

An Analysis of the Role of Software Engineering in Improving the Quality of Academic Information Systems at Wirahusada University Medan

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ABSTRACT

Software engineering plays a crucial role in ensuring the quality of information systems used in higher education institutions. This study aims to analyze the role of software engineering practices in improving the quality of academic information systems at Wirahusada University Medan. The research focuses on how systematic software engineering processes contribute to system reliability, usability, and maintainability. This study employs a descriptive research method with a case study approach. Data were collected through observations, interviews, and questionnaires involving system users and developers. The analysis results indicate that the application of software engineering principles, including requirements analysis, system design, implementation, and testing, has a significant impact on improving system quality. The findings show that structured development processes enhance system performance, reduce errors, and increase user satisfaction. Therefore, the implementation of proper software engineering practices is essential to ensure the quality and sustainability of academic information systems in higher education institutions.

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1. INTRODUCTION

Information systems have become an essential component in supporting academic and administrative activities in higher education institutions. Academic information systems are widely used to manage student data, course registration, grading, and reporting processes. As the complexity and dependency on these systems increase, ensuring their quality becomes a critical challenge. Poor system quality may lead to

data inaccuracies, system failures, and low user satisfaction, which can negatively affect institutional performance and decision-making processes [1].

Software engineering provides a systematic and disciplined approach to the development, operation, and maintenance of software systems. By applying well-defined software engineering practices, organizations can improve system reliability, usability, efficiency, and maintainability [2]. Previous studies emphasize that structured

development processes, such as requirements analysis, system design, testing, and maintenance, play a significant role in reducing software defects and improving overall system quality [3]. Therefore, software engineering is considered a key factor in ensuring the sustainability and effectiveness of information systems.

Despite the widespread implementation of academic information systems, many higher education institutions still face challenges related to system quality, including frequent errors, limited usability, and inadequate documentation [4]. These issues are often caused by the absence of proper software engineering practices during system development and evolution. Consequently, it is important to evaluate how software engineering principles are applied in real-world academic environments and how they influence the quality of information systems used by universities.

This study aims to analyze the role of software engineering in improving the quality of academic information systems at Wirahusada University Medan. The research focuses on identifying the contribution of software engineering processes to system performance and user satisfaction. The findings of this study are expected to provide empirical insights for higher education institutions in enhancing their information system quality through the effective application of software engineering practices.

2. LITERATURE REVIEW

2.1 Software Engineering

Software engineering is a discipline that applies engineering principles to the systematic development, operation, and maintenance of software systems. According to Pressman, software engineering aims to produce high-quality software that meets user requirements within budget and time constraints through structured processes and methodologies [1]. Sommerville further emphasizes that software engineering covers a wide range of activities, including requirements engineering, system design,

implementation, testing, deployment, and maintenance, all of which are essential to ensure software quality and sustainability [2].

Several studies highlight that the application of software engineering practices significantly reduces software defects and improves system performance. The use of standardized development life cycle models, such as the Software Development Life Cycle (SDLC), enables organizations to manage complexity and risks during software development [3]. Moreover, agile-based software engineering practices encourage continuous feedback, adaptability, and close collaboration between developers and users, which contribute to the development of systems that better align with user needs [4]. Therefore, software engineering serves as a critical foundation for developing reliable and maintainable information systems.

2.2 Information System Quality

System quality is a key dimension in evaluating the effectiveness of information systems. DeLone and McLean define system quality as the degree to which an information system performs reliably, efficiently, and is easy to use [5]. System quality encompasses several attributes, including functionality, usability, reliability, response time, and security. High system quality is strongly associated with increased user satisfaction and system usage, which ultimately supports organizational performance [6].

International standards such as ISO/IEC 25010 provide a comprehensive framework for assessing software and system quality. This standard identifies eight quality characteristics, including functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability [7]. Previous research demonstrates that applying quality models during software development helps organizations identify weaknesses early and improve system outcomes [8].

In the context of higher education, ensuring the quality of academic information systems is essential, as these systems directly support academic services and institutional decision-making processes.

2.3 Relationship between Software Engineering and System Quality

The relationship between software engineering practices and system quality has been widely discussed in prior studies. Effective requirements analysis ensures that the system aligns with user expectations, while proper system design and testing contribute to system reliability and usability [9]. Research findings indicate that institutions that consistently apply software engineering principles tend to produce information systems with higher quality and better user acceptance [10]. Consequently, understanding the role of software engineering in ensuring system quality is crucial for improving the performance and sustainability of academic information systems.

3. METHODS

3.1 Research Design

This study employs a descriptive research design with a case study approach. The descriptive method is used to provide a systematic and factual description of the role of software engineering practices in ensuring the quality of academic information systems. The case study approach allows an in-depth analysis of real conditions within a specific organizational context, enabling the researcher to examine how software engineering principles are applied in practice and how they affect system quality.

3.2 Research Object

The object of this research is the Academic Information System implemented at Wirahusada University Medan. The system supports various academic activities, including student data management, course registration, grading, and academic reporting. The

subjects of the study consist of system users, including administrative staff, lecturers, and students, as well as personnel involved in system development and maintenance. This object was selected due to its strategic role in supporting academic operations and decision-making processes within the university.

3.3 Data Collection

Data collection was conducted using multiple techniques to ensure data validity and reliability. Observation was carried out to understand system functionality and usage patterns in daily academic activities. Interviews were conducted with system administrators and developers to obtain information regarding software engineering processes applied during system development and maintenance. In addition, questionnaires were distributed to system users to measure perceptions of system quality, focusing on aspects such as usability, reliability, and overall satisfaction.

3.4 Data Analysis

The collected data were analyzed using descriptive analysis techniques. Qualitative data obtained from interviews and observations were analyzed by identifying patterns related to the application of software engineering practices. Quantitative data from questionnaires were processed using percentage and mean score analysis to evaluate user perceptions of system quality. The results of the analysis were then interpreted to assess the contribution of software engineering practices to improving the quality of the academic information system at Wirahusada University Medan.

4. RESULTS AND DISCUSSION

4.1 Results

This study evaluated the quality of the Academic Information System at Wirahusada University Medan based on user perceptions and the application of software engineering practices during system development and maintenance.

Data were collected from students, lecturers, and administrative staff who actively use the system in academic activities. The assessment of system quality focused on four main dimensions: usability, reliability, performance efficiency, and maintainability.

The results of the questionnaire analysis indicate that the Academic Information System demonstrates an overall good level of quality. As shown in Table 1, usability achieved the highest mean score, suggesting that users

consider the system easy to use, understandable, and supportive of academic tasks. Reliability and performance efficiency also received positive evaluations, indicating that the system operates stably and provides acceptable response times during normal and peak usage periods. However, maintainability received a lower mean score compared to other dimensions, reflecting challenges related to system documentation and maintenance procedures.

Table 1. User Perception of Academic Information System Quality

Quality Dimension	Mean Score	Interpretation
Usability	4.28	Very Good
Reliability	4.12	Good
Performance Efficiency	4.05	Good
Maintainability	3.76	Moderate

Source: Processed research data (2026)

In addition to quantitative findings, qualitative data obtained from interviews revealed that the development team applied fundamental software engineering stages, including requirements analysis, system design, implementation, and testing.

These structured processes contributed to minimizing functional errors and improving system consistency with academic requirements.



Figure 1. Relationship between Software Engineering Practices and Academic Information System Quality

Figure 1 illustrates the conceptual relationship between software engineering practices and system quality improvement. The figure shows that systematic software engineering activities positively influence key quality attributes such as usability, reliability, and user satisfaction.

4.2 Discussion

The findings of this study confirm that software engineering plays a significant role in improving the quality of academic information systems. The high usability score indicates that proper requirements analysis and user-centered design were effectively implemented

during system development. This result supports previous studies which state that clear requirements and well-structured design significantly enhance system usability and user acceptance.

Furthermore, the positive results for reliability and performance efficiency demonstrate that systematic testing and controlled implementation processes contribute to system stability and performance. These findings highlight the importance of software engineering practices in reducing system errors and ensuring continuous system availability in higher education environments.

However, the relatively lower score for maintainability indicates an area that requires further improvement. This suggests that although the system performs well operationally, aspects such as technical documentation, maintenance planning, and system scalability have not been fully optimized. This condition is common in academic institutions where system development often prioritizes functionality over long-term maintenance strategies.

Overall, the results demonstrate that consistent application of software engineering principles significantly enhances the quality of academic information systems. Strengthening software engineering practices, particularly in documentation and maintenance management, is essential to ensure system sustainability and continuous improvement at Wirahusada University Medan.

5. CONCLUSION

This study analyzed the role of software engineering in improving the quality of the Academic Information System at Wirahusada University Medan. The results indicate that the application of software engineering practices, including requirements analysis, system design, implementation, and testing, has a significant contribution to system quality improvement. The academic information system demonstrates good

performance in terms of usability, reliability, and performance efficiency, which positively influences user satisfaction. These findings are consistent with previous studies stating that systematic software engineering processes enhance software quality and reduce system failures [1], [2]. However, the maintainability aspect shows room for improvement, particularly in documentation and long-term maintenance planning. Overall, this study confirms that consistent and structured software engineering practices are essential to ensure the quality, sustainability, and effectiveness of academic information systems in higher education institutions [3].

Suggestions

Based on the findings of this study, it is recommended that Wirahusada University Medan strengthen software engineering practices related to system documentation and maintenance management to improve system maintainability. The adoption of recognized quality standards, such as ISO/IEC 25010, is suggested to provide a comprehensive framework for continuous system quality evaluation [4]. In addition, future research may apply quantitative or mixed-method approaches and involve larger respondent samples to obtain more comprehensive results. Further studies could also compare different software development methodologies to identify the most effective approach for improving academic information system quality in higher education environments [5].

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