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A Design of University Information System Operation Audit Model based on ITIL V3

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Abstract

The purpose of constructing university information system is for improvement in diversification and throughput of information, streamlines business processes, rapid exchange of information, sharing of information, decision-making information, and securing educational facilities. Similar to business information technology system, university information system does not have a review system for sharing and overlapping investment of information. Due to the lack of project management for outsourcing and vulnerability of system suitability, system audit is absolutely needed for the university information system. This paper especially focuses on an operational phase in the audit of university information system. Additionally, we proposed operating model and checklists of the university information system based on Management Guidelines of ITIL V3 Operational and Information System. We derived the checklists of operation audit by each domain of service strategy, service design, service transition, service operation, and continual service improvement. As the result, this study appear to have more than average satisfaction the suitability results were.

Keywords : University Information System, System Audit, ITIL V3, Checklists, Operation Audit

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1. Introduction

Universities began building university information systems aimed at standardizing their work and building integrated systems as a strategic tool for university development [Yun, 2008]. The purpose of establishing the university's information system is to diversify and increase information throughput, to rationalize business processes, to exchange information quickly and share information outside the campus, to provide decision-making information, to secure advanced educational facilities, and to promote schools [Lee et al., 2012]. In this way, the development of information systems in the university and the internet have been combined with the new educational paradigm of e-learning [Nam et al., 2011].

As cyber lecture students increase, cyber university information system is continuously growing. Therefore, it is also the bachelor's administration, general administration and research administration field which is operated in the existing university. In the case of universities, it is necessary to carry out the duty audit for the establishment of information system of a certain scale or more in accordance with Article 2 of the Enforcement Decree of the Act on the Efficient Implementation and Operation of Information Systems [NISA, 2005]. Until now, there are few cases in which the audit is carried out because the scale of the project to be implemented by the university is small and it is the initial stage of the law enforcement. As with the information-oriented business in the public sector, the information system construction project of the university has inherent risks such as lack of a detailed technical review system for information sharing and redundant investment, lack of specialized business management functions for outsourcing, and vulnerability to system stability.

In this paper, we focus on the operational stage of information system configuration in the audit of university information system based on ITIL V3 and information system operation management guideline, information management system, cyber education system (LMS, LCMS), and we will suggest the appropriate operation audit model and check items of the system.

2. Related Work

2.1 Information System Operation Audit

2.1.1 Concept of Operation Audit

Information system operation audit refers to the audit that is carried out when a periodic or special case occurs as an auditor to check the equipment organization of the computer system, the operation management of the work, and the error countermeasure [Kim et al., 2004].

Operational audit is a major activity that assesses the risk of system operation and presents improvement measures by comprehensively evaluating various internal controls such as general control and application control existing in the organization that constitutes the operating environment of information system. And it includes the performance, capacity management, and the effectiveness and effectiveness of user satisfac-

tion and management contribution [Oh, 2011]. Therefore, information system operation audit is to advise stakeholders by checking efficient and effective computer system installation, operation management and error countermeasure.

2.1.2 Necessity of University Information System Operation Audit

The university information system can be divided into portal management system and cyber education system based on the administrative administration system. Each system can be linked to form an effective university information system. With the development of IT technology, the university information system market is getting bigger day by day. However, the domestic information system audit is concentrated on the public sector information system, and the university information system has recently been under the audit through the university information system based on the advanced information infrastructure, but it is still insufficient.

In addition, universities are accelerating the pace of change as a mobile campus through e-campus, focusing on future-oriented universities and focusing on ubiquitous campus implementation.

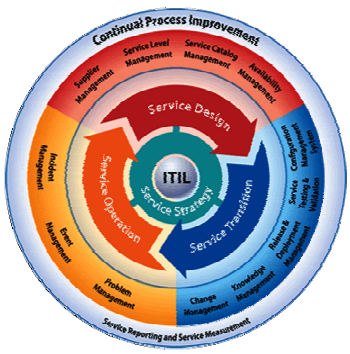
In order to construct such an important college information system efficiently and to continuously manage and operate it, it is necessary to check each system through operational audit, and it should be audited by appropriate management audit standard that is suitable for university information system.

2.2 ITIL (IT Infrastructure Library)

2.2.1 Service Life Cycle of ITIL

The IT Infrastructure Library (ITIL) is a collection of documents to help implement the framework for ITSM. ITIL is a collection of best practices for IT service management processes around the world. ITIL is a framework for IT service management and reference model for implementing ITSM. We provide a high quality IT service to our customers, so that we can reach the customer's business objectives from the four perspectives of technology, process, organization and manpower for all IT resources [Yoo, 2013].

The service life cycle consists of five components. As shown in <Figure 1>, service design, conversion, and operation are revolving around the service strategy, pausing for continuous service improvement, and then turning again when the improvement is over. Each element has a mutual influence and is dependent on input and feedback. By continually reviewing and coordinating activities during the service lifecycle, IT services can respond effectively to changing business demands [Yun, 2008].



〈Figure 1〉 ITIL V3 Life Cycle

2.2.2 Component of ITIL

The components of ITIL v3 consist of five areas: Service Strategy, Service Design, Service Transition, Service Operation, and Continual Service Improvement. It forms a cycle.

(1) Service Strategy

It contains information on how to design and build service management as strategic assets as well as organizational capabilities.

〈Table 1〉 ITIL V3 Service Strategic Process [Yun, 2008]

Process	Contents
Request management	Efficient organization management for service delivery
Strategy creating	Establish a service strategy that meets customer needs through business environment analysis
Service portfolio	Activities that manage the life cycle of service strategies
IT Accounting management	Perform quantitative management activities of IT costs according to service strategy

The service strategy is divided into demand management, strategy creation, portfolio management, and IT financial management as shown in <Table 1>. It includes service portfolio management, financial management, organizational development, and strategy risks, and it plays a role in connection with future IT governance, reflecting service strategy establishment and decision making.

(2) Service Design

It contains information on the design and development of service and service management processes.

〈Table 2〉 ITIL V3 Service Design Process [Yun, 2008]

Process	Contents
Service catalog	Activities that manage the details of the services provided, including definitions of services
Service level management	Activities to manage service levels according to service level agreements with customers
Capacity management	Activities that identify available availability and manage the appropriate level of availability objectives for customers
Availability management	Activities that ensure service performance with periodic monitoring and improvement of capacity management targets
IT service continuing	Overall management activities to provide continuity of IT services in the event of a disaster
Info security management	Security-related activities to ensure confidentiality, integrity, and availability of IT services
Supply management	Activities to manage suppliers and the services they provide to provide customers with efficient IT services

Service design is divided into service catalog management, service level management, capacity management, service continuity management, information security management, and supplier management. This includes not only the design of new services, but also the changes and improvements to existing services, and the recent inclusion of IT service trends.

(3) Service Transition

Service transition provides information on the development and enhancement of competencies needed to transition services or modified services to the operational phase.

〈Table 3〉 ITIL V3 Service Transition Process [Yun, 2008]

Process	Contents
Transition planning and support	Activities that adequately plan and coordinate relevant resources to ensure that the transition of services provided is successful.
Chanage management	Overall activity of managing changes to IT services by control procedures
Service asset/ configuration management	Activities that define and maintain service assets and configuration items
Release and enforcement management	Efficiently perform and release releases and deployments to release targets
Verification and testing	Activities to verify that the services provided to the customer are appropriate for their purpose and use and to perform tests
Evaluation management	Evaluate and continuously manage actual performance against expected service provision
Knowledge management	Activities to systematically manage and provide business information generated during service provision to customers

(4) Service Operation

Service operations are divided into event management, incident management, requirement fulfillment, problem management, access management, and operational management. It also presents a part of the actual service operation process and a conceptual IT service operation model.

(5) Continual Service Improvement

Continuous Service Improvement deals with principles and methods related to quality control, change management, and capacity building, and explores ways to improve service quality and business continuity.

〈Table 4〉 ITIL V3 Service Operation Process [Yun, 2008]

Process	Contents
Event management	Activities to identify, assess, and manage the significant impacts associated with delivering IT services
Request implementation	Overall activity to return to service level in the event of an abnormal event such as a defect or defect
Incident management	Activities that manage the process by which customer requirements are serviced
Problem management	Identify the root cause of incidents and manage them until the end
Access management	Ensure that only authorized users can access and ensure appropriate services only for authorized users

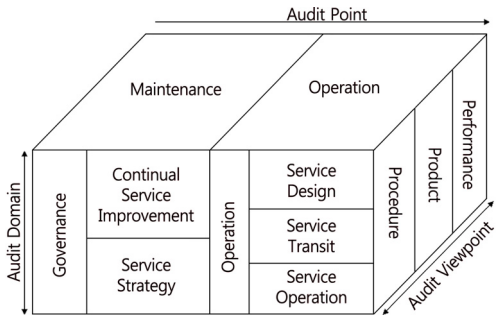
〈Table 5〉 ITIL V3 Continual Service Improvement Process [Yun, 2008]

Process	Contents
Service measurement	Activities that measure service levels by identifying the targets and analyzing the results of the process for continuous service improvement
Service analysis	Activities that analyze measurement results and identify improvement points and report them to the target person during continuous service improvement process
Service reporting	Activities to identify and remedy improvement tasks for continuous service improvement, and to verify and feedback results

3. Operational Audit Model of University Information System

3.1 Proposed Model of Operation Audit

For comparison with the operational control model of the ITIL V3-based information system, we refered to the operational audit model [Telecommunication Technology Association, 2008]



〈Figure 2〉 University Information Systems Operation Audit Model

and the life cycle [Yoo, 2013] of the ITIL in the information system audit framework of Korea IT Promotion Agency.

The audit domain is divided into five areas: continuous service improvement, service strategy, service design, service switching, and service operation. In order to provide IT service suitable for rapidly changing educational field requirements and environment change, it is aimed to enhance the continuous service improvement and service strategy part so that more detailed audit and inspection items can be derived to perform audit role [Oh, 2011].

3.2 ITIL-based Operational Audit Viewpoint and Check Criteria

ITIL-based operational audit viewpoints and audit point are classified into five stages: service strategy, service design, service transition, and service operation. <Table 6> summarizes the criteria for checking the university information system.

〈Table 6〉 Check Criteria of System Operation [Ministry of Information and Communication, 2005]

Check criteria		Related characteristics
Gov' guidelines	ITIL V3	
Manage config. changes	Service design	Provides procedures for managing configuration information such as hardware, software, and documents, which are components of the university information system, and for efficiently managing changes to components.
Operational state management	Continuous service improvement, Service operation	To monitor, discover, record, classify, analyze, and notify the university's information system of anomalies so that prompt action can be taken. - Server, network, storage, DBMS, middleware, application software, PC
Performance management	Service operation	Performance problem detection and improvement regulation through performance analysis
Fault Management		Provision for quick recovery of incurred failures, provision for preventive measures against disabilities through ongoing management of disaster recovery
Security		Security Management Standard Specification for information assets (information systems, networks, application systems, databases, etc.)
Backup		Provision of backup system construction procedure and backup system operation procedure
User Support	Continuous service improvement, Service Transition	Management of the computerized disorder reception, processing, guidance, record and disability status occurring in operation
Computer room		The access control service of the computer room and the management service of the building and related facilities related to the computer room
Operations outsourcing		Service level management, Operational personnel management
Budget Management	Service Strategy	Establish procedures and guidelines for planning, enforcing and controlling budgets in the information system operating organization.

3.3 Check Items of University Information System Operation Audit

3.3.1 Service Strategy Area

In the service strategy phase, the IT service delivery unit manages the clear requirements of the IT service utilization departments and defines plan services that meet the requirements.

The detailed processes required are shown in <Table 7>, and the requirements management, strategy creation, service portfolio management, and IT financial management should be considered in the service strategy stage. It is necessary to check the service contents provided by the university information system and the support activity strategy for realizing the desired values of managers, students and professors, the process management of the service portfolio, and IT financial management.

3.3.2 Service Design Area

This course introduces the integrated design principles of new or changed IT services to be applied to the operating environment at the service design stage, and introduces the processes that should be considered as a priority when designing IT services. In addition, it introduces organizational structure and role responsibilities and considerations from the service design point of view, so that service design provides cost reduction, quality improvement, consistency enhancement, and ease of implementation.

The required detailed processes are shown in <Table 8>. In the service design stage, service catalog management, service level management, capacity management, availability management, IT service continuity management, information security management, and supplier management should be considered together. It is necessary to check the accuracy of service catalog, stan-

〈Table 7〉 Service Strategy Check items [Oh, 2011; NISA, 2009]

Classification	Check Items
Request Management	Is there a definition of a service-level package that varies the service content and service levels provided by the university information system?
Strategy Creating	Is there a supportive strategy for creating and delivering the value that the person in charge, student, or professor wants?
Service Portfolio	Is the process of defining, analyzing, and documenting the consensus of the service portfolio managed throughout the service life cycle?
IT Accounting Management	Is systematic management of budget planning and accounting for the systems provided by the university?

〈Table 8〉 Service Design Check items [Yun, 2008; Nam et al., 2011; Oh, 2011]

Classification	Check Items
Service Catalog	Do you maintain and maintain accurate service catalogs?
Service Level Management	Do you develop and operate procedures to record, propagate, measure and resolve disability issues?
Capacity Management	Is it easy to obtain strategic planning and information on tasks required for job capacity, service capacity, and component capacity management?
Availability Management	Are there diagnostic and resolution plans for availability problems in college information systems?
IT Service Continuing	Are there continuing training and inspections, and test change management?
Info Security Management	Are the school's information security organization and policies, guidelines established, security breaches and major incidents reported and reviewed?
Supply Management	Is supplier contract evaluation, contracting, contract renewal and termination and performance management systematic?

dardization of service level, plan of system capacity management, availability management against customer's expectation, continual training and inspection of service, and change management. Also, it is necessary to check whether information security policy is established and maintained and supplier contract.

3.3.3 Service Transition Area

Processes supporting the process service lifecycle within ITIL V3 include processes such as transition planning and support, change management, service asset and configuration management, release and application management, validation and test management, assessment management, and knowledge management. In order to plan the appropriate resources and capacity from release to application, check whether the recording and composition of change of service assets and configuration is optimized, and the output of release and application plan. It also checks for the existence of verification and test implementation, reports on performance evaluation results, and knowledge management processes.

〈Table 9〉 Service Transition Check items [Yun, 2008; Nam et al., 2011; Oh, 2011]

Classification	Check Items
Transition planning and support	Has a change plan been established to maintain the integrity of customers, services, and assets?
Change management	Are standardized methodologies and procedures established to handle all changes efficiently and expeditiously?
Service Asset and Configuration Management	Do you identify, control, and understand service assets and configuration items to protect and ensure consistency?
Release and enforcement management	Are knowledge transfer and related deliverables satisfied so that customers and users can receive optimal business support?
Verification and testing	Are test personnel, skills and testing tools adequate?
Evaluation management	Are risk profiles, deviation reports, evidence statements, confirmation statements, change management recommendations, etc. based on the performance evaluation results included in the evaluation report?
Knowledge management	Are knowledge management strategies, processes, and procedures designed, delivered, and managed?

3.3.4 Service Operation Area

Service operations are aimed at providing and supporting services and are the most important step in visualizing services in the ITSM life cycle. Processes include event management, request fulfillment, incident management, problem management, and access management.

Monitoring of events and whether or not an early response process is established, documenting the request type, and recording outputs for incidents are checked. Also, it is necessary to check the problem, whether the record of the solution is maintained, and the access right of the user.

〈Table 10〉 Service Operation Check items [Yun, 2008; Nam et al., 2011; Oh, 2011]

Classification	Check Items
Event Management	Does it provide the basis for operational monitoring and control to detect events for system failures and take appropriate action?
Request Implementation	Is there a clear definition and documentation of the type of request?
Incident Management	Are records of all incidents performed faithfully?
Problem Management	Do you record and maintain information about problems, appropriate workarounds and solutions?
Access Management	Is the user granted appropriate access to use the service?

3.3.5 Continuous Service Improvement Area

The detailed processes required in the continuous service improvement phase are as follows, and the cycle of service measurement, service analysis, service report, and service improvement should be considered. In order to analyze future improvements, and to analyze service change prediction and measurement, definition of service measurement object and collection activity, presence of output, analysis of measurement data, implementation of reporting of analysis information, improvement activity through continuous monitoring measurement It is necessary to check whether it is implemented or not.

〈Table 11〉 Continual Service Improvement Check items [Yun, 2008; Nam et al., 2011; Oh, 2011]

Classification	Check Items
Service measurement	Does the service data collection activity work?
Service Analysis	Are activities for data processing and analysis based on the measured data implemented?
Service reporting	Are reporting activities of analytical information on performance and improvement measures implemented?
Service improvements	Are improvement activities derived from monitoring measurements implemented?

4. Demonstration and Verification

4.1 Survey on University Information Systems Operation Audit Checklist

4.1.1 Survey targets

The questionnaire includes the developer who develops the university information system, the system administrator who manages the system operation and management, the security related person, the DBA which manages the database which keeps the bachelor's information of the student, the webmaster who manages the web service, and auditor, total of 32 respondents responded. The questionnaire was selected as shown in <Table 12>, and they have system operator (28.1%), system administrators (12.5%), security manager (6.3%), database administrators (9.4%), webmasters (12.5%) and auditors (31.3%).

In the questionnaire survey, 50% of the respondents were experts with more than 10 years of experience. Eighty percent of respondents said they had operational audit experience, and 30 percent of respondents said they have experience with ITIL service management.

〈Table 12〉 Results of Surveyer

Developer	System Operator	Security Manager	DBA	Web master	Auditor	Total
9	4	2	3	4	10	32
28.1	12.5	6.3	9.4	12.5	31.3	100

〈Table 13〉 Necessity of Operation Audit

	Developer	System Operator	Security Manager	DBA	Web master	Auditor	Total
Necessity	7	4	2	3	3	8	27 (84.4%)
Unnecessity	2	0	0	0	2	2	5 (15.6%)

4.1.2 Results of Survey on the Necessity of Operation Audit

The 84.4% of respondents answered that they needed to inquire about the necessity of operation audit when building the university information system. Some developers, webmasters, and auditors who gave "unnecessary" comments responded somewhat subjective that it was vaguely unnecessary, but commented on the importance of the operation audit of university information systems.

4.2 Evaluation of Operation Audit Check Items

The questionnaire on the operation of the university information system audit is very suitable for verifying the suitability of the ITIL-based management audit items by referring to the IT service guidelines and operation management guidelines. To verify the suitability, we investigated using 5 points from very adequate (5) to very inadequate (1). The total average was 4.37, which means that most of the checks were highly suitable or appropriate.

In <Table 14>, it can be seen that the scores in access management, information security management, availability management, and event management are high. In the case of access management, the characteristics of university organization and characteristics of human members can be seen that the authority of the work is important according to the characteristics of the members of the professors, employees, and students. In the case of universities, all functions such as examinations, classes, attendances, and assignments are conducted through information systems, so that monitoring of system failures and diagnosis and resolution of problems related to system failures. The confirmation and test management showed the lowest score. Although it is important to confirm and test management in operation management, it is considered that there is a part where the check item is not related to operation management.

〈Table 14〉 Results of University Information System Operation Audit Check Items

Audit Domain	Audit Classification	Avg.	Std. Dev.
Service strategy	Request management	3.92	0.51
	Strategy creating	4.17	0.58
	Service portfolio	4.25	0.45
	IT Accounting management	4.00	0.74
Service design	Service catalog	4.42	0.67
	Service level management	4.58	0.67
	Capacity management	4.42	0.79
	Availability management	4.75	0.45
	IT service continuing	4.67	0.65
	Info security management	4.75	0.45
	Supply management	4.33	0.78
Service transit	Transition planning and support	4.33	0.78
	Change management	4.58	0.67
	Service asset and configuration management	4.42	0.79
	Release and enforcement management	4.17	1.09
	Verification and testing	3.83	1.40
	Evaluation management	4.25	0.97
	Knowledge management	4.17	0.94
Service operation	Event management	4.75	0.62
	Request implementation	4.50	0.52
	Incident management	4.58	0.67
	Problem management	4.25	1.14
	Access management	4.83	0.39
Service improvements	Service measurement	4.17	0.83
	Service analysis	4.33	0.49
	Service reporting	4.58	0.79
	Service improvements	4.08	0.79

〈Table 15〉 Results of Check Items Suitability

Check items	Adequate	Normal	Inadequate	Avg.	Suitability
27	768 (88.89%)	72 (8.33%)	24 (2.78%)	4.37	Fit

The results of the questionnaire survey are summarized in <Table 15>, we have defined "very adequate. adequate" as the adquate, "normal" as normal, and "very inadequate. inappropriate" as the inadequate. A summary of the questionnaire survey on the audit items of the university information system indicates that the check item is "fit" for all items with a level of 80% or more and that the check items derived are appropriate.

5. Conclusion

Recent changes in the information system development environment are changing rapidly, and the check items of the information system audits are widely used at the audit site. However, most of the current information system audit is focused on the public sector, but the university information system does not have much audit. Also, as the paradigm of education is changed, e-learning is activated and cyber universities are expanding. Also, researches on the introduction of university information systems are being carried out in various ways, but from the viewpoint of the auditor, researches have not been performed so far. In addition, the university information system should set up the principles of operating the university information system in accordance with the business strategy and goals in accordance with the changes in the environment for the customers and business-oriented services.

Therefore, we proposed an operation audit model for the utilization of ITIL-based operation audit of university information system and derive audit check items. First, the characteristics of the university information system and the internal system were explained. The necessity of information system operation audit and the current operational audit standards were compared with ITIL, and the conformity study was made for the university information system. ITIL V3-based operational audit model was based on ITIL V3 which is consist of ITIL V3 life cycle service strategy, service design, service conversion, service operation and continuous service improvement. To verify the suitability of the suggest model, we verified through questionnaires of experts.

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