Evaluation of IT Service Management Capabilities and Computer Laboratory Infrastructure Risks Using the ITIL 4 Framework in a School Environment

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Abstract

This study aims to evaluate IT service management capabilities and computer laboratory infrastructure risks using the Information Technology Infrastructure Library (ITIL) 4 framework at SMK Negeri 9 Medan. The increasing dependence on information technology in educational activities requires effective management of computer laboratory infrastructure to ensure service availability, reliability, and security. This research employs a descriptive qualitative approach through interviews, questionnaires, direct observations, and institutional documentation. The evaluation focuses on 12 relevant ITIL 4 management practices, including Incident Management, Problem Management, Service Desk, Monitoring and Event Management, Infrastructure and Platform Management, Risk Management, Change Enablement, Service Configuration Management, Service Request Management, Information Security Management, Availability Management, and Continual Improvement. The research stages include defining the evaluation scope, collecting data, mapping existing IT service management practices, assessing implementation conditions, identifying infrastructure risks, and formulating improvement recommendations. The assessment indicators are designed to examine incident handling, technical support, infrastructure maintenance, network performance, information security, and risk mitigation procedures. The evaluation framework is expected to identify weaknesses in IT service management and establish improvement priorities based on operational requirements. The findings are intended to provide recommendations for strengthening infrastructure reliability, improving service quality, and supporting sustainable computer laboratory operations. Actual capability levels and infrastructure risk scores require validation using empirical research data.

***Keywords**:* IT Service Management, ITIL 4, Capability Evaluation, Infrastructure Risk, Computer Laboratory.

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Introduction

The development of information technology has become an important factor in supporting educational activities, particularly in improving the effectiveness of teaching and learning processes through the utilization of digital infrastructure. Educational institutions increasingly depend on information technology facilities, such as computer laboratories, internet networks, hardware, software, and other supporting systems, to facilitate practical learning activities. At the vocational high school level, computer laboratories play an essential role in developing students' technical competencies, particularly in computer operation, programming, networking, and information technology applications. Therefore, the availability, reliability, and quality of information technology services are important aspects that must be considered to ensure the continuity of technology-based learning activities. SMK Negeri 9 Medan, as an educational institution that utilizes computer laboratory facilities to support learning activities, requires effective information technology service management to maintain the performance and availability of its infrastructure [1] [2] [3].

However, the management of information technology services in school environments still faces various challenges, particularly concerning infrastructure maintenance, service availability, hardware reliability, network connectivity, and information technology security. Problems such as computer equipment failures, unstable internet connections, software errors, inadequate maintenance procedures, and delays in handling technical incidents can disrupt laboratory operations. These conditions may affect the effectiveness of practical learning activities and reduce the optimal utilization of available technological resources. In addition, insufficient risk management can increase the possibility of infrastructure damage, data loss, service interruptions, and inefficient allocation of maintenance resources. Consequently, a systematic evaluation is required to identify existing weaknesses and determine appropriate improvement measures for computer laboratory infrastructure management [4][5][6].

Information Technology Service Management (ITSM) provides a structured approach to managing information technology services to ensure that technology resources are aligned with organizational needs. One of the internationally recognized frameworks for IT service management is the Information Technology Infrastructure Library (ITIL) 4. This framework introduces the Service Value System (SVS), Service Value Chain, guiding principles, governance, continual improvement, and management practices to support the delivery of effective and sustainable IT services. ITIL 4 emphasizes the importance of creating service value through collaboration, continuous evaluation, and optimization of service management processes. In the context of educational institutions, this framework can be utilized to evaluate service management practices, improve infrastructure reliability, and establish more structured procedures for handling technical problems and operational risks[7] [8][9].

The application of ITIL 4 in evaluating computer laboratory infrastructure management involves several relevant practices, including Incident Management, Problem Management, Service Desk, Monitoring and Event Management, Infrastructure and Platform Management, and Risk Management. These practices provide a basis for identifying service disruptions, analyzing recurring technical problems, monitoring infrastructure performance, and evaluating potential risks that may affect service continuity. By assessing the implementation of these practices, the organization can identify gaps between existing management conditions and the expected service management standards. Furthermore, the evaluation can provide measurable information regarding the current capability of IT service management and establish improvement priorities based on the operational needs of the computer laboratory. This approach is expected to support more systematic infrastructure management and improve the quality of technology services within the school environment [10], [11].

Based on these considerations, this study aims to evaluate IT service management capabilities and computer laboratory infrastructure risks using the ITIL 4 framework at SMK

Negeri 9 Medan. The research focuses on assessing the implementation of relevant ITIL 4 management practices, identifying infrastructure-related problems, analyzing potential operational risks, and determining priority areas for improvement. The evaluation results are expected to provide an objective overview of the existing IT service management conditions and serve as a reference for developing appropriate improvement recommendations. Through this research, SMK Negeri 9 Medan is expected to obtain recommendations for improving service quality, strengthening infrastructure risk management, optimizing computer laboratory facilities, and ensuring the sustainability of information technology services in supporting effective and reliable educational activities [12].

Literature Review

Information Technology Service Management (ITSM) is an approach used to manage information technology services systematically to ensure that technology resources support organizational objectives effectively and efficiently. ITSM covers various activities, including service planning, implementation, monitoring, maintenance, and continuous improvement. In educational institutions, ITSM plays an important role in maintaining the availability and reliability of technology infrastructure, particularly computer laboratories, internet networks, hardware, software, and technical support services. Effective IT service management can minimize operational disruptions, improve service quality, and ensure that technology facilities continuously support teaching and learning activities[13], [14].

Information Technology Infrastructure Library (ITIL) 4 is a framework that provides comprehensive guidance for managing and improving information technology services. ITIL 4 introduces the Service Value System (SVS), Service Value Chain, guiding principles, governance, continual improvement, and various management practices. Several relevant practices for computer laboratory infrastructure evaluation include Incident Management, Problem Management, Service Desk, Monitoring and Event Management, Infrastructure and Platform Management, and Risk Management. These practices support organizations in identifying service disruptions, analyzing recurring problems, monitoring infrastructure performance, managing technical resources, and controlling potential operational risks. Through the implementation of ITIL 4, educational institutions can establish more structured, measurable, and sustainable IT service management processes[15].

Computer laboratory infrastructure risk management involves identifying, analyzing, evaluating, and mitigating potential threats that may affect the availability, performance, and security of information technology services. Potential risks include hardware failures, unstable network connections, software errors, malware attacks, unauthorized access, data loss, and inadequate maintenance procedures. In this study, the ITIL 4 framework is used to evaluate IT service management capabilities and identify infrastructure-related risks at SMK Negeri 9 Medan. The assessment results are expected to identify existing management weaknesses, determine improvement priorities, and provide recommendations for strengthening IT service quality, infrastructure reliability, and risk management to support sustainable technology-based educational activities[15] [16].

Research Methodology

This study employs a descriptive qualitative research approach to evaluate IT service management capabilities and computer laboratory infrastructure risks using the ITIL 4 framework at SMK Negeri 9 Medan. The research aims to identify the current condition of IT service management, assess the implementation of relevant ITIL 4 management practices, analyze potential risks affecting computer laboratory infrastructure, and formulate recommendations for service improvement. Data are collected through interviews with IT personnel, laboratory administrators, teachers, and relevant stakeholders, questionnaires, direct observations of computer laboratory operations, and analysis of institutional documents related to IT infrastructure, maintenance procedures, service management, and operational activities.

The evaluation process is conducted systematically by aligning the collected data with relevant management practices within the ITIL 4 framework. The methodology focuses on defining the research scope, collecting primary and secondary data, identifying relevant ITIL 4 practices, assessing existing service management conditions, analyzing infrastructure-related risks, and developing improvement recommendations. The assessment emphasizes several practices, including Incident Management, Problem Management, Service Desk, Monitoring and Event Management, Infrastructure and Platform Management, Risk Management, and Continual Improvement. The results are expected to provide an overview of IT service management conditions and establish improvement priorities to support reliable, effective, and sustainable computer laboratory operations.



Figure 1. Research Methodology

1. Research Planning and Scope Definition
   The first stage involves defining the research objectives, determining the scope of IT service management evaluation, and identifying the stakeholders involved in computer laboratory management at SMK Negeri 9 Medan. The research focuses on computer laboratory infrastructure, including computer hardware, software, network connectivity, internet access, maintenance activities, and technical support services. Furthermore, relevant ITIL 4 management practices are selected based on the operational characteristics of the computer laboratory. This stage establishes the research boundaries and ensures that the evaluation focuses on aspects directly related to IT service management and infrastructure risk.
2. Data Collection
   Data collection is conducted using several techniques to obtain comprehensive information regarding existing IT service management practices. Primary data are obtained through interviews with IT personnel, laboratory administrators, teachers, and other relevant stakeholders. Questionnaires are distributed to collect information regarding the implementation of IT service management activities and infrastructure management procedures. Direct observations are also conducted to examine computer laboratory conditions, equipment availability, network performance, and technical support activities. Secondary data consist of maintenance records, standard operating procedures, infrastructure documentation, equipment inventories, and other relevant institutional documents. All collected data are used as the basis for evaluating actual IT service management conditions.

3. Mapping IT Service Management Practices to ITIL 4

The collected information is analyzed by mapping existing IT service management activities to relevant ITIL 4 management practices. The mapping focuses on several practices, including Incident Management, Problem Management, Service Desk, Monitoring and Event Management, Infrastructure and Platform Management, Risk Management, and Continual Improvement. Each practice is selected based on its relevance to computer laboratory operations and infrastructure management requirements. This stage provides a structured understanding of how existing IT service management activities correspond to the principles and practices recommended by the ITIL 4 framework. The mapping results also establish the assessment indicators used in the subsequent evaluation process.

4. Capability Assessment and Risk Analysis
   After completing the mapping process, an assessment is conducted to evaluate the implementation of the selected ITIL 4 management practices. The assessment examines existing procedures, service management activities, infrastructure maintenance, incident handling, monitoring mechanisms, and risk control measures. Data obtained from interviews, questionnaires, observations, and institutional documentation are analyzed using predefined assessment indicators. The implementation results are then categorized based on an assessment scale established in this research to describe the current condition of each management practice. Furthermore, risk analysis is conducted to identify potential threats, determine their likelihood and impact, and establish infrastructure risk priorities. This stage helps identify weaknesses in IT service management and areas requiring improvement.
5. Formulation of Improvement Recommendations
   Based on the assessment results and infrastructure risk analysis, improvement recommendations are formulated to strengthen IT service management at SMK Negeri 9 Medan. The recommendations focus on improving incident handling procedures, establishing systematic maintenance schedules, optimizing technical support services, strengthening infrastructure monitoring, improving hardware and software management, and implementing appropriate risk mitigation strategies. Improvement priorities are determined based on the identified weaknesses, potential operational impacts, and the urgency of infrastructure problems. The proposed recommendations are expected to provide practical guidance for improving IT service quality, minimizing infrastructure disruptions, and ensuring the availability of computer laboratory facilities.
6. Conclusion and Validation
   The final stage summarizes the research findings, including the implementation of ITIL 4 management practices, the results of IT service management assessments, identified infrastructure risks, and proposed improvement recommendations. Validation is conducted through discussions with relevant stakeholders, particularly IT personnel and laboratory administrators, to examine the relevance, feasibility, and applicability of the proposed recommendations. Feedback obtained during the validation process is used to refine the improvement priorities. The final results are expected to provide a structured reference for strengthening IT service management, improving infrastructure reliability, and supporting sustainable computer laboratory operations at SMK Negeri 9 Medan.

Results

This section presents the results framework for evaluating IT service management capabilities and computer laboratory infrastructure risks using the ITIL 4 framework at SMK Negeri 9 Medan. The evaluation focuses on identifying relevant ITIL 4 management practices, establishing assessment indicators, examining infrastructure-related risks, assessing existing service management conditions, and formulating improvement recommendations. The analysis is organized into four tables covering the mapping of ITIL 4 practices, assessment indicators and supporting evidence, capability assessment and infrastructure risk identification, and gap analysis with improvement recommendations.

A total of 12 relevant ITIL 4 management practices are included to represent essential aspects of computer laboratory management, covering incident handling, problem resolution, technical support, infrastructure monitoring, risk management, security, maintenance, and service improvement. The assessment is designed to use evidence obtained through interviews, questionnaires, direct observations, and institutional documentation. Since verified assessment data have not been provided, the capability results and risk ratings are presented as assessment fields rather than fabricated empirical findings. These fields should be completed based on the actual research results.

Table 1. Mapping of Selected ITIL 4 Management Practices for Computer Laboratory Infrastructure

No.	ITIL 4 Practice	Focus of Evaluation	Relevance to Computer Laboratory
1	Incident Management	Handling service disruptions	Resolving computer and network failures
2	Problem Management	Identifying root causes	Preventing recurring hardware and software problems
3	Service Desk	Technical support services	Managing complaints and user requests
4	Monitoring and Event Management	Infrastructure monitoring	Monitoring computer and network performance
5	Infrastructure and Platform Management	Infrastructure maintenance	Managing hardware, software, and network devices
6	Risk Management	Identifying and controlling risks	Managing infrastructure operational risks
7	Change Enablement	Controlling infrastructure changes	Managing hardware and software updates
8	Service Configuration Management	Managing configuration information	Recording computer and network configurations
9	Service Request Management	Handling service requests	Managing requests for laboratory facilities
10	Information Security Management	Protecting information assets	Preventing unauthorized access and malware
11	Availability Management	Maintaining service availability	Ensuring computer laboratory readiness
12	Continual Improvement	Improving service quality	Developing continuous infrastructure improvements

Table 1 presents 12 ITIL 4 management practices selected according to their relevance to computer laboratory infrastructure management. Incident Management and Problem Management focus on handling technical disruptions and identifying their root causes, while Service Desk and Service Request Management support communication between users and technical personnel. Monitoring and Event Management, Infrastructure and Platform Management, and Availability Management emphasize infrastructure performance and service continuity. Meanwhile, Risk Management and Information Security Management address potential threats to laboratory resources. These practices provide the foundation for conducting a structured evaluation of IT service management at SMK Negeri 9 Medan.

Table 2. Assessment Indicators and Supporting Evidence for ITIL 4 Practices

No.	ITIL 4 Practice	Assessment Indicators	Supporting Evidence

1	Incident Management	Availability of incident reporting and resolution procedures	Incident records, complaint reports
2	Problem Management	Identification and documentation of recurring problems	Problem reports, troubleshooting records
3	Service Desk	Availability of technical support and complaint services	Service logs, support documentation
4	Monitoring and Event Management	Routine monitoring of computer and network performance	Monitoring reports, network logs
5	Infrastructure and Platform Management	Availability of hardware and software maintenance procedures	Inventory records, maintenance schedules
6	Risk Management	Identification, assessment, and mitigation of infrastructure risks	Risk register, mitigation documentation
7	Change Enablement	Documentation and approval of infrastructure changes	Change requests, implementation records
8	Service Configuration Management	Availability of configuration and asset documentation	Configuration records, asset inventory
9	Service Request Management	Procedures for handling laboratory facility requests	Service request forms, request records
10	Information Security Management	Implementation of access control and security procedures	Security policies, access records
11	Availability Management	Monitoring of computer and network service availability	Availability reports, operational records
12	Continual Improvement	Implementation of periodic service evaluations	Evaluation reports, improvement plans

Table 2 describes the assessment indicators and supporting evidence used to evaluate the implementation of each selected ITIL 4 practice. The indicators provide a reference for examining the extent to which IT service management activities are performed and documented. For example, Incident Management requires evidence of incident reporting and resolution, while Problem Management requires documentation of recurring technical problems and their root causes. Risk Management requires evidence of risk identification and mitigation procedures, whereas Information Security Management examines access control and security policies. The supporting evidence is collected through interviews, observations, questionnaires, and institutional documentation. The use of multiple evidence sources is important to ensure that the evaluation reflects actual operational conditions rather than relying solely on stakeholder perceptions.

Table 3. Capability Assessment and Infrastructure Risk Identification

No.	ITIL 4 Practice	Assessment Focus	Evidence Reference	Assessment Status

1	Incident Management	Incident handling effectiveness	Incident documentation	Pending assessment
2	Problem Management	Root cause identification	Problem reports	Pending assessment
3	Service Desk	Technical support availability	Support records	Pending assessment
4	Monitoring and Event Management	Infrastructure monitoring activities	Monitoring logs	Pending assessment
5	Infrastructure and Platform Management	Hardware and software maintenance	Maintenance records	Pending assessment
6	Risk Management	Infrastructure risk identification	Risk register	Pending assessment
7	Change Enablement	Infrastructure change control	Change documentation	Pending assessment
8	Service Configuration Management	Configuration documentation	Asset inventory	Pending assessment
9	Service Request Management	Service request handling	Request records	Pending assessment
10	Information Security Management	Information security implementation	Security documentation	Pending assessment
11	Availability Management	Infrastructure availability	Availability records	Pending assessment
12	Continual Improvement	Service evaluation and improvement	Improvement reports	Pending assessment

Table 3 presents the assessment structure for examining IT service management capabilities and identifying potential infrastructure risks. Each practice is evaluated based on its implementation, supporting documentation, and operational evidence. The assessment status is currently marked as pending because validated institutional assessment results have not yet been provided. The actual assessment should determine whether each practice is implemented consistently, partially implemented, or not yet implemented. Infrastructure risks should also be identified based on observed conditions, including hardware failures, network disruptions, software problems, unauthorized access, and inadequate maintenance procedures. The assessment results will subsequently provide the basis for determining capability conditions and infrastructure risk priorities.

Table 4. Gap Analysis and Improvement Recommendations for IT Service Management

No.	ITIL 4 Practice	Current Condition	Improvement Recommendation	Priority

1	Incident Management	To be assessed	Establish standardized incident reporting and resolution procedures	To be determined
2	Problem Management	To be assessed	Implement root cause analysis for recurring technical problems	To be determined
3	Service Desk	To be assessed	Establish centralized technical support services	To be determined
4	Monitoring and Event Management	To be assessed	Implement routine monitoring of computer and network performance	To be determined
5	Infrastructure and Platform Management	To be assessed	Develop scheduled hardware and software maintenance	To be determined
6	Risk Management	To be assessed	Develop an infrastructure risk register and mitigation plans	To be determined
7	Change Enablement	To be assessed	Establish approval and documentation procedures for infrastructure changes	To be determined
8	Service Configuration Management	To be assessed	Maintain updated hardware, software, and network configuration records	To be determined
9	Service Request Management	To be assessed	Standardize procedures for handling laboratory service requests	To be determined
10	Information Security Management	To be assessed	Strengthen access control, antivirus protection, and security policies	To be determined
11	Availability Management	To be assessed	Establish infrastructure availability monitoring and backup procedures	To be determined
12	Continual Improvement	To be assessed	Conduct periodic IT service evaluations and improvement reviews	To be determined

Table 4 connects the ITIL 4 assessment results with proposed improvement actions for computer laboratory infrastructure management. The recommendations are designed to address potential weaknesses in service management, technical support, infrastructure maintenance, information security, and operational risk control. For example, standardized incident reporting can improve the efficiency of technical problem resolution, while scheduled maintenance can reduce the likelihood of hardware and software failures. Risk Management can be strengthened through the development of a documented risk register and appropriate mitigation strategies. However, the final improvement priorities must be determined based on validated assessment findings, the severity of identified risks, operational impacts, and available institutional resources.

Conclusion

This study presents an evaluation of IT service management capabilities and computer laboratory infrastructure risks using the ITIL 4 framework at SMK Negeri 9 Medan. The evaluation covers 12 relevant ITIL 4 management practices to examine service management

activities, infrastructure maintenance, incident handling, technical support, service availability, and information security. The framework provides a systematic approach to identifying potential weaknesses in IT service management and infrastructure risk management within the school environment.

The proposed evaluation framework is expected to support improvements in IT service quality through standardized operational procedures, systematic infrastructure maintenance, effective incident handling, and appropriate risk mitigation strategies. The assessment results can serve as a reference for determining improvement priorities and strengthening infrastructure reliability. However, actual capability levels and risk scores must be established through validated research data to ensure objective and measurable conclusions.

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