

E-Learning Evaluation Using Information Technology Infrastructure Library 4 with ISO/IEC 25010 Indicators

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Abstract— The most popular approach to remote learning in the Covid-19 age is e-learning. For this reason, it's critical to guarantee the effectiveness and quality of the e-learning platforms being utilized. The purpose of this study was to detect and rectify any possible shortcomings in Darwan Ali University in Sampit's e-learning implementation. Problem identification, instrument construction, testing, data collecting, and data processing were all part of the research technique. The university's lecturers and students made up the research population and sample. The results showed that the quality and efficiency of the e-learning system are obtained at level 3 (Defined), where the target is at level 4 (Quantitative) which achieves its objectives in a highly organized manner, and its performance continues to be measured and assessed in the context of a service management system, it can be improved by utilizing the ITIL4 framework and ISO/IEC 25010 indicators. Sub-characteristics such as functionality, dependability, usability, efficiency, maintainability, and portability are used to evaluate e-learning systems.

Keywords— *e-learning, ITIL 4, ISO/IEC 25010, university, software quality standards*

I. INTRODUCTION

One of the reasons why e-learning systems are so popular is their main benefits [1]. If used correctly, e-learning systems can reduce learning costs and time and increase the efficiency and productivity of lecturers. Improved consistency, adaptability, and distant learning; scalable learning; acknowledgment of past learning; and multicultural learning. One advantage of online learning is that it gives people the freedom to "learn anywhere at any time" by offering a range of tools that enable them to actively engage, grasp the subject, and study on their own. [2], [3]. E-learning enables educators to efficiently plan, manage, deliver, and monitor learning activities. Given its crucial role in education, e-learning software must adhere to high-quality standards, as the software's success is indicative of successful implementation [4]. Continuous updates are necessary to meet user needs and enhance education at Darwan Ali University. Evaluating and improving e-learning service management is essential due to varying quality levels, directly influencing the effectiveness and efficiency of the learning experience.

The goal of ITIL 4 (Information Technology Infrastructure Library version 4) is to give businesses a useful and adaptable framework for managing their IT and delivering digitally connected goods and services [5]. In this

study, the ITIL 4 framework was chosen as the best practice because ITIL 4 is the latest version of ITIL with the renewal of many ITSM (Information Technology Service Management) practices. For effective governance and management of IT-enabled services, ITIL 4 is intended to provide adaptable, synchronized, and integrated systems. Businesses may take advantage of contemporary technology and meet new problems in service management with the help it offers [6]. The 34 practices that make up the three categories of General Management Practices, Service Management Practices, and Technical Management Practices of ITIL 4 are in line with the requirements of the IT department. To address problems at Darwan Ali University, the study focuses on general and service management strategies. The university aspires to be a leading institution in science and technology, contributing to societal advancement and national welfare.

Using the ITIL 4 framework, which has seven practices in the general management practice area and eleven in the service management practice domain, this study attempts to assess information technology services. In addition to the ITIL 4 framework, ISO/IEC 25010 indicators are used in the e-learning evaluation process. ISO/IEC 25010 standard for developing and evaluating software, since the general features of ISO/IEC 25010 are required to assess the quality of the system in comparison to other models [7]. Using these standards, information system quality analysis can be carried out specifically or specifically by existing dimensions, namely the dimensions of Software Product Quality and its sub-characteristics.

The research focuses on evaluating the e-learning system at Darwan Ali University using the ITIL4 framework and ISO/IEC 25010 indicators. Through the identification and correction of potential e-learning implementation weaknesses, the study seeks to increase the effectiveness and quality of remote learning. The research methodology involves problem identification, instrument making, testing, data collection, and data processing. Students and lecturers at the university make up the study's population and sample. The assessment of the e-learning platform and the digital literacy of the participants constitute the basis of the study's conclusions and suggestions [8]. The contributions of the research include providing practical guidance and solutions

to optimize the e-learning system, ensuring it meets software quality standards and enhances the learning experience.

This study's limitations include a narrow emphasis on Darwan Ali University, a small sample size of students and lecturers, and a restricted research scope during the odd semester of 2023–2024. Furthermore, access to data is restricted to university-affiliated official sources and documents about the implementation of e-learning [9]. The entire analysis and conclusions of this study will be based on data obtained from these limitations.

The introduction is provided in Section 1. The literature review is presented in Section 2, the research methodology is explained in Section 3, the findings and discussion are presented in Section 4, and the conclusion in Section 5.

II. LITERATURE REVIEW

A. ITIL 4

The 2019 version of ITIL 4 saw a major reorganization of the framework, placing more of a focus on the concepts of risk, cost, and value [5]. While embracing the most recent information and ideas that demonstrate a more value-oriented approach to IT service delivery, ITIL 4 retains many of the elements of ITIL V3. ITIL4 has been redesigned and restructured to address criticism and ensure that it remains the most relevant international framework for IT service management.[10], [11], [12]. The three categories of general management, service management, and technical management comprise a total of 34 management practices as of right now. Table 1 displays the management practices for ITIL 4.

B. ISO/IEC 25010

An international standard called ISO/IEC 25010 can be used to assess, evaluate, and gauge the quality of software systems. The distinction between ISO/IEC 9126 and ISO/IEC 25010 is that the latter added a standard framework to the quality model. ISO / IEC 25010 is a reference standard for assessing the level of software quality that a company, organization, or institution uses. According to the International Electrotechnical Commission and the International Organization for Standardization (ISO), Quality in Use and Software Product Quality are the two current dimensions that can be specifically or specifically based upon when evaluating the quality of software systems using ISO / IEC 25010 [11]. Table 2 displays the ISO/IEC 25010 Software Product Quality model.

Software Product Quality is the dimension employed as an indicator in this research to analyze the use of ISO/IEC 25010 in evaluating software quality, particularly e-learning. The majority of the sub-characteristics of the software product quality model are specific to software and systems, hence it can only be used for software products [13].

III. RESEARCH METHOD

A. Research Tool

The main purpose of this study was to evaluate the EdLink e-learning platform used at Darwan Ali University located in Sampit City, Indonesia. This study used a sample of students and lecturers, and the scope of research was limited during the odd semester of 2023–2024 as many as 100 respondents. By using following the ITIL 4 framework, and

assessing e-learning using ISO/IEC 25010 indicators as a research tool.

B. Research Procedure

This research is included in quantitative descriptive research. Fig. 1 below is a research flow chart that explains the stages of the research to be carried out.

1) Problem Identification

Currently, the study object is being used to identify problems. To identify issues, Darwan Ali University conducted interviews and observations. It is evident from the findings of the observations and interviews that there are issues with e-learning assessment implementation. These issues are brought on by several factors that impact organizational objectives.

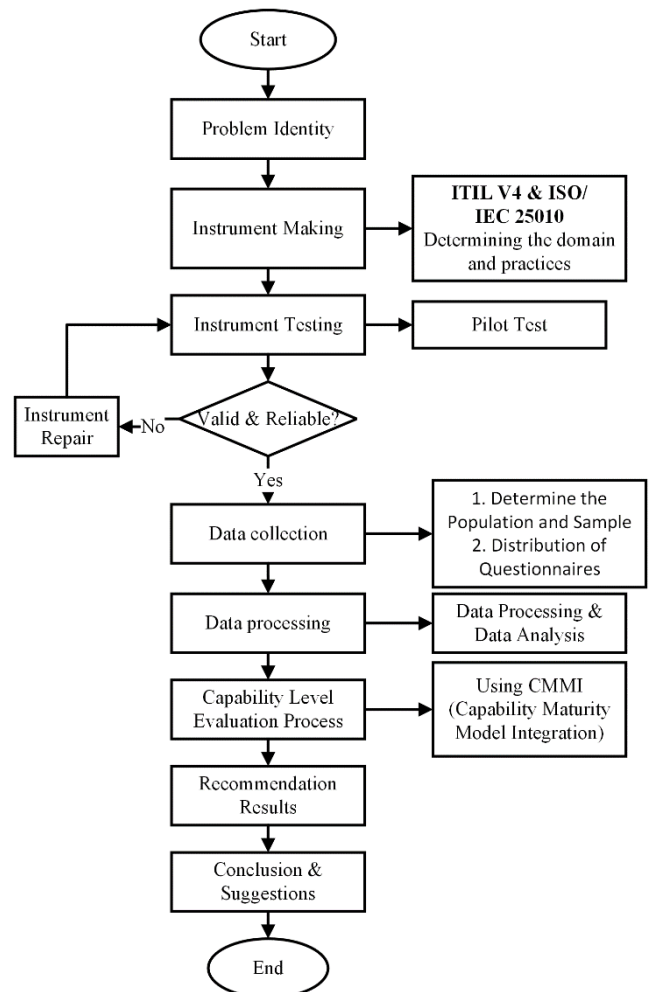


Fig. 1. Research flowchart

2) Instrument Making

Research instruments are tools used for systematic data collection and analysis in research to address a problem or test a hypothesis. They are crucial for research quality and aim to convert facts into data. In a particular study, instruments included online questionnaires distributed through Google Drive, following the ITIL 4 framework, and assessing e-learning using ISO/IEC 25010 indicators on a 5-point Likert scale. This is a non-forced choice scale since it lets respondents indicate their neutrality [14].

Based on the results of interviews and observations to overcome problems at Darwan Ali University, this study

focuses on general and service management strategies. Using the ITIL4 framework, which has seven practices in the general management practice area and eleven in the service management practice domain, this research attempts to assess information technology services. In addition to the ITIL4 framework, ISO / IEC 25010 indicators are used in the e-learning evaluation process to strengthen the assessment of the framework. ISO / IEC 25010 standard for developing and evaluating software, since the general features of ISO / IEC 25010 are necessary to assess the quality of the system compared to other models.

3) Instrument Testing

Pre-testing is a crucial step in research to ensure questionnaire content validity and assess respondent understanding. Following pre-testing, a pilot test is conducted to evaluate instrument feasibility and reliability, including clarity of wording and data consistency [15]. In a specific study, 28 randomly selected respondents participated in the pilot test. This step is essential for refining the questionnaire and ensuring data quality before the actual survey.

4) Validity and Reliability Test

A validity test evaluates whether a questionnaire effectively measures what it intends to. Validity is established when the questions in the questionnaire correspond to what it aims to measure. The correlation between each question and the final score obtained from respondents' responses is examined using the Pearson correlation product moment validity test. By contrasting the estimated "r" value with the tabular "r" value for a certain degree of freedom, significance is ascertained.

Reliability testing assesses whether a questionnaire consistently measures a construct or variable over time. A questionnaire is considered reliable if respondents' answers remain consistent. Reliability is tested for each legitimate indicator, with a Cronbach Alpha value greater than 0.60 indicating reliability [16]. Calculations to test the validity and reliability of research instruments were carried out with SPSS software.

5) Data Collection

a) Population and Sample

The Slovin formula is used to calculate the sample size needed when you have a large population and want to take a representative sample. The sample is calculated using the Slovin formula with a margin of error of 10%. The Slovin formula is as follows (1):

$$n = \frac{N}{1 + N(e^2)} \quad (1)$$

where n is Sample Quantity, N is Total Population, and e is Ten percent, or 0.1, is the tolerance for inaccuracy resulting from acceptable sampling error. This error rate was selected because of financial and timing restrictions. One can still utilize a 10 percent error rate in the Slovin calculation.

b) Questionnaire distribution

Distributing the questionnaire online through a Google Form link is a common and convenient method for collecting data in research studies. The questionnaire describes the research and centers around points related to evaluating E-learning based on ITIL4 and ISO/IEC 25010 indicators. The use of these frameworks indicates a focus on assessing the

effectiveness and quality of E-learning platforms according to industry standards. Leveraging an online platform like Google Forms ensures easy access to a broader audience and efficient data collection.

6) Data Processing

At this stage, data processing and data analysis are carried out from the data that has been obtained. Data processing is done by collecting and recapitulating the final results of the questionnaire. Data analysis is carried out using a scale at the level of maturity level in ITIL. In the completion of the data that has been analyzed, the results of the evaluation of the maturity level of IT services and Gap Analysis will be known based on the maturity level value obtained at this time with the expected value.

7) Capability Level Evaluation Process

At this stage, an evaluation of the level of capability or ability level is carried out, which is carried out to determine the level of achievement activities and expectations of IT service management using CMMI (Capability Maturity Model Integration) [17]. In this process, the results are obtained from data analysis that has been carried out.

8) Recommendation

Based on the practices used in ITIL V4, specifically the 7 General Management Practices and 11 Service Management Practices with ISO / IEC 25010 indicators that have been determined at the instrument preparation stage, analysis and recommendations for improving information technology services are currently being made. Choose the recommendations for improvement that will be implemented after evaluating the suggestions.

TABLE I. ITIL 4 MANAGEMENT PRACTICES [5], [12]

Domain	Practices
General Management Practices (14)	Architecture management, Continual improvement, Information security management, Knowledge management, Measurement and reporting, Organizational change management, Portfolio management, Project management, Relationship management, Risk management, Service financial management, Strategy management, Supplier management, Workforce and talent management.
Service Management Practices (17)	Availability management, Business analysis, Capacity and performance management, Change control, Incident management, IT asset management, Monitoring and event management, Project management, Release management, Service catalog management, Service configuration management, Service continuity management, Service Design, Service desk, Service level management, Service request management, Service validation, and testing.
Technical Management Practices (3)	Deployment management, Infrastructure and platform Management, Software development and Management.

TABLE II. SOFTWARE PRODUCT QUALITY MODEL ISO/IEC 25010

Domain	Practices
Functional Suitability	Functional Completeness, Functional Correctness, Functional Appropriateness
Performance Efficiency	Time Behavior, Resource Utilization, Capacity
Compatibility	Co-existence, Interoperability
Usability	Appropriateness Recognizability, Learnability, Operability, User Error Protection, User Interface Aesthetics, Accessibility
Reliability	Maturity, Availability, Fault Tolerance, Recoverability
Security	Confidentiality, Integrity, Non-repudiation, Authenticity, Accountability

Maintainability	Modularity, Reusability, Analyzability, Modifiability, Testability
Portability	Adaptability, Installability, Replaceability

IV. FINDINGS AND DISCUSSION

The population of active students in the odd semester of 2023/2024 at Darwan Ali University amounted to 369 students. Lecturers numbered 54. The total population for the research study is 423. The number of samples with a margin of error of 10% was found to be at least 79 respondents. For the test value to be more valid, we determine the sample number of 100 respondents.

As indicated in Tables 3 and 4, there are a total of 36 questions on the questionnaire, two for each practice. The code table's acronym, GM1, stands for questionnaire number 1, and it indicates the number of the questionnaire. These inquiries come from the 11 Service Management Practices and the 7 General Management Practices. From the results of the pilot test, it was found that some questions were invalid, so the solution used was to improve the sentences and points of the questions.

TABLE III. MATURITY LEVEL GENERAL MANAGEMENT PRACTICES

Practice/Sub-domain	Code	Current Maturity	Avg
Architecture Management (Indicator: Functional Appropriateness)	GM1	4.02	4.02
	GM2	4.02	
Continual Improvement (Indicator: Maintainability)	GM3	3.80	3.78
	GM4	3.76	
Knowledge Management (Indicator: Learnability)	GM5	4.04	4.00
	GM6	4.03	
Measurement and Reporting (Indicator: Analyzability)	GM7	2.71	3.25
	GM8	3.80	
Organizational Change Management (Indicator: Adaptability)	GM9	3.92	3.32
	GM10	2.73	
Relationship Management (Indicator: Compatibility)	GM11	3.77	3.31
	GM12	2.86	
Risk Management (Indicator: Security)	GM13	3.76	3.80
	GM14	3.84	
Average			3.65

TABLE IV. MATURITY LEVEL SERVICE MANAGEMENT PRACTICES

Practice/Sub-domain	Code	Current Maturity	Avg
Availability Management (Indicator: Availability)	SM1	3.87	3.80
	SM2	3.74	
Capacity and Performance Management (Indicator: Capacity)	SM3	3.40	3.18
	SM4	2.96	
Change Control (Indicator: Modifiability)	SM5	3.52	3.67
	SM6	3.83	
Incident Management (Indicator: Reliability)	SM7	2.71	3.17
	SM8	3.64	
IT Asset Management (Indicator: Security)	SM9	3.83	3.80
	SM10	3.77	
Monitoring and Event Management (Indicator: Performance Efficiency)	SM11	3.81	3.85
	SM12	3.90	
Problem Management (Indicator: Fault Tolerance)	SM13	3.67	3.72
	SM14	3.78	
Service Continuity Management (Indicator: Recoverability)	SM15	3.79	3.59
	SM16	3.40	
	SM17	3.72	3.73

Service Desk Management (Indicator: Usability)	SM18	3.75	
Service Level Management (Indicator: Functional completeness)	SM19	3.12	3,52
	SM20	3.93	
Service Request Management (Indicator: Usability)	SM21	3.80	3,71
	SM22	3.62	
Average			3,61

$$Maturity Level = \frac{\sum Maturity Index Domain}{\sum Domain Process} \quad (2)$$

The determination of the maturity level is calculated based on the questionnaire analysis; the maturity level is obtained from the average of each domain that has been analyzed questionnaire. These results are caused by problems or conditions that occur. The maturity index (IM) value for each objective of the research results is calculated (2). For maturity levels, it can be seen in Table 3 and Table 4.

Based on the table of research questionnaire results, it can be seen that the maturity level in the General Management Practices and Service Management Practice domains related to e-learning evaluation at Darwan Ali University is obtained at level 3 (Defined), where the target is at level 4 (Quantitative) which achieves its goals in a very organized manner, and its performance is continuously measured and assessed in the context of a service management system. Fig. 2 and Fig. 3 a radar chart that is known and obtained from maturity level analysis with GAP analysis against targets.

The capacity level is at level 3 (Defined) in the table above, indicating that the process is well-organized and concentrated on accomplishing organizational goals and performance as depicted in Fig. 2 and Fig. 3. The practice and indicator components utilized in Tables 3 and 4 are shown in Fig. 2 and Fig. 3, for which AM (FA) stands for Architecture Management (Indicator: Functional Appropriateness). Meanwhile, the gap shows that there is a gap in each practice used. With this gap, improvement recommendations are needed to achieve the expected value.

Results of recommendations given to Darwan Ali University for E-learning evaluation:

A. General management practices include

- 1) Architecture Management (Indicator: Functional appropriateness) Level 4: This practice has reached the level 4 target, so the recommendation is to maintain and improve the architecture of the organization's systems and processes in line with its functional requirements.
- 2) Continual Improvement (Indicator: Maintainability) Level 3: Recommendations from this practice improve e-learning processes and systems to improve their maintenance and upgrade skills or train human resources to help to feel ready to contribute to improvement sustainable.
- 3) Knowledge Management (Indicator: Learnability) Level 4: This practice has reached the level 4 target, so the recommendation is to maintain and improve managing and sharing knowledge within the organization to improve learnability.
- 4) Measurement and Reporting (Indicator: Analysability) Level 3: It is recommended to conduct data collection and documentation of any e-learning service activities,

regulations, or procedures performed and involves measuring and reporting key performance indicators to enable data-driven analysis and decision-making.

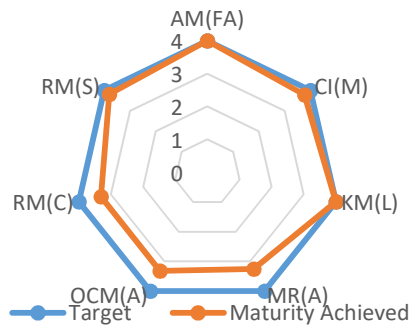


Fig. 2. Average General Management Practice Maturity Score

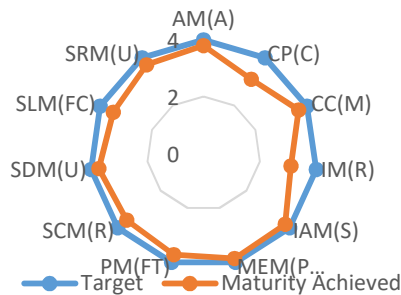


Fig. 3. Average General Management Practice Maturity Score

- 5) Organizational Change Management (Indicator: Adaptability) Level 3: Suggested recommendations for improvement are ensuring that changes made have a clear purpose, providing a sense of urgency to e-learning changes, and increasing adaptability to the features developed.
- 6) Relationship Management (Indicator: Compatibility) Level 3: Recommendations for improvement are to ensure that E-Learning facilitates interaction between users and features for discussion rooms to facilitate discussion between students.
- 7) Risk Management (Indicator: Security) Level 3: Suggested recommendations involve identifying and managing risks to ensure the security and stability of the e-learning system as well as adequate security features to protect personal data.

B. Service Management Practices include

- 1) Availability Management (Indicator: Availability) Level 3: It is recommended to conduct the regular testing process of failover and recovery mechanism of IT services, and calculate and report the availability matrix of the services to ensure the services are not degraded.
- 2) Capacity and Performance Management (Indicator: Capacity) Level 3: The suggested changes enhance the university's e-learning system's functionality and quality, which in turn enhances both lecturers' and students' educational experiences.
- 3) Change Control (Indicator: Modifiability) Level 3: It is recommended to assess and validate changes made in the same way, manage change schedules, document and report

changes to e-learning services, and conduct training for users.

- 4) Incident Management (Indicator: Reliability) Level 3: It is recommended to keep records in managing incidents and solutions that can be seen from the frequency of incidents or their severity. Regular communication is needed to understand incidents, provide status updates on incidents, and agree that incidents are resolved. Make sure situations are handled quickly and under control.
- 5) IT Asset Management (Indicator: Security) Level 3: It is recommended to improve the management and security of IT assets, such as hardware and software, to protect information and E-Learning systems and provide relevant notifications related to learning activities.
- 6) Monitoring and Event Management (Indicator: Performance Efficiency) Level 3: It is recommended that the following actions be taken: trend analysis of incident records; helpdesk, technical, and user staff identify similar and recurring issues; evaluate the possibility that an incident will recur; analyze data from project teams, technical teams, and test teams in internal software development; and reduce the number of incidents and the impact of incidents that cannot be prevented through incident prevention.
- 7) Problem Management (Indicator: Fault Tolerance) Level 3: It is recommended that when there are technical issues, E-Learning has a mechanism to restore functionality quickly.
- 8) Service Continuity Management (Indicator: Recoverability) Level 3: It is recommended that e-learning has a service continuity plan that ensures the availability of learning materials despite technical issues and service disruptions.
- 9) Service Desk Management (Indicator: Usability) Level 3: It is advised to make the system more user-friendly and intuitive, and to have a help desk that offers efficient support to assist with problem solving.
- 10) Service Level Management (Indicator: Functional Completeness) Level 3: Assessing the e-learning system's compliance with the functional specifications and goals established by the university is advised. A thorough and well-defined service level management procedure is necessary to guarantee the effectiveness and caliber of the e-learning platform.
- 11) Service Request Management (Indicator: Usability) Level 3: Improving service request management in e-learning systems is recommended. Ease of submitting and tracking service requests and how it affects overall user experience and satisfaction.

V. CONCLUSION

This research focuses on improving the quality and efficiency of e-learning systems through evaluation using the ITIL4 framework and ISO/IEC 25010 indicators. This study was conducted at Darwan Ali University to find and resolve potential weaknesses in e-learning implementation. The research methodology includes problem identification, instrument creation, testing, data collection, and data processing. University lecturers and students comprised the

population and sample of the study. The research results show that the quality and efficiency of the e-learning system are obtained at level 3 (Defined), where the target is at level 4 (Quantitative) which achieves its goals in a very organized manner, and its performance is continuously measured and assessed in the context of the service management system. The results show how the quality and efficiency of e-learning systems can be improved by utilizing the ITIL4 framework and ISO/IEC 25010 indicators. Sub-characteristics including functionality, dependability, usability, efficiency, maintainability, and portability are used to evaluate e-learning systems. Other educational institutions hoping to improve the effectiveness and caliber of their e-learning systems may benefit from this research. The findings of this research may also contribute to the development of software quality standards for e-learning systems. Overall, this research highlights the importance of ensuring that e-learning systems are of good quality and efficiency, especially in the current era of distance learning.

The implementation of EdLink as a learning management system by the universities under investigation is the main topic of this study. It is recommended that comparative studies examine usability issues from other e-learning systems that are not the subject of this investigation. This study uses a sample of lecturers and students from the 2023–2024 semester. More research can be done to find out how other lecturers and students in different batches and universities feel about the e-learning system. Furthermore, comparative analyses of commercial and open-source e-learning platforms are recommended.

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