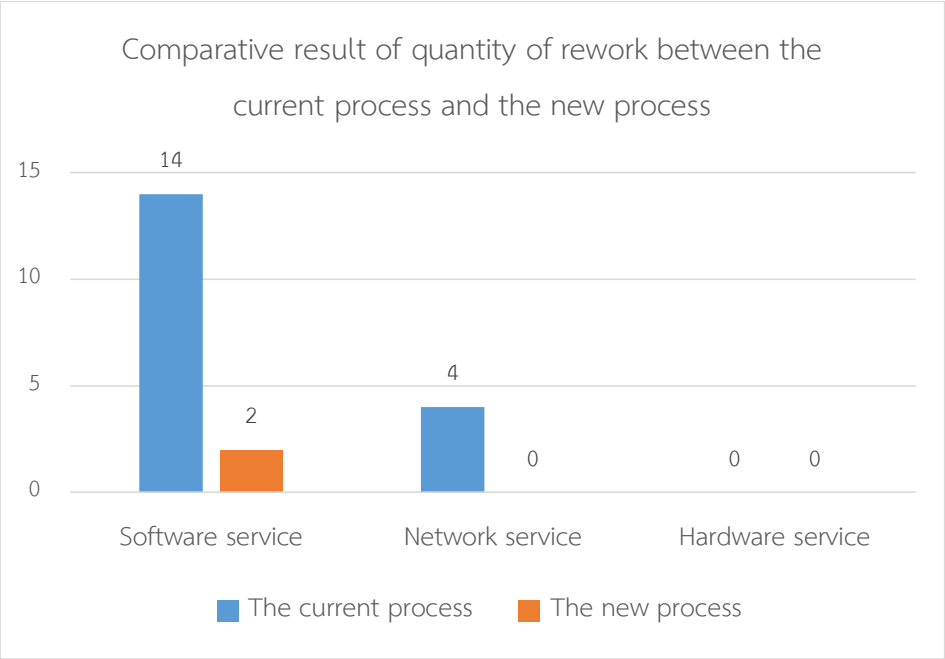

Figure 4-4 Comparative result of Quantity of rework between the current process and the new process

The new process of computer service center developed by using BPR based on the relevant of rules and policies are the most appropriate to the computer service center. The performance of service is effective and is better than the current process by reducing cycle time for service process and quality of rework.

CHAPTER 5

CONCLUSION PROBLEMS AND SUGGESTION

This chapter gives a summary of Business Process Reengineering in computer service center, discussion, problems, key factors and conclusion.

5.1 Discussion

Although computer service is not the main task of the organization, but it has play an important role in driving organizations to work effectively. The main objective in this study is to reduce the cycle time. After reviewing many literatures, it is appropriate to apply BPR to new process development from 1) Identify the As-Is processes, 2) Review, update and analyze the As-Is process, 3) Design the To-Be process, and 4) Test and Implement To-Be.

Moreover, the framework was used as a practical guide to making decision, process development, and reducing 6 unnecessary steps, as shown in Table 4-2. The framework was created in consideration of the environment of the organization which benefited similar structural organization to improve the process. Finally, all necessary steps were verified by 3 executives of the computer service center.

The results of this study was successfully implemented. All of the comparison results of the new process were better than the current process. Results from Section 4.2 can be summarized below:

- Waiting time for the request documentation was reduced to 1133 minutes/job.
- The cycle time of service process was reduced to 1.21 days/job.

- The number of rework was 18 times (10.47%) in the current process and 2 times in the new process (1.20%).

Sending of request documentation changed call center system service time to 1133 minutes/job (Table 4-3) that complied with Hammer and Champy study. Stewart [32] claimed that Bell Atlantic reduced the time of new telecommunication circuits installation from 16 days to just hours. The new process reduced waiting time of request documentation and task assignment. As a result, reworks decreased.

According to above results, the new process is more efficient and saves time than the current process. The cycle time and waiting time decrease in the same manner as Sung J. Shim [20] and Doomun's study [21]. When implementingthe process to the organization, the result is going in the same way according to Ghannouchi, Chou, and Zhang study [16] [27] [33].

5.2 Threats to validity

1. Regulation or policies of the organization are not clear so they affect the decision making of each step in creating new process. The study of rules and education policies of the organization is necessary for making right decision.
2. There are unavailability of staffs and customers in the transition period from current process to new process using. According to that, staff coaching and public relations should be provided.
3. There are many staffs who are familiar to work with the current process and require a period of time for adaptation to the new process. In the first month, they should use parallel system. In the second month, they can begin using the new process alone to minimize counterproductive behaviors of the staffs.
4. The changing of major task comes to the delay in service so there must be a system of alternative service.

5.3 Key factors

The key factors that make a successful process improvement are:

1. High-ranking authority supports the organization with great improvement support and full cooperation by the various sides serious and clear. They allow the process to improve forward stability, without a doubt, this support is an important factor in the success of this work.
2. Process reengineering team has supported throughout the whole operation to the needs of the new processes and provide support for the resource including data analysis after implementing a new process.
3. Clearing the purpose of process reengineering is the delay in providing the service. The researcher could properly meet the demand and goal. Finally, the final results clearly support the aim purposes.
4. Process controlling and monitoring. This study is designed to collect request time, start time and success time of the service. It has verification process by customer and leader, include customers suggestions for better quality and performance of the service, that lead to clear guideline and standard.
5. The officers agrees to improve the process and would adapt it forward for operating the new process smoothly.

5.4 Conclusion

The phases of process reengineering in this study is follows;

5. Identify the current process
6. Review, update and analyze the As-Is process
7. Design the To-Be process
8. Test and Implement the To-Be process

The conclusion of process reengineering results in this study is follows;

1. The current process is clear and correct.
2. The problems are relevant and accurate.
3. The number of steps in the new process less than the number of step in the current process.
4. The results show the new process are better than the current process.

The reengineering profoundly changes all aspects of process and people. The current process is easy to change by reinventing a way to work. But the people part is very difficult to change. It requires not only roles and skills change but also people's styles - the ways in which they think and behave - and their attitudes - what they believe is important about their work. So personnel are a key factor of successful process improvement.

The performance of the new process is better than the current process. The cycle time of the new process is less than the cycle time of the current process because the new process can reduce unnecessary steps in the current process. Result, the service provider resolves the problem faster, it reduces the number of rework.

Finally, the new process presented in this study is designed in consideration of the environment of the organization. For other organizations, it is important to consider about the availability of staffs. There must be a personnel survey of staff numbers, ability, and work experience in order to provide enough staffing.

REFERENCES

[1] J. Harris, Scientific management, bureau-professionalism, new managerialism: the labour process of state social work, British Journal of Social Work, vol. 28, 1998, pp. 839–62.

[2] M. Hammer and J. Champy, Reengineering the Corporation: A Manifesto for Business Revolution, Atlanta: Harperbusiness, 1993.

[3] T.H. Davenport, Process Innovation: Reengineering Work Through Information Technology, Boston: Harvard Business School Press, 1993.

[4] S. Mohapatra, Business Process Reengineering Automation Decision Points in Process Reengineering, New York: Springer, 2013.

[5] U. G. Seebacher, Cyber Commerce Reframing: The End of Business Process Reengineering? , Berlin: Springer, 2002.

[6] D. Jack Elzinga, T. R. Gulledge and Chung-Yee Lee., Business process engineering : advancing the state of the art, New York: Springer, 1999.

[7] M. Hammer and J. Champy, Reengineering the Corporation: A Manifesto for Business Revolution, Atlanta: Harperbusiness, 2001.

[8] S. Mohapatra, Business Process Reengineering Automation Decision Points in Process Reengineering, New York: Springer, 2013.

[9] R. Clary and J. Wandersee, Fishbone Diagram Organize Reading Content With a “Bare Bone” Strategy, Science Scope, vol. 33 Issue 9, 2010, pp. 31-37.

[10]M’H. Abdous, Towards a Framework for Business Process Reengineering in Higher Education, Journal of Higher Education Policy and Management, vol. 33, 2011, pp. 427 - 433.

[11]R. A. Swanson, Theory Building in Applied Disciplines, San Francisco, CA: Berrett-Koehler Publishers, 2013.

[12]E. S. K. Yu and J. Mylopoulos, An actor dependency model of organizational work: with application to business process reengineering, COCS '93 Proceedings of the conference on Organizational computing systems, 1993, pp. 258-268.

[13]B. Schwartz, B. W. Hwang and C. J. Hwang, A workplan for business process reengineering and a challenge for information science and technology, 1995, pp. 178-194.

[14]A. Gunasekaran and B. Kobu, Modelling and analysis of business process reengineering, International Journal of Production Research, vol. 40 issue 11, 2002, pp. 2521-2546.

[15]Y. Wu, N. Han and H. Wang, Implementation of the Computer Aided Business Process Reengineering System Based on UML and J2EE Technology, Business and Information Management, 2008. ISBIM '08. International Seminar on, 2008, pp. 173 – 176.

[16]S. A. Ghannouchi, K. Mabrouk and S. Ghannouchi, Proposal of data warehouse in the context of healthcare process reengineering, Business Process Management Journal, Vol. 16 iss 4, 2010, pp.688 – 712.

[17]H. N. Nzewi and U. Nzewi and P. C. Moneme, Business Process Reengineering and Performance of Courier Service Organizations in Anambra State, Nigeria, American Journal of Social and Management Sciences, 2015, pp. 24-33.

[18]M. M. Fathee, R. Redd, D. Gorgas and B. Modarres, The effects of complexity on business processes reengineering: values and limitations of modeling and simulation technologies, Simulation Conference Proceedings, 1998, pp. 1339 – 1345.

[19]R.M. Doomun and N.V. Jungum, Business process modelling, simulation and reengineering:call centres, Business Process Management Journal, vol. 14 lss 6, 2008, pp. 838 – 848.

[20]Sung J. Shim and A. Kumar, Simulation for emergency care process reengineering in hospitals, Business Process Management Journal, vol. 16 lss 5, 2010, pp. 795 – 805.

[21]M. Albers, R. Agarwal and M. Tanniru, The practice of business process reengineering: radical planning and incremental implementation in an IS organization, SIGCPR '94 Proceedings of the 1994 computer personnel research conference on Reinventing IS : managing information technology in changing organizations: managing information technology in changing organizations, 1994, pp. 87-96.

[22]J. W. Candler, P. C. Palvia, J. D. Thompson and S. M. Zeltmann, The ORION project: staged business process reengineering at FedEx, Communications of the ACM CACM Homepage archive, vol. 39 Issue 2, 1996, pp. 99-107.

[23]Rajiv Kohli and Ellen Hoadley, Towards developing a framework for measuring organizational impact of IT- enabled BPR: case studies of three firms, ACM SIGMIS Database, vol. 37 Issue 1, 2006, pp. 40-58.

[24]C. Shen, Effect of Business Process Reengineering on Logistics Performance: A Case Study of Taiwan, 2007 IEEE International Conference on Automation and Logistics, 2007, pp. 2887 – 2890.

[25]L. L. Zhang, R. J. Jiao and Q. Ma, Accountability-based order fulfillment process reengineering towards supply chain management: A case study at a semiconductor equipment manufacturer, Journal of Manufacturing Technology Management, Vol. 21 iss 2, 2010, pp.287 – 305.

[26]S. Fithri and J. H. Yahaya, CONCEPTUAL MODEL OF BUSINESS PROCESS RE-ENGINEERING: A CASE STUDY OF A CARGO COMPANY IN MALAYSIA, The International Conference on Informatics and Applications (ICIA2012), 2012, pp. 36-48.

[27]YC Chou, BY Chen and others, Prescription-filling process reengineering of an outpatient pharmacy, Journal of Medical Systems, vol. 36, 2012, pp. 893-902.

[28]D. Biswas, STUDY OF EMPLOYEES' MENTAL REVOLUTION BY IMPLEMENTATION OF BUSINESS PROCESS REENGINEERING BY HUMAN RESOURCE DEPARTMENT, International Journal of Organizational Behaviour & Management Perspectives, vol. 1, 2012, pp. 140-144.

[29]A. kumar, A Qualitative Study on the Barriers of Lean Manufacturing Implementation: An Indian Context (Delhi Ncr Region), The International Journal Of Engineering And Science (IJES), vol. 3 iss 4, 2014, pp. 21-28.

[30]A. Mahjoor, A descriptive study on business process re-engineering methods for Small and medium sized companies, Journal of Current Research in Science, vol. 1, 2016, pp. 946-949.

[31]J. Esbenshade, M. Vidal, G. Fascilla and M. Ono, Customer-driven management models for choiceless clientele? Business process reengineering in a California welfare agency, Work, employment and society, vol.1 iss 1, 2016, pp. 77-96.

[32]T.A. Stewart, Re-Reengineering. The Hot New Management Tool, Fortune, 1993, pp. 41-48.

[33]Zhang, R. J. Jiao, Q. Ma, Accountability-based order fulfillment process reengineering towards supply chain management, Journal of Manufacturing Technology Management, vol. 21 lss 2, 2010, pp. 287-305.

APPENDIX

VITA

Mr. Soontorn Phiphopsuthipaiboon was born on November 4th, 1990 in Bangkok, Thailand. He received his bachelor's degree in computer science from Chulalongkorn University in Thailand in 2013. He started early job as a system analyst in Faculty of Science, Chulalongkorn University. He is currently a graduate student in Chulalongkorn University, Bangkok, Thailand.

Publication:

"Business Process Reengineering–A Case Study on Computer Center Service"International Conference on Engineering Design and Analysis, 2016

Accepted and published in MATEC Web of Conferences, ISSN: 2261-236X, Volume 81, Article Number 06006, 2015.