

STUDY ON IT SERVICE MANAGEMENT AT A POLYTECHNIC COLLEGE

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ABSTRACT

In this case study on maintenance activities of the information systems at a polytechnic college, we classify actual operations of the maintenance activities by following the classification of the service operations described in the ITIL (Information Technology Infrastructure Library) which is a compiled set of best practices for IT service management. Based on this classification, we discuss practical usefulness of the service operations of one of the processes in the ITIL service life cycle. From these results, we consider IT service management at the polytechnic college.

Keywords: Maintenance Activities, IT Service Management, ITIL

INTRODUCTION

Information systems of higher educational institutes are indispensable to the education and business operations of institutes. Their maintenance activities should keep the systems available even when their circumstances have been changed in education and business operations. Maintenance activities are not usually recognized as IT service; consequently there are few activities intended to provide IT services. Instead, the focal point of the improvement of maintenance activities has been cost and budget reduction. In addition, previous studies in the domain of maintenance activities focused mainly on problems of software maintenance.

Kung and Hsu(1998), for example, proposed a software maintenance life cycle model by modifying the well-known product life cycle model. This model identified the four stages of the maintenance activities of software applications as introduction, growth, maturity, and decline. In the paper, the maintenance tasks of software applications were classified as user support, repair, and enhancement. The authors then identified the related stages in the life cycle model.

Nah *et al.*(2001) analysed the characteristics of three enterprise resource planning (ERP) implementations using the following six categories of maintenance activities: corrective maintenance, adaptive maintenance, perfective maintenance, preventive maintenance, user support, and external parties. Following Kung and Hsu(1998), they showed the frequency of maintenance tasks in the first three stages of the software life cycle model to discuss the characteristics of the maintenance activities of three different ERP implementations.

Yokota and Yasuda (2010) employed the six categories of maintenance tasks of ERP packages proposed in Nah *et al.*(2001). Yokota and Munehira (2012) analysed the

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characteristics of maintenance activities of an enterprise information system by employing the same six categories of maintenance tasks with some details. Focusing on three different ERP packages, they analysed the actual maintenance data over time instead of their frequency of occurrences in the six categories of maintenance tasks. They showed that there were strong correlations among the six categories while the combinations of the categories in the correlations changed over time.

Wada and Yoshida (2012) investigated the characteristics of maintenance activities of the information systems at a polytechnic college. They classified the maintenance tasks into the three categories, User Support, Repair, and Enhancement, based on the categories of maintenance activities of the software packages proposed by Kung and Hsu (1998). They clarified some features of the maintenance activities. For example, Repair tasks increased over time. Many tasks of user support were technical support. It pointed out that the maintenance activities required tasks more than availability and enhancement of the systems. There were many maintenance tasks to change operations of the systems, and to enhance the software applications according to changes of their circumstances such as ones in educational contents and business operations at the polytechnic college. And there were many types of maintenance tasks: hardware maintenance, update of operating system and middle ware and application soft, modifying policy of network and access, user support. Consequently, the maintenance tasks could not be appropriately classified by following the classification methods in the previous studies of software packages. Furthermore, they did not clarify what kind of value of the information systems would be provided as service by the maintenance activities.

The current case study, based on Wada and Yoshida (2012), focuses on the maintenance activities of the information systems at the polytechnic college. We change our focal point of the investigation from the maintenance activities that mainly repair and enhance both hardware and software to IT service for users of the information systems. We investigate the maintenance activities of the information systems at the polytechnic college by referring to the ITIL (Information Technology Infrastructure Library) and compare the maintenance tasks with the processes described in ITIL Service Operation, ITIL Service Design, and ITIL Service Transition, three of the five stages of the ITIL service life cycle. We also investigate value for users as IT service by maintenance activities. From the results, we discuss the practical usefulness of the processes described in ITIL Service Operation of the ITIL service life cycle. Then we discuss details of the IT service management at the polytechnic college.

Classification of the Maintenance Tasks into the Processes described in the Stages of the ITIL Service Life Cycle

- **About the ITIL**

ITIL is the most widely recognized framework for the accepted practical guides of IT service management in the world. The ITIL core elements consist of the five stages of the ITIL service life cycle. They are the Service Strategy, Service Design, Service Transition, Service Operation, and Continual Service Improvement stages. Each stage of the ITIL

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service life cycle exerts influence on the other stages, and relies on them for inputs and feedback. In each stage of the ITIL service life cycle, the processes are defined as operations to accomplish the objective of providing users with service of information systems.

Service Strategy provides guidance on how to view service management, not only as an organizational capability but also as a strategic asset. Value creation begins with understanding organizational objective and customer needs. Five processes are defined to accomplish the purpose of this stage; they are Business Relationship Management, Demand Management, Financial Management, Service Portfolio Management, and Strategy Management processes for IT services.

Service Design provides the guidance for the design and development of services and service management practices. The primary effort of Service Design is the service design which includes defining service with the requirements of users. The scope of this stage is open to new services. It includes the changes and improvements necessary to increase or maintain value to customers over the life cycle of services. Seven management processes are defined in this stage: Availability Management, Capacity Management, Design Coordination, IT Service Continuity Management, Service Catalogue Management, Service Level Management, and Supplier Management.

Service Transition describes how to transfer an organization from one state to another while controlling risk. It also provides guidance on managing complexity related to changes to services. The primary activities of this stage are transition planning and support. In addition, it provides guidance on managing complexity related to changes to services. Seven processes are defined in this stage as follows: Change Evaluation, Knowledge, Management, Release and Deployment Management, Service Asset and Configuration Management, Service Validation and Testing, and Transition Planning and Support processes.

Service Operation describes IT services available for end users. Its purpose is to coordinate the processes required to deliver and manage services at agreed levels with users. Five processes are defined in this stage: Incident Management, Problem Management, Request Fulfilment, Event Management, and Access Management processes. In addition to these processes, four functions are also defined in Service Operation. They are Service Desk, Technical Management, IT Operations Control and Application Management functions. Operations of the processes in Service Operation rely on some functions to execute maintenance tasks. A function is a team or group of people and the tools or other resources they use to carry out one or more processes.

Continual Service Improvement describes best practice for achieving large scale improvements in service quality, operational efficiency, business continuity and business needs. The guidance of this stage is provided for linking improvement efforts and outcomes from Service Strategy, Service Design, Service Transition and Service Operation. Feedback from any stages of the ITIL service life cycle can be used to identify improvement opportunities for any other stages. A Seven-Step Improvement Process is defined in this stage: definition of what is to be measured, definition of what can be measured, measurement of data, processing, analysis of the data, presentation of the

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information, and implementation of corrective action along the Plan-Do-Check-Action cycle.

• The Target Information Systems and Data

There are 161 tasks to be considered in this study. Note that these tasks include those for user support. These tasks were processed in the first year from the release of the information systems at the polytechnic college from November, 2010 to October, 2011. We investigated the relationships between these tasks and the processes of the ITIL service life cycle. These tasks were carried out on the following resources of the information systems at the polytechnic college:

- Servers (Windows server, Proxy server, DNS Server, Data Base Server)
- Network Devices (Core Switch, Fire Wall, Floor Switch, Link Controller)
- Web Mail (Gmail)
- Software Applications (Data Base Management System, System Monitoring, Data Backup System, Computer System, Mailing List System)
- PCs (In Computer Classroom)

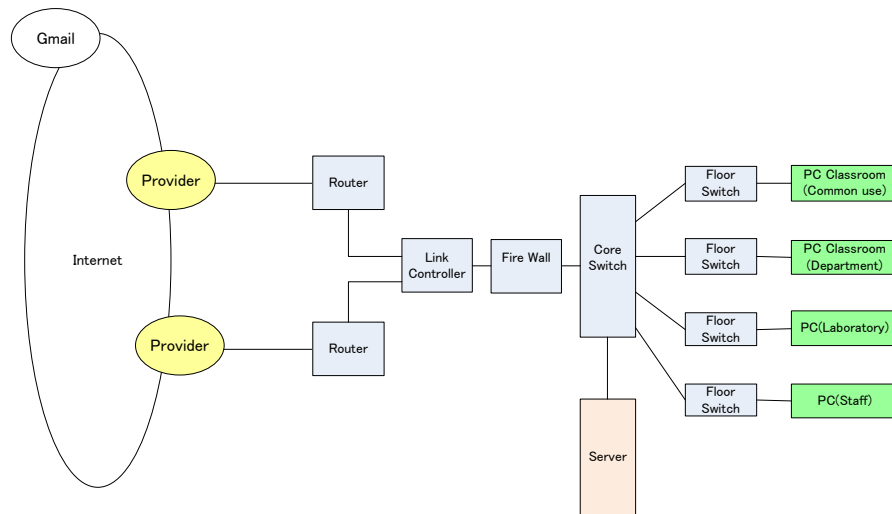


Figure1. Information Systems at the Polytechnic College

• Result

161 maintenance tasks were classified into four processes of Service Operation: Incident Management, Problem Management, Request fulfilment and Access Management (Figure 2). There was no task to correspond to Event Management because the information system had only been implemented in November 2010; thus any monitoring system was not appropriately operated to gather events. For example, threshold was not set appropriately. Consequently, no maintenance task was detected by Event Management using the monitoring system.

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Except for the processes in Service Operation, we found out the necessary processes of the other stages of the ITIL service life cycle. In this stage two processes are identified among the tasks. They are Capacity Management and Information Security Management. These processes improved the lack of resource and security of the information systems by providing appropriate IT service.

Three processes in Service Transition are found to be related to the tasks. They are Change Management, Service Asset and Configuration Management, and Release and Deployment Management. These processes were carried out to manage the changes and improvements from the requirements of users.

The polytechnic college's information systems were indispensable to accomplishing the main purpose of education and research. When system failures have occurred, education and research could not be accomplished. Indeed, the result presented in Figure 2 shows that there are 87 tasks in Incident Management process out of 161 tasks. Figure 2 shows that 90.1% of user value was provided by IT services and 9.9% of user values were provided by information about the provided IT services. From the results, we can say that our investigation was effective to grasp the characteristics of the provided IT services.

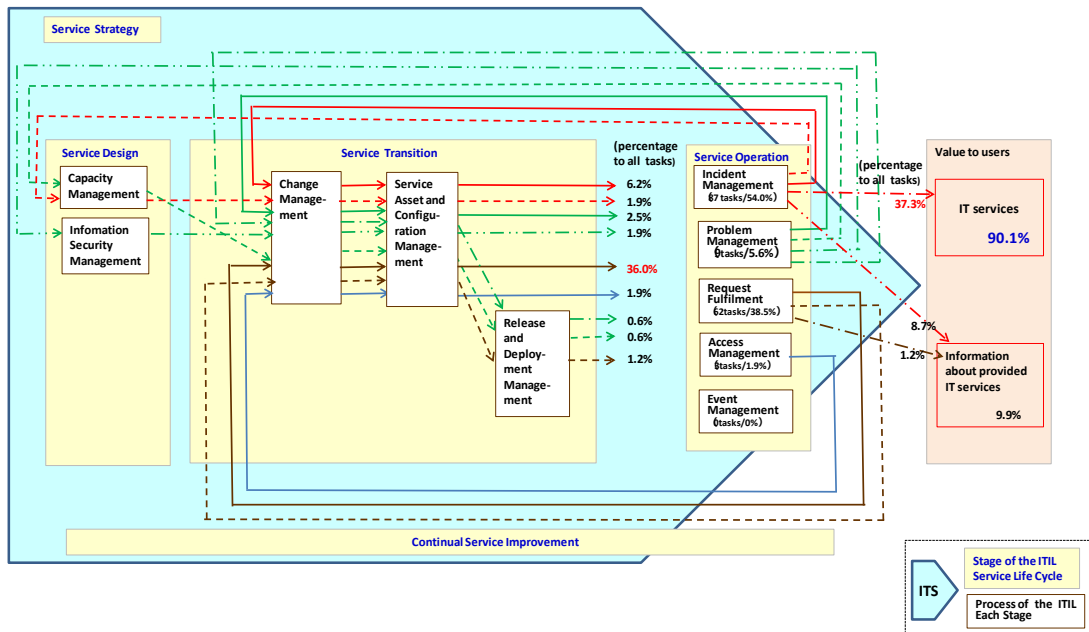


Figure 2. Classification of the maintenance tasks into the processes of the stages of the ITIL service life cycle (n=161)

Discussion of Practical Usefulness of Operations of the Processes in the ITIL Service Life Cycle

In this section, we show the details of the tasks in the processes of the stages of the ITIL service life cycle and confirm what kinds of operations of the tasks have provided IT services for users. Then we discuss the practical usefulness and value of operations in the processes of the stages of the ITIL service life cycle.

- **Service Operation Stage**

For this investigation, we define five types of operations and five types of resources of the information systems and four types of workloads. Five types of operations are Setting, Change, Repair, Recovery, and Investigation. Five types of resources are Operating System (OS), Software (SW), Hardware (HW), Network (NW), and others. Four types of workloads are one day, from two to ten days, from ten to twenty days, and more than twenty days which are the completion time periods of the tasks.

Table 1 shows the result of the classification of the maintenance tasks in this case study. These tasks were carried out in the four processes and two of the four functions of Service Operation. Two functions are Service Desk and Technical Management. The staffs of Service Desk were assigned from the maintenance department of the information systems at the polytechnic college. The staffs of Technical Management were system engineers of a system integrator and vendor. This company was a project member of the construction of the information systems at the polytechnic college. Note that there was no task about IT Operations Management and Application Management functions. Application Management is responsible for the life cycle management of application and there was no task of such application management in the period of this study. The role of IT Operations Management function is the execution of the activities to deliver IT services to users.

There are 94 tasks done by Service Desk function and 67 tasks by the Technical Management function. There are 87 tasks in Incident Management, 9 tasks in Problem Management, 62 tasks in Request Fulfilment, and 3 tasks in Access Management. The Service Desk function only executed tasks with one-day workload except for the two tasks of the Change activities in Request Fulfilment. The 22 tasks with more than or equal to two-day workload were done by Technical Management function.

Incident Management

Incident Management is intended to restore the failed IT services caused by unplanned incidents and deliver the services to users as rapidly as possible. Table 1 showed that the 87 tasks out of 161 occurred in Incident Management. 71 tasks out of 87 were executed in a day. This result shows that Incident Management process handled many IT service failures effectively. Although some tasks were executed in Incident Management, they were finally fed back to Service Design and Service Transition to further consideration.

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Many tasks in Incident Management were caused by or found with requests or reports from users of the information system. It is important for the Service Desk and Technical Management functions to achieve PDCA (Plan-Do-Check-Act) cycle with users and to provide IT services to users in Incident Management.

Table 1. Classification of Maintenance Tasks into the Processes and the Functions of Service Operation Stage, Resource of System and Type of Workload (n=161)

Functions · Resources Process · Activities		Type of Workload	Service Desk					Technical Management				
			Resource of System for Maintenance Tasks					Resource of System for Maintenance Tasks				
			OS	SW	HW	NW	Oth-ers	OS	SW	HW	NW	Oth-ers
Incident Management	Setting	1										1
		2-10										1
	Change	1		1								7
		2-10										2
	Repair	1	11	7	2	1		9	3			1
		2-10								1	1	1
		10-20										
	Recovery	20-								1		
		1	2		4		2	2			2	3
		2-10								3		
	Investigation	10-20								1		
		1	1	8				1	3			
2-10											4	
Problem Management	10-20										1	
	1						3	2				
	2-10						1				1	
Request Fulfillment	Change	20-									1	1
		1		17		30			2			
	Setting	1	1	2		1		2	2			
		2-10	1					1				
	Investigation	10-20	1									
Access Management	Setting	1							1			
		2-10										1
	Change	1	2									

Problem Management

All tasks in Problem Management were carried out by the Technical Management function. Some of the tasks were, for example, tasks to revise specification of the information systems, tasks to replace application software of the backup system, and so on. The Service Desk function played the role of the contact point between users and Technical Management function. The Problem Management process provided high-quality technical support to resolve fundamental problems of the information systems by Technical Management function.

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Request Fulfilment

Request Fulfilment handled standard changes and specific types of service requests. The 53 tasks out of 62 in this process were carried out by the Service Desk function. These tasks were standard changes and settings such as the registration of peripheral equipment. Accordingly, it can be said that the Request Fulfilment process is important to keep the systems available when their circumstances have been changed in education and business operations.

Access Management

The Access Management process was carried out to provide access permission, such as one to the file systems for users. These tasks were carried out at the time of annual update of user's data at the polytechnic college. This process is important for security of the information systems.

- **Service Design Stage**

The Service Design stage includes processes of the changes and improvements necessary to increase or maintain value to users over the life cycle of IT services, the continuity of IT services, the achievement of IT service levels, and conformity to standards and regulations. In this stage, some tasks in the Incident Management and Problem Management processes of the Service Operation stage were fed back to this stage. The related processes to those tasks in this stage were Capacity Management and Information Security Management. The Capacity Management was carried out to adjust capacity of IT resource. The Information Security management process was carried out to resolve the problems about security incidents such as a hacking of the security of network with new technology. Two processes were required to compensate for lack of resources and security, and to maintain the availability of the information systems in this case study.

In the ITIL, the activities of these processes involve analysis and planning. Based on the analysis of problems, we can plan to deliver better IT service by activities of these processes before the problems occur. However, in this case study, these processes were carried out after the problems had occurred. Investigating the details of operations in each process, we could confirm the differences between best practice and actual operations of the ITIL processes.

- **Service Transition Stage**

Many tasks in the Request Fulfilment process of the Service Operation stage were fed back to this stage. The Change Management, Service Asset and Configuration Management, and Release and Deployment Management processes were related to most of those tasks. These processes were also required to keep the information systems available when their circumstances were changed in education and business operations. Some tasks were related to the Release and Deployment Management. This process manages the transition of IT service while controlling risk. The Change Management process was carried out without adequate risk management. As well as Service Design

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stage, we could confirm the difference between best practice and actual operations of the ITIL processes.

CONCLUSION

In this study the main feature of the maintenance activities at the polytechnic college was clarified effectively by the classification of the tasks into the processes of the ITIL Service Operation as proposed in this study. According to this result, we may identify the needs of users, the level of performance of information systems required for users, conformity with business strategy, and other factors to provide better IT services for users. Figure 3 shows the relationship among the five stages of the IT service management in this study and the ITIL. In the figure, we compared the actual operations of IT service management at the polytechnic college with best practices as described in the ITIL by classifying the maintenance tasks into the ITIL processes. Consequently, we confirmed the inadequacies of operations of maintenance activities to provide value of the information systems as IT service. If we address this lack of operations, we can improve IT services for users.

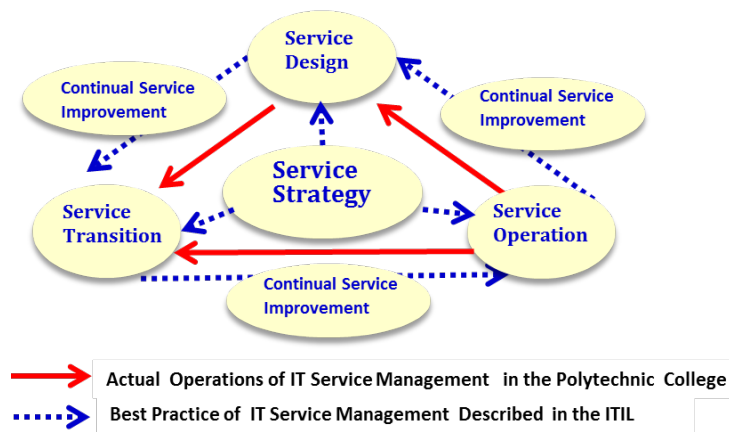


Figure3. IT Service Management of the Polytechnic College and the ITIL

One of the roles of maintenance activities is to keep information systems available to users. These activities must be carried out while supporting needs of users and adapting the information systems to changes of environment. Another important role of maintenance activities is to provide value of information systems for users. Indeed, many tasks for incidental failures and requests were carried out as IT services for users.

It is important to establish IT service management through maintenance activities as IT services like the ITIL. The PDCA (Plan-Do-Check-Act) from the users' viewpoints will work for the purpose to fully meet the needs of education and business operations at the polytechnic college.

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• Limitation of this Research and Future Research Directions

This study covers the maintenance activities of only one polytechnic college. It is necessary to investigate maintenance activities of information systems at other institutes of higher education and research to validate the framework of analysis proposed in this study. In addition, it is necessary to expand the domain of investigation of the maintenance activities to all stages of the life cycle of systems.

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