A Decision-Making Framework for Academic Information System Maintenance Prioritization using AHP and Tiered Resource Allocation

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Abstract Academic information systems in higher education institutions play an important role in supporting academic operations. Institutions, especially private universities with varying resources, need a clear priority plan for allocating those resources. This quantitative study took place at ISB Atma Luhur in four phases: (1) creating an inventory of 237 features from eight systems known as the One-Stop System and organizing them into eight assessment criteria; (2) employing the Analytical Hierarchy Process (AHP) to map the system maintenance scale and weighting criteria provided by 11 experts using Expert Choice software and validating consistency (CR < 0.10); (3) calculating priority scores with $PS_k = \Sigma(w_i \times s_{ki})$; (4) developing a system maintenance plan over 24 months with different resource allocations. The analysis found two high-priority systems (BAAK: 9.14, SIAD: 8.12), three medium-priority systems (Finance: 6.85, Student Affairs: 6.79, Final Project: 6.23), and three low-priority systems (PMB: 5.18, Library: 4.12, General: 3.25). Preservation of Academic Value is the most important criterion (weight: 0.258). The resource allocation strategy based on current system importance is 60% for high-priority systems, 30% for medium-priority systems, and 10% for low-priority systems. This study shows how Multicriteria Decision Making (MCDM) can be applied in higher education, moving from cost-based priorities to value-based ones in academic information systems. The AHP-based framework provides a data-driven tool for managing maintenance. Future research should look into integrating predictive analytics to proactively improve system reliability.

Keywords: academic information systems; Analytic Hierarchy Process; maintenance prioritization; resource allocation; higher education IT management.

1. Introduction

Universities that use technology-based information systems need continuous maintenance and management. Information systems for university administration typically include academic systems, student systems, financial systems, libraries, and other support services. These services are essential to higher education, specifically the Tri Dharma of Higher Education[1]. Current development strategies for private Indonesian campuses involve restructuring, exploring new markets, networking, developing human resources, and addressing university social responsibility[2]. To achieve sustainable academic performance in Indonesian higher education, it is important to have strategic planning, strong leadership, and quality assurance[3],[4].

To achieve sustainable academic performance, an academic information system that works with other support systems is needed. This information system improves management efficiency and helps with decision-making in educational institutions[5]. Universities are also starting to adopt digital transformation in response to the industrial revolution [6]. They are moving toward a paperless, automated system [7].

Academic information system services require a continuous update plan [8]. However, implementing academic information systems is not without challenges. Limited infrastructure, human resource readiness, and technology integration remain major obstacles [9]. On the other hand, these systems play a strategic role in managing academic processes and supporting decision-making at the institutional level [10], [11]. Cloud computing technology is also being utilized to improve system performance [12], while lecturer performance measurement is closely tied to the academic services available[13].

Maintaining systems that support learning processes requires consideration of unique operational factors, as well as compliance with increasingly stringent data privacy regulations[14]. Scheduled maintenance is necessary to address software aging [15]. Today, Industry 4.0 technology is also being used to improve real-time monitoring and prevent unexpected costs [16]. Digital-based maintenance planning can employ the Reliability-Centered Maintenance (RCM) method [17]. In the context of computer-based maintenance management systems (CMMS), AHP is considered an appropriate method for selecting systems that suit industrial needs [18]. In education, AHP has been used for various purposes: managing academic data [19], improving academic decision-making [20], supporting library services [21], and supporting reliability-centered maintenance strategies [22].

The development of the AHP method continues to evolve. Some studies have simplified it using the GBOM approach for efficiency and consistency in group decisions [23]. AHP has also been used for system log analysis to detect data security threats [24], determining industrial maintenance strategy priorities [25], and supporting the selection of the best alternatives in the transition to Industry 4.0 [26], [27]. In education, AHP serves as an analytical tool for developing smart campuses [28], or selecting school software [29].

In the classification of maintenance models, condition-based approaches are considered superior to corrective maintenance [30]. AHP is also used to prioritize software requirements [31], support productive industrial maintenance systems [32], select predictive maintenance techniques [33] formulate maintenance management systems [34], and select software architecture based on quality attributes[35]. Even the current evolution of MCDM recommends an artificial intelligence-based multi-criteria decision-making framework [36].

Computer-based maintenance management systems (CMMS) are fundamentally designed to improve automation, integration, and efficiency[37]. Some studies have even integrated AHP into CMMS to automate maintenance needs [38]. On the other hand, MCDM methods are also used to determine the most effective software maintenance options[39], the most critical ones [40], or those most aligned with digital-based intelligent maintenance strategies [41], [42].

Research on system maintenance management has grown considerably. However, most of it remains focused on the industrial sector. In factories, maintenance decisions typically revolve around two things: cost and machine reliability [25], [32]. Universities? A different story. Here, academic values and institutional reputation carry more weight. Educational services must keep running, without interruption. This is not merely about economics. This is about maintaining public trust.

Unfortunately, the literature has not extensively addressed this difference. As a result, IT managers on campus lack clear theoretical guidance for setting priorities. Moreover, no study has systematically demonstrated how MCDM methods can be integrated with a resource allocation framework—turning priority rankings into concrete action plans.

This study steps in to fill that gap. We develop a structured, data-driven framework for prioritizing academic system maintenance in higher education. Our approach is the Analytic Hierarchy Process (AHP). Through this method, system features are grouped into three categories low, medium, and high enabling more efficient and accountable resource allocation. What sets this study apart is this: we do not stop at rankings. We directly link those rankings to resource allocation strategies. In other words, this framework translates MCDM results into concrete, implementable maintenance plans.

2. Method

This study develops a structured framework that generates maintenance priorities for academic information systems in higher education using AHP as a quantitative decision support method. This academic system maintenance framework is supported by experts who support criteria relevant to academic system maintenance needs, thus becoming a multi-criteria framework, a maintenance implementation plan, which provides information for strategic decision makers in determining system maintenance priorities that are able to provide the best alternatives under conditions of limited resources. This study does not position AHP as a standalone ranking tool; it embeds AHP within a four-phase maintenance prioritization framework, as illustrated in Figure 1.

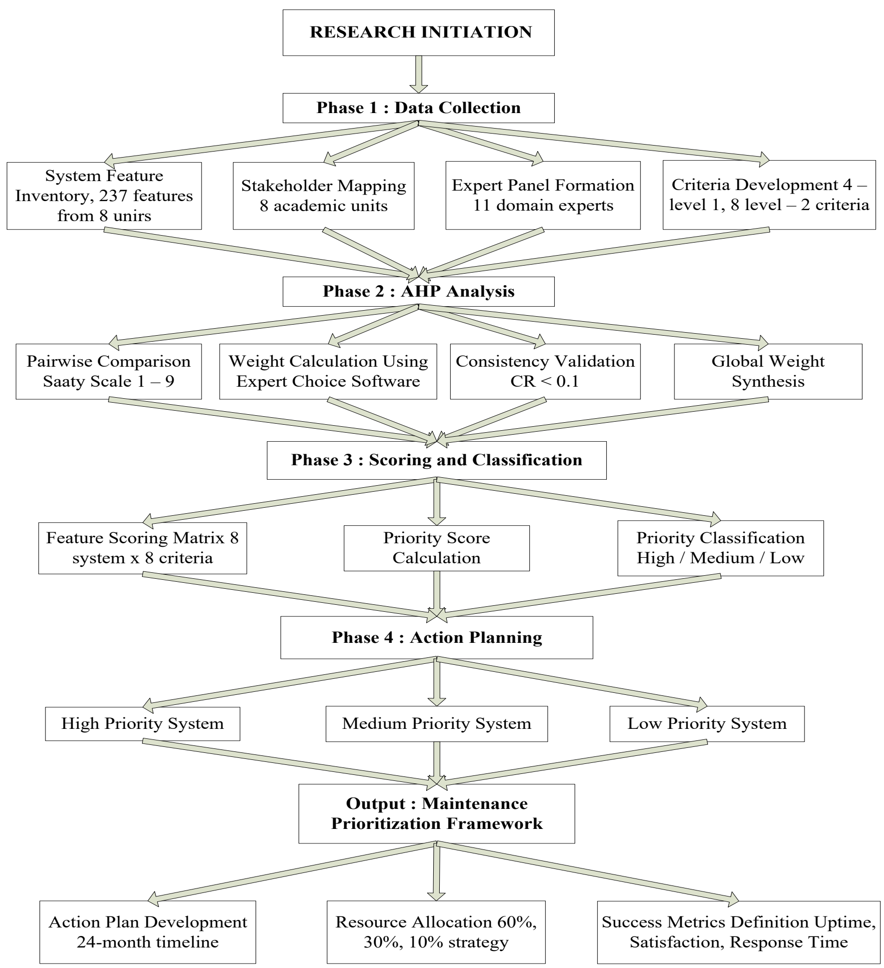

Figure 1. Conceptual Framework for Prioritizing Academic System Maintenance

Figure 1 shows the research steps to be undertaken in this study, which consists of four sequential steps:

1. The data collection phase, which includes an inventory of features from eight campus system units, criteria mapping based on input from 11 expert respondents, and the development of four level 1 criteria and eight sub-criteria.

2. The AHP analysis phase includes conducting pairwise comparisons, calculating criteria weights using Expert Choice, verifying the consistency ratio <0.1, and producing a global synthesis of criteria weights.
3. The scoring and classification phase, which includes calculating the score for each system feature and classifying system features into three system levels: low, medium, and high.
4. The system prioritization phase and resource allocation according to system level, as well as a 24-month system maintenance plan and success indicators.

This framework provides priority for maintaining the academic system along with its implementation plan and performance measurement index.

This research was conducted at Atma Luhur Institute of Science and Business. The research data came from the Sistem Satu Pintu that serves academic administration across eight campus units: Lecturers, Teaching Bureau, Student Affairs Bureau, Finance, Library, Alumni, Employee Classes & Student Admissions, and General Affairs. Across these eight units, 237 system features were identified and documented by the campus Information Systems Bureau. Each feature is accompanied by information such as development status, utilization level, access rights, and operational conditions. Broadly speaking, the research stages are grouped as follows:

2.1. Phase 1: Data Collection and Criteria Development

The criteria-setting process was conducted by 11 experts, consisting of academic managers, IT staff, and several users, all of whom participated in a Focus Group Discussion. Based on the literature review and expert consensus, this study defined level 1 criteria representing the strategic dimensions of system maintenance, while level 2 sub-criteria reflected operational considerations. This process ensured that all criteria could encompass both managerial and technical perspectives equally.

Table 1. Theoretical Mapping of Evaluation Criteria

Level 2 Criteria	Theoretical Source	Rationale for Selection
Academic Value Preservation	Quality in Higher Education frameworks (e.g., CHEA; UNESCO); Institutional theory [3], [4].	Direct link to institutional mission, accreditation, and academic credibility; systems that fail to support academic operations carry existential risk
Technical Debt Reduction	Software engineering [43]; Technical debt literature.	Balances short-term fixes with long-term sustainability; prevents accumulation of maintenance backlogs that degrade system quality over time
User Pain Points & Feedback	IT service management (ITIL v4); User-centered design [44].	Focuses on user-perceived disruptions; captures severity and frequency of user complaints as actionable maintenance signals
Usage Criticality & Frequency	Reliability engineering [45]; Systems usage analytics.	Captures operational impact of downtime; systems with high usage frequency affect more stakeholders when disrupted
Maintenance Resource Availability	Resource-based view [46]; Organizational capacity theory.	Reflects institutional capacity for maintenance; acknowledges that priorities must align with available skills, budgets, and infrastructure
Implementation Complexity	Software engineering; Project management[47].	Considers cost, effort, and risk of maintenance tasks; prevents overcommitment to complex fixes with diminishing returns
System Stability Risk	Risk management (ISO 31000:2018); Reliability engineering[48].	Focuses on predictive failure prevention; identify systems approaching failure thresholds requiring proactive intervention

Level 2 Criteria	Theoretical Source	Rationale for Selection
Compliance & Security Gaps	Information security (ISO/IEC 27701:2025); Privacy regulations[49] Preservation of Academic Values.	Addresses regulatory and privacy requirements, while low-weighted in routine decisions, retains non-negotiable status for critical compliance issues

The criteria selection process was systematic. Initially, 15 potential criteria were identified from the software maintenance literature, including sources from ISO/IEC 25010 for assessing software quality, reliability-focused maintenance literature, and IT service management frameworks. After three focus group sessions with 11 of our experts, these criteria were refined based on: (1) relevance to academic system maintenance, (2) measurability using institutional data derived from the Sistem Satu Pintu, and (3) non-redundancy criteria that correlated highly with other criteria were combined or eliminated. The result was eight sub-criteria that represent and capture the multidimensional nature of academic system maintenance decision-making in higher education.

2.2. Phase 2: AHP-Based Weighting and Consistency Validation
The second phase applied the AHP method to compare the relative importance of maintenance criteria and sub-criteria. Expert assessments were collected using pairwise comparison scores based on the Saaty scale of 1-9, which captures the relative importance of each criterion. The pairwise comparison matrix was processed using Expert Choice software, resulting in the calculation of priority criteria weights, the aggregation of expert assessments, and consistency validation with a Consistency Ratio (CR) below 0.10. These validation results ensured that the expert assessment results and their aggregation were coherent and that the resulting weightings were reliable.

2.3. Phase 3: Prioritization and System Classification
In the third phase, each academic system is evaluated based on the criteria that have been prepared in the previous stage, and the assessment results are entered into a structured assessment matrix. The priority score is the result of combining the weights of level one criteria as global criteria with the weights of level 2 criteria as performance criteria. Based on the results of these calculations, the academic system priority scores are classified into three maintenance priority levels, namely:

- High priority (score > 7.0)
- Medium priority (score between 5.0 and 7.0)
- Low priority (score < 5.0)

This classification supports managerial decision-making by simplifying complex evaluation results into priority groups that are easier to present than relying on numerical rankings.

2.4. Phase 4: Action Planning and Resource Allocation
The final phase involves translating the priority groups into a 24-month system maintenance action plan. Maintenance resources are allocated proportionally based on priority ranking: 60% for high-priority systems, 30% for medium-priority systems, and 10% for low-priority systems. To evaluate implementation effectiveness, this study used the following performance indicators:

- System availability (target uptime > 99.5%),
- User satisfaction level (> 90%),
- Maintenance response time.

By linking prioritization results to implementation metrics, this framework ensures that decision outcomes directly contribute to operational improvements and institutional performance. To evaluate the robustness of the prioritization results, this study also conducted a sensitivity analysis by varying the criteria weights within ±10% to assess the stability of the system rankings. The sensitivity analysis ensures that maintenance priorities remain consistent when expert judgments change, with some reasonable variation.

3. Results and Discussion

In the results and discussion section, the research results are described in several stages of data processing and presentation.

3.1. Initial Grouping of System Features

Initial data is presented in Table 2, which shows the initial grouping of the Sistem Satu Pintu features based on access units.

Table 2. System Feature Classification

System Group	Actual Number of Features	Feature Examples	Percentage	Dominant Developer
Academic Administration System (BAAK)	78 features	Check Group Contents, Course Entry Published, Final Exam Schedule, Create Schedule, Duty Schedule, Print Grade List, Transcript, Student KRS, Check Number of KRS, Lecture Survey, Supervisor Schedule, Question Receipt List, Institution Master, Course Master, Hour Master	32.9%	Yo1 (95%)
Lecturer Academic System (SIAD)	46 features	Lecture Minutes, Lecturer Teaching Schedule, Upload RPS, Grade Predictions, Attendance Recap, Upload Exam Questions, PA Student Passed Credits, PA/KP/TA Consultation, Check Scan Status, Teaching Session Recap	19.4%	Yo1 (98%)
Student System	28 features	Student Master, Upload Photos, Manage Student ID Numbers, Print KRS/KHS, Exam Cards, Certificates	11.8%	Yo1 (89%)
Final Project/Thesis System	18 features	ACC Thesis defense, Check Thesis Defense Schedule, Thesis Guidance Consultation Sheet, Print Thesis Defense Minutes Sheet, Examiner Attendance List	7.6%	Yo1 (83%)
Financial System	17 features	Check Tuition Payment, Print Tuition Payment Slip, Verify Tuition Payment, Monitor KRS, Financial Report	7.2%	Yo1 (82%)
New student admission system & employee class	16 features	New student entry, change new student data, new student registration report, new student payment verification, complete the new student's institution of origin	6.8%	Yo1 (94%)
General Systems & Administration	12 features	Operational Vehicle Loan, Goods Inventory, Announcement Master, Student Email	5.1%	SJN (67%)
Library System	11 features	Check Book Not Returned, Library Free Status	4.6%	Yo1 (91%)
Internal Quality Assurance System (SPMI)	11 features	Staff Satisfaction, Lecturer Satisfaction, Service Survey	4.6%	Yo1 (82%)
Total	237		100%	

System Group	Actual Number of Features	Feature Examples	Percentage	Dominant Developer
	features			

Table 2 displays the academic system feature group consisting of 237 features spread across eight campus units or sections. Based on the academic system features, an AHP-based hierarchical structure was designed to prioritize academic system maintenance.

3.2. Results of AHP-Based Feature Assessment and Weighting

To support systematic maintenance prioritization, this study developed a hierarchical decision-making structure that integrates strategic, operational, and risk-related considerations. The hierarchy was built based on expert consensus and consists of four Level-1 criteria and eight Level-2 sub-criteria, reflecting the key dimensions of academic information system maintenance in higher education settings (Figure 2).

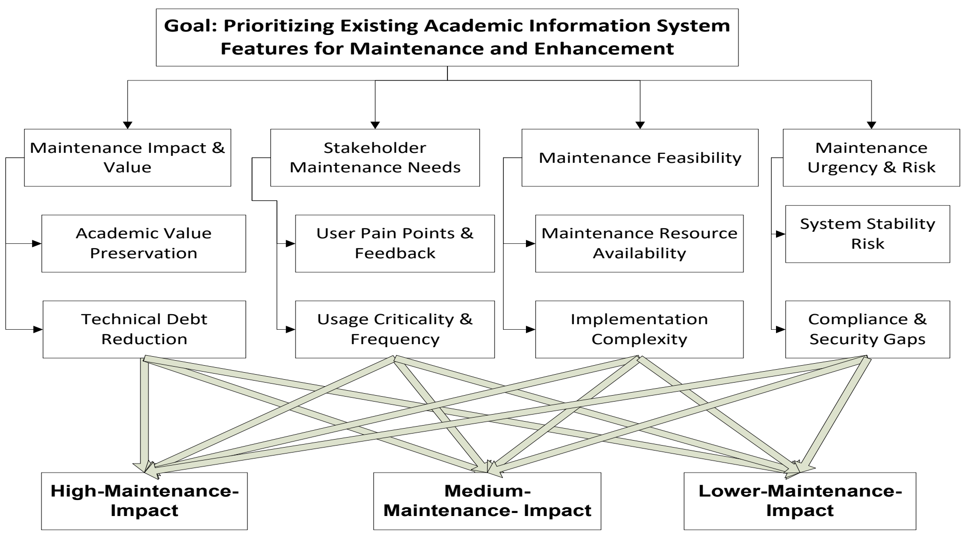

Figure 2. Analytical Hierarchy Structure

Figure 2 displays the decision-making structure for maintaining a university's academic information system using the AHP method. This structure generates decisions based on a comparative assessment of the relative inter-criteria provided for each aspect of maintenance from a managerial perspective, not just a technical assessment.

Table 3. Weighting Expert Choice Processed Result Criteria

Level 1 Criteria	Weight (L)	Level 2 Criteria	Weight (G)
Maintenance Impact & Value	0.377	Academic Value Preservation	0.258
		Technical Debt Reduction	0.120
Stakeholder Maintenance Needs	0.244	User Pain Points & Feedback	0.103
		Usage Criticality & Frequency	0.141
Maintenance Feasibility	0.204	Maintenance Resource Availability	0.092
		Implementation Complexity	0.111
Maintenance Urgency & Risk	0.176	System Stability Risk	0.116

Level 1 Criteria	Weight (L)	Level 2 Criteria	Weight (G)
		Compliance & Security Gaps	0.060

Table 3 shows that the level 2 criterion of Preserving Academic Values is the highest-weighted level 2 criterion with a weight of 0.258. The criterion of Preserving Academic Values receiving the highest score is an indication of the importance of the portion of academic values in the academic information system of higher education.

The highest weighting on Preservation of Academic Values (0.258) is evidence of the unique characteristics of the higher education environment, where the sustainability of academic values such as the integrity of student data, curriculum, and accreditation—is a top priority that cannot be compromised. This finding is in line with research [3], [4], which states that educational institutions tend to prioritize aspects that directly impact academic reputation and legitimacy rather than mere technical efficiency.

Interestingly, the weights for the Technical Debt Reduction (0.120) and System Stability Risk (0.116) criteria are nearly identical. This suggests that experts recognize the importance of balancing long-term improvements (technical debt reduction) with short-term risk mitigation (system stability). The weights of these two criteria reflect real-world challenges, where IT managers must allocate limited resources to prepare for preventative maintenance while simultaneously responding to operational disruptions.

Meanwhile, the Compliance & Security Gap criterion (0.060) received the lowest weighting. This result does not imply a disregard for security, but rather indicates that, within the context of daily maintenance priorities, compliance and security aspects are often considered standard practice and therefore not considered primary factors in emergency resource allocation decisions. This interpretation is supported by the literature [50], [51], [52] which found that in the education sector, regulatory compliance is more often addressed through separate policies rather than being included in routine maintenance priorities.

3.3. Sensitivity Analysis

Sensitivity analysis was conducted systematically to evaluate the robustness of the prioritization results by varying the Level 1 weight values within a range of ±10% while maintaining the proportional stability of the other weights. Table 4 presents the variation in priority scores and ranking stability generated in each scenario.

Table 4. Sensitivity Analysis Results (±10% Weight Variation)

Scenario	Weight Varied	BAAK Score	SIAD Score	Finance Score	Student Score	Final Project Score	Ranking Stability
Base Case	—	9.14	8.12	6.85	6.79	6.23	—
S1	Maintenance Impact & Value (+10%)	9.32	8.25	6.72	6.65	6.15	Stable (ranks 1-5 unchanged)
S2	Maintenance Impact & Value (-10%)	8.96	7.98	6.98	6.92	6.31	Stable (ranks 1-5 unchanged)
S3	Stakeholder Needs (+10%)	9.08	8.15	6.61	6.73	6.18	Stable (ranks 1-5 unchanged)
S4	Stakeholder Needs (-10%)	9.19	8.09	7.02	6.85	6.28	Stable (ranks 1-5 unchanged)
S5	Maintenance Feasibility (+10%)	9.11	8.10	6.88	6.81	6.25	Stable (ranks 1-5 unchanged)

Scenario	Weight Varied	BAAK Score	SIAD Score	Finance Score	Student Score	Final Project Score	Ranking Stability
S6	Maintenance Feasibility (-10%)	9.17	8.14	6.82	6.77	6.21	Stable (ranks 1-5 unchanged)
S7	Urgency & Risk (+10%)	9.12	8.11	6.87	6.80	6.24	Stable (ranks 1-5 unchanged)
S8	Urgency & Risk (-10%)	9.16	8.13	6.83	6.78	6.22	Stable (ranks 1-5 unchanged)

3.3.1. Sensitivity Analysis Interpretation

What does the sensitivity analysis tell us? A few things stand out. First, the two systems at the top BAAK and SIAD are rock-solid. We changed the criteria weights up and down by 10%, and their scores barely moved (less than 0.35 points difference). This tells us that labeling them 'High Priority' is not a fluke. No matter how you adjust the weights within reason, they stay on top. That makes the decision to prioritize them a safe bet, even if different experts have different opinions.

Second, the middle group is a bit more delicate. The Finance and Student Systems usually stay in their lanes, but Scenario 4 showed us something interesting. When we dropped the weight on Stakeholder Maintenance Needs by 10%, the gap between these two systems shrank to just 0.04 points. In other words, if the Usage Criticality weight shifts by more than 8%, they could swap places. This is a useful warning: institutions should not rely solely on expert judgment. They should periodically check actual usage patterns and adjust weights accordingly.

Third, the low-priority systems Library and General Affairs stayed low across every scenario. Their scores never crossed 5.0, no matter what we did with the weights. This confirms that, while these systems are not unimportant, they are clearly less urgent than the core academic systems. The maintenance flexibility they offer is real.

Finally, there is a practical lesson here. The sensitivity analysis shows which levels matter most for which systems. Take the Financial System: its ranking is most sensitive to the Stakeholder Maintenance Needs criterion. For universities that process high volumes of financial transactions during enrollment peaks, this is a signal to weigh Usage Criticality more heavily. This kind of adaptability is what makes the framework useful across different institutional settings and strategic goals.

3.4. Classification of Academic System Maintenance Priorities

After the criteria weights are determined, the next step is to classify academic information systems based on their maintenance priority level. The eight systems were evaluated using a structured assessment matrix against eight predetermined Level 2 criteria. This matrix resulted in an aggregated priority score for the eight systems within the One-Stop System. Table 5 presents the detailed results of the system feature assessment based on the criteria in the AHP structure.

Table 5. Detailed Scoring Matrix

System	Acad Value	Tech Debt	User Pain	Usage Crit	Resource	Complex	Stability	Compliance
Academic Administration System (BAAK)	10	9	9	10	8	9	8	8
Lecturer Academic System (SIAD)	9	8	8	9	7	8	7	7

System	Acad Value	Tech Debt	User Pain	Usage Crit	Resource	Complex	Stability	Compliance
Student System	8	7	8	8	6	7	6	6
Final Project/Thesis System	7	6	7	7	5	6	7	6
Financial System	8	5	6	6	4	5	8	9
New student admission system & employee class	6	6	5	5	5	5	5	5
Library System	5	4	4	4	4	4	4	4
General Systems & Administration	4	3	3	3	3	3	3	3

Table 5 displays the scores and priority rankings. The results show clear differences among the systems, allowing for a classification into three priority levels—high, medium, and low—to be followed. Systems with a score greater than 7.0 are categorized as high priority, systems with scores between 5.0 and 7.0 as medium priority, and systems with scores below 5.0 as low priority.

Table 6. System Priorities

Rank	System	Priority Score	Category
1	Academic Administration System (BAAK)	9.14	High Priority
2	Lecturer Academic System (SIAD)	8.12	High Priority
3	Financial System	6.85	Medium-High
4	Student System	6.79	Medium-High
5	Final Project/Thesis System	6.23	Medium
6	New student admission system & employee class	5.18	Medium-Low
7	Library System	4.12	Low Priority
8	General Systems & Administration	3.25	Low Priority

The system ranking results in Table 6 show a sharp difference between the core academic systems and other supporting systems. BAAK (9.14) and SIAD (8.12) are the highest-ranking systems, with quite significant differences in scores compared to the other systems. These scores emphasize the role of these two systems as (1) the backbone of daily operations serving thousands of students and lecturers, and (2) the primary data sources for the Institution's strategic decision-making. Their high scores are primarily driven by their significant contributions to the Preservation of Academic Value and Criticality of Use criteria, which directly reflect the institutional consequences of a disruption.

An interesting point is the Finance system's position (6.85), which ranks third but falls into the 'Medium-High' category. Although not directly an academic system, the Finance system is closely linked to the continuity of student operations (UKT payments, scholarships) and institutional reporting. This indicates that within the framework of academic system priorities, the Finance aspect has a 'cross-weight' that influences the smooth running of the academic process. This role makes the Finance system deserve more attention than other non-academic support systems.

In contrast, the Library System (4.12) and the Public Area (3.25) were given low-priority ratings. This finding does not imply that these systems are unimportant but rather reflects their more clustered or seasonal usage characteristics (e.g., the library is busy at the beginning and end of the semester, the public area is busy during the graduation period). In other words, maintenance timing for these systems is much more flexible, allowing resources to be allocated to more urgent systems. This approach aligns with the concept of risk-based maintenance proposed by [53], which determines maintenance priorities based on the level of operational risk in the event of downtime.

Figure 3 below visualizes the priority ranking of academic systems and the distribution of maintenance urgency across eight campus units. The resulting classification ranking provides managers with a perspective that supports maintenance planning. Grouping systems into priority levels allows decision-makers to allocate maintenance resources more effectively, focusing first on systems that directly support academic activities.

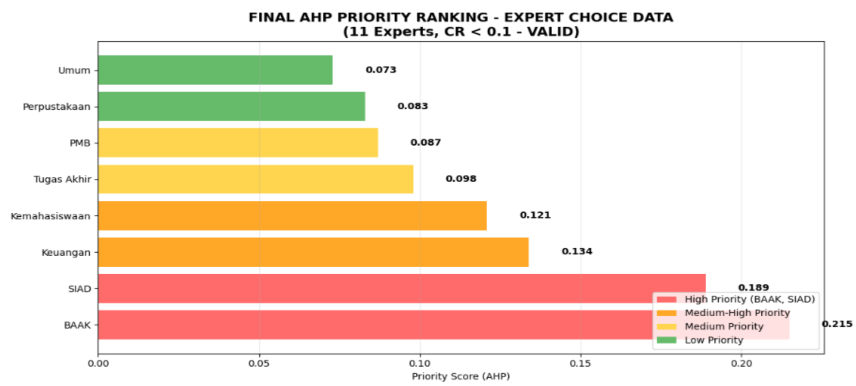

Figure 3. AHP Priority Ranking

Overall, Figure 3 shows the results of the system priority ranking classification, with their importance divided into high-priority, medium-high-priority, medium-priority, and low-priority. This grouping transforms a complex multi-criteria system evaluation into clear, actionable maintenance categories with strategic academic objectives.

To ensure the level of consistency of expert judgment, the AHP method requires that the Consistency Ratio (CR) value be calculated per respondent at each level of the decision structure and also the combination of all Consistency Ratios (CR) to verify the logical coherence of expert judgment.

The results of the study show that all criteria and sub-criteria show a consistency ratio below the acceptable threshold, namely 0.10, as illustrated in Figure 4. This finding confirms that the expert assessment is stable and consistent, so that the results of the criteria weights and priority scores are credible results.

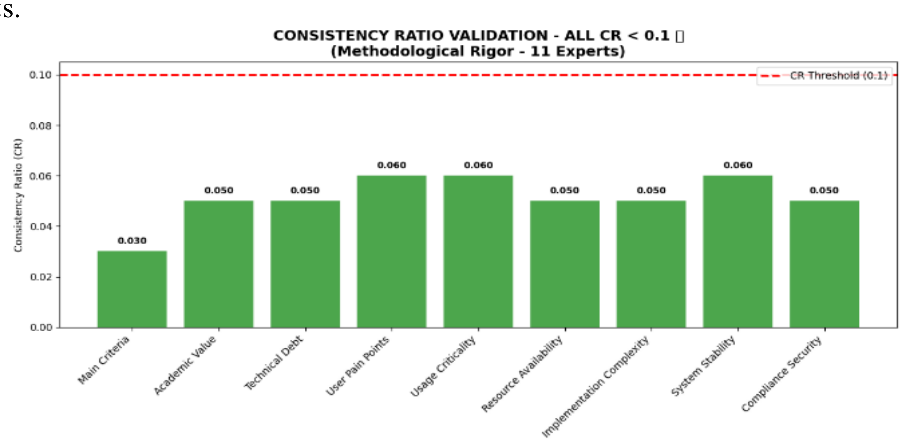

Figure 4. Consistency Ratio Validation

Figure 4 validates the consistency of the expert judgments involved in this study. The combined consistency ratio accurately reflects the decision-making structure. This validation result is important to ensure that the maintenance prioritization results are not driven by subjective bias or random judgment. Overall, the consistency and validity results indicate that the maintenance prioritization results from this academic system can be used to support decision-making.

3.4.1. Theoretical Implications

Our findings carry several theoretical implications. First, we expand the use of AHP beyond its usual home in manufacturing. In factories, as studies [25] and [32] show, maintenance choices are mostly about cost and keeping machines running. Universities operate on a different logic entirely. Here, the top priority is not saving money or avoiding downtime, it is preserving academic integrity and institutional reputation. Our results back this up: the criterion with the highest weight (0.258) was Academic Value Preservation. In short, in a non-profit educational setting, 'value' can outweigh 'cost' when deciding what to maintain[54].

Second, we contribute a fresh perspective to the information systems maintenance literature. Previous work has often focused on technical issues—software aging [15] or system reliability [14], for example. Our study shows that, for academic systems, those technical factors are only part of the picture. Maintenance priorities also depend on organizational needs and stakeholder expectations. This aligns with socio-technical systems theory, which says that effective information systems require alignment between technology and the organizational context.

Third, our work highlights how much context matters. We compared our results with a study that used AHP for maintenance in a drone factory [40]. The contrast is striking. In the factory, 'machine downtime' and 'repair costs' were the main criteria. At a university, 'academic impact' and 'frequency of use' carried more weight. The lesson here is clear: maintenance frameworks are not one-size-fits-all. They need to be tailored to the setting. For MCDM theory, this has an important implication: criterion weighting is not a purely technical exercise. It reflects the institution's underlying values and logic. Future MCDM research should therefore pay closer attention to the institutional context, rather than assuming the same criteria will work everywhere.

3.4.2. Transferability and Institutional Variation

We tested our framework at one private university in Indonesia. That is our starting point. But we did not design it to stay there. The framework is meant to travel.

Different institutions will need to tweak it. Here is how, First, take a well-funded public university. They have stable maintenance budgets. So, they can afford to focus more on Academic Value Preservation. Long-term academic quality is their priority, not short-term resource constraints.

Second, consider a smaller private university with limited IT staff. For them, Technical Debt Reduction matters more. They cannot afford costly emergency fixes. Every dollar and every hour of IT time counts. Their focus should be on avoiding preventable failures. Third, look at research universities. These institutions handle sensitive research data. They collaborate with international partners. For them, the Compliance & Security Gap criterion carries more weight. Data privacy and regulatory adherence are non-negotiable.

Fourth, think about teaching-focused institutions. Their survival depends on student enrollment. Student satisfaction drives enrollment. So, they should weigh the User Issues criterion more heavily. Keeping students happy through reliable systems is not just nice to have it is a business imperative. The beauty of our framework is that it is modular. The four-phase structure inventory, weighting, classification, and action planning stays the same. But the inputs can change. You can adjust the criteria's definitions, the weights, and even the thresholds. This flexibility is what makes the framework useful for strategic IT governance, regardless of the institution's size, mission, or budget.

3.4.3. Practical Implications

What does this framework do for IT managers on the ground? Three things, really. First, transparency. Before, resource allocation decisions were often based on who shouted loudest or who had connections. Not anymore. Now, the decisions are based on weighted criteria that experts agreed upon. When you present a maintenance budget to the university leadership, you can show them exactly why System A needs more resources than System B. No guesswork. No politics. Just data.

Second, accountability. Table 6 makes it clear which systems are top priority, and which are not. If a dean asks, 'Why is my system not getting more attention?' you can point to the criteria, the weights, and the scores. This is crucial when resources are tight and everyone wants a piece of the IT budget. Third, efficiency. The 60:30:10 rule (Table 7) ensures that most of the IT resources go to the systems that matter most. In our case, the high-priority systems account for more than 80% of the institution's daily operations. This is the Pareto principle in action 80% of the impact comes from 20% of the systems. By focusing on resources there, the university gets the biggest bang for its buck.

These benefits translate into real improvements on campus. Fewer disruptions to critical academic services. Faster responses when something does go wrong. Better service for students and faculty. And perhaps most importantly, the framework ensures that maintenance investments are not just random fixes, they are strategic. They support accreditation, teaching quality, and research productivity. In other words, they align with what the university cares about.

3.5. Details of the Action Plan for Academic System Maintenance

Based on the priority classification results, this study translates analytical findings into a 24-month maintenance action plan. This priority classification is designed to support strategic decision-making in the management of the academic information system. The proposed maintenance action plan addresses system priorities, resource allocation, implementation timelines, and performance indicators.

Maintenance resources are allocated using a tiered, proportional approach based on priority: 60% for high-priority systems, 30% for medium-priority systems, and 10% for low-priority systems. This allocation scheme reflects varying levels of academic impact and operational risk. High-priority systems require proactive maintenance to ensure the continuity of critical academic services, whereas medium- and low-priority systems are scheduled incrementally based on available resources.

Table 7. Summary Timeline & Resource Allocation

Priority Tier	Systems	Months 1-6	Months 7-12	Months 13-24	Total Resources
HIGH	BAAK, SIAD	45%	25%	15%	60%
MEDIUM	Finance, Student Affairs, Final Project	15%	20%	10%	30%
LOW	PMB, Library, General	5%	8%	7%	10%
TOTAL	**All Systems**	**65%**	**53%**	**32%**	**100%**

Table 7 outlines the system maintenance action plan, divided into three stages. Stage 1 is the short-term maintenance phase, covering the first 1 to 6 months. Stage 2 is the medium-term maintenance phase, spanning months 7 through 12. Stage 3 is the long-term maintenance phase. This phased approach ensures that critical systems receive immediate attention while simultaneously establishing maintenance mechanisms for systems with medium and low priorities.

For other higher education institutions adapting this framework to maintain their academic systems, the 60:30:10 allocation should be viewed as a starting point rather than a rigid rule. Institutions can adjust these resource allocation percentages to align with their respective strategic priorities. For instance, a rapidly growing institution might allocate a larger share to medium-priority systems that support the scaling of campus operations, whereas an institution with stable operations might focus its resources on reducing technical debt in low-priority systems.

This action plan provides structured guidance aligned with the priorities for maintaining academic systems in higher education institutions. Through an evidence-based approach, system maintenance decisions become transparent and accountable particularly for institutions facing budget constraints and managing complex systems. The proposed framework goes beyond merely ranking systems; it ensures that maintenance investments are justifiable, the rationale for prioritizing specific systems is easily explained, and accountability is enhanced. Overall, this plan offers a practical management tool that strengthens the effectiveness, transparency, and sustainability of academic information system maintenance.

4. Conclusion

So, what have we learned? Our AHP-based framework works. At ISB Atma Luhur, we were able to sort the academic systems into three clear priority levels high, medium, and low. The high-priority systems BAAK and SIAD deserve 60% of maintenance resources. The medium group Finance, Student Affairs, and Final Project get 30%. The rest PMB, Library, and General Affairs takes the remaining 10%. This is not just a ranking exercise. It is a concrete plan for resource allocation that is both transparent and defensible.

On the theoretical side, our study offers three contributions. First, we show that AHP can work outside the factory floor. In higher education, the criteria for maintenance are different: academic values matter more than cost efficiency. Second, we push back against the cost-centric assumptions that dominate maintenance literature. Our data makes it clear: in academic settings, preserving institutional reputation and academic integrity outweighs purely financial considerations. Third, we add to MCDM theory by showing that criterion selection and weighting are not neutral technical steps. They are shaped by the institution's logic and values. This is a reminder that context matters.

For the field of information systems, the takeaway is this: quantitative prioritization methods can do more than just rank systems. They can improve planning, make stakeholders happier, and ease the burden on IT teams. The 24-month roadmap we developed gives the institution a clear path forward. It strengthens the university's ability to deliver reliable, predictable maintenance over the long haul.

Of course, our study has its limits. We relied on expert judgment from a single institution. Our specific weights and classifications may not fit every university. A public university with bigger budgets, or a small private college with limited IT staff, would need to adjust. The good news is that the framework is modular. We have included guidelines to help others adapt it to their own context. Still, future work should test it across different settings, public and private, large and small, research-heavy and teaching-focused.

Looking ahead, there is plenty of room to build on this. We see three promising directions. First, validation studies in other institutions both in Indonesia and abroad would strengthen the evidence base. Second, linking the framework with machine learning could allow automatic recalibration of priority scores based on system logs. Third, longitudinal studies could track whether the framework actually leads to better uptime and happier users. These are all avenues worth exploring.

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