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An Explainable AHP with Sensitivity Analysis Approach for Strategic IT Project Prioritization in Higher Education

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Abstract. This study addresses the strategic challenges faced by private universities in Indonesia in selecting the most suitable IT project to support digital transformation, comparing a Next-Generation Learning Management System (LMS) and an Integrated University Mobile Super-App. Rather than developing a new method, this study enhances the conventional Analytical Hierarchy Process (AHP) by integrating sensitivity analysis and priority decomposition to improve decision explainability (Explainable MCDM). Expert assessments were collected from five academic stakeholders using pairwise comparisons based on Saaty's scale. Four criteria were assessed: Strategic Alignment, Benefits & Impact, Feasibility & Resources, and Risk Assessment. The results show a narrow preference for the LMS (50.7%) over the Super-App (49.3%), primarily driven by its superiority on the highest-weighted criterion, Strategic Alignment (35.6%), particularly the "Support for Core Educational Goals" sub-criterion. Sensitivity analysis reveals that the ranking would reverse if the Benefits & Impact weight increases from 0.200 to above 0.278. This study provides a transparent, replicable, explainable AHP framework that enables decision-makers to understand not only what is recommended but also why and under what conditions the recommendation changes.

Keywords: Analytic Hierarchy Process, IT project portfolio, higher education digital transformation, decision explainability, sensitivity analysis.

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1. INTRODUCTION

Indonesian universities are facing increasing pressure to digitally transform their academic services. Digital transformation in Indonesia requires consideration of geography, infrastructure, human resources, and government support [1]. The challenges of implementing digital transformation in higher education come from the vision and mission, leadership and human resource management, digital resources and competencies, as well as digital culture and its ethics [2]. Implementing a Learning Management System (LMS) to support structured, flexible, and documented digital learning in higher education institutions. However, LMS implementation requires infrastructure support, faculty training, and student outreach, as well as support from university management [3], [4]. From a student's perspective, LMS implementation provides structured access to course materials, learning resources, schedules, and academic announcements [5], [6].

On the other hand, the implementation of the Mobile Super-App Application towards a smart campus in higher education requires internet infrastructure, data management, academic certainty, system compliance, and leadership commitment [7]. [8]. In Indonesian universities, policies related to the implementation of a smart campus are formulated systematically and strategically [9]. [10]. So, the success of IT projects in higher education requires a positive organizational culture, such as communication, appreciation, learning, and cooperation [11]. For private campuses domiciled in regions such as *ISB Atma Luhur*, currently the development of digital transformation is focused on two major things, namely developing a new generation Learning Management System (LMS) or developing a Super-App Mobile Application as a solution to improve student engagement and services holistically. The strategy for selecting IT projects in higher education that best suit current campus needs is created using the MCDM method, namely a multi-criteria decision-making technique, to obtain the best alternative [12]. There are many methods in MCDM, one of which is AHP [13]. Anticipating IT project failure can be done using the ANP and Best Worst Method (BWM) methods, as well as artificial intelligence [14], [15].

This study specifically uses AHP with the Explainable MCDM (XMCDM) concept to support campus leadership decisions when determining which information technology projects to develop as part of a digital transformation strategy. AHP was chosen because it can generate decisions based on multi-criteria conditions and also analyze risks [16]. The AHP method developed by T.L. Saaty is a systematic procedure in hierarchical form, then a series of paired comparison assessments against other elements to get the best alternative [17]. AHP has developed quite variedly and can be combined with other methods, such as AHP and Expert Knowledge [18], [19]. Another modification is AHP Express by simplifies the alternative priority calculation method [20]. The AHP method is considered more effective than ANP [21], and is considered superior in supporting strategic decision making compared to other calculation methods such as geometric mean and arithmetic mean [22]. The implementation of decision making with AHP is more widespread in Brazil in the public sector and R&D projects [23], [24]. AHP has also been tested when supporting system development decisions or evaluating software projects, and the results show that functional criteria, software quality, and ease of use are the three most important criteria [25], [26], [27], [28].

AHP is also used to support managerial decisions in digital transformation processes and new technologies [29], and various other fields, such as manufacturing technology [30], information technology projects [31], [32], education [33], [34], law [35], company [36], [37], [38], government [39], and sustainable development [40]. Specifically to support the project portfolio management selection strategy, AHP is used to select a portfolio of public projects with a limited budget [41], to identify important factors in construction projects [42], to analyse all risk factors in the decision to select a project [43], to determine the priority scale of innovative technology projects [44], to evaluate the level of project success [45], to choose the most appropriate project implementation method [46], and become a decision-making model in construction project selection [47]. In particular, several studies discuss the use of AHP as a decision-making method in the selection of information technology project portfolios in various aspects in universities in Indonesia and in other countries in the world, starting from learning methods, academic services, selection of learning support software and library services, major selection strategies, and analysing the priorities of decision makers for information technology projects [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58], [59], [60].

Based on the literature review above, several research gaps can be identified. First, although AHP has been widely applied in various contexts, research specifically designing AHP models for strategic IT project prioritization in higher education remains very limited

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[50], [59], [61]. Most existing studies focus on operational or tactical decisions (e.g., software selection or learning methods) rather than institutional-level strategic IT investments. Second, from a methodological perspective, conventional AHP tends to operate as a "black box" that produces a final ranking without explaining *why* one alternative is preferred over another or *under what conditions* that recommendation might change. The principles of Explainable MCDM (XMCDM)—which emphasize transparency, traceability, and interpretability of decision outcomes—have not been systematically integrated into AHP-based IT prioritization studies. Third, the hierarchy of criteria used in prior software selection research [25], [26], [27], typically does not comprehensively cover the strategic, feasibility, and risk dimensions that are central to institutional-level IT investment decisions in higher education.

To address these gaps, this study proposes a novel explainable AHP framework that integrates sensitivity analysis and priority decomposition into the conventional AHP procedure. Unlike standard AHP applications that only report final weights, our framework enables decision-makers to: (1) trace how each criterion contributes to the final recommendation, (2) identify the key drivers (specific sub-criteria) that determine the ranking, and (3) simulate "what-if" scenarios to understand how changes in stakeholder priorities would alter the recommendation, including the exact breakpoint at which the ranking reverses. This approach transforms AHP from a black-box ranking tool into a transparent, interpretable decision support system aligned with XMCDM principles [62], [63].

The objective of this study is to develop and validate an explainable AHP model for prioritizing strategic IT projects in higher education, using a case study of a private university in Indonesia comparing a Next-Generation LMS and an Integrated University Mobile Super-App. The contributions of this study are threefold: (1) Methodologically, it demonstrates how sensitivity analysis and priority decomposition can be integrated into AHP to achieve explainability without developing an entirely new MCDM method, offering a replicable framework for other strategic IT prioritization contexts. (2) Empirically, it provides a validated hierarchy of criteria and sub-criteria (Strategic Alignment, Benefits & Impact, Feasibility & Resources, Risk Assessment) tailored to higher education IT investment decisions, based on assessments from five key academic stakeholders. (3) Practically, it delivers actionable insights for university leaders by not only

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recommending which IT project to prioritize (LMS with 50.7%) but also explaining why (superiority on the highest-weighted criterion, Strategic Alignment) and under what conditions the recommendation would reverse (if Benefits & Impact weight exceeds 0.278).

2. METHODS

This study integrates the Analytical Hierarchy Process (AHP) with the Explainable MCDM (XMCDM) concept to produce traceable and interpretable decisions. The XMCDM framework consists of three stages: preparing explainable multi-criteria data, conducting explainable multi-criteria decision-making analysis, and providing decision support through explainable multi-criteria rankings[62]. Additionally, artificial intelligence-powered decision-making models can enhance complex decision-making processes [63]. Based on the need to produce explainable multi-criteria decisions using the AHP method, the research stages are described in the following sections.

2.1. Research Design

This research employs a mixed-methods approach with a sequential explanatory design, conducted in two main phases: (a) a qualitative phase to identify and validate criteria and sub-criteria through a systematic literature review followed by expert validation. (b) Quantitative phase to collect and analyse pairwise comparison data using the AHP method, followed by sensitivity analysis to enhance explainability. This design ensures that the criteria hierarchy is grounded in both existing literature and local expert judgment, while the quantitative analysis produces measurable and reproducible priority scores. The research was conducted in six main phases, as illustrated in Figure 1. The following narrative provides a detailed explanation of each phase to complement the flowchart.

1) Preparation Stage

A systematic literature review was conducted using academic databases (Google Scholar, Scopus, IEEE Xplore) with keywords including "AHP," "IT project prioritization," "higher education digital transformation," and "MCDM." This review identified an initial set of criteria and sub-criteria commonly used in IT project selection and higher education contexts [12], [13]. In addition, an initial interview was conducted with an expert in higher education IT management to understand the local context and validate the relevance of the identified criteria[62].

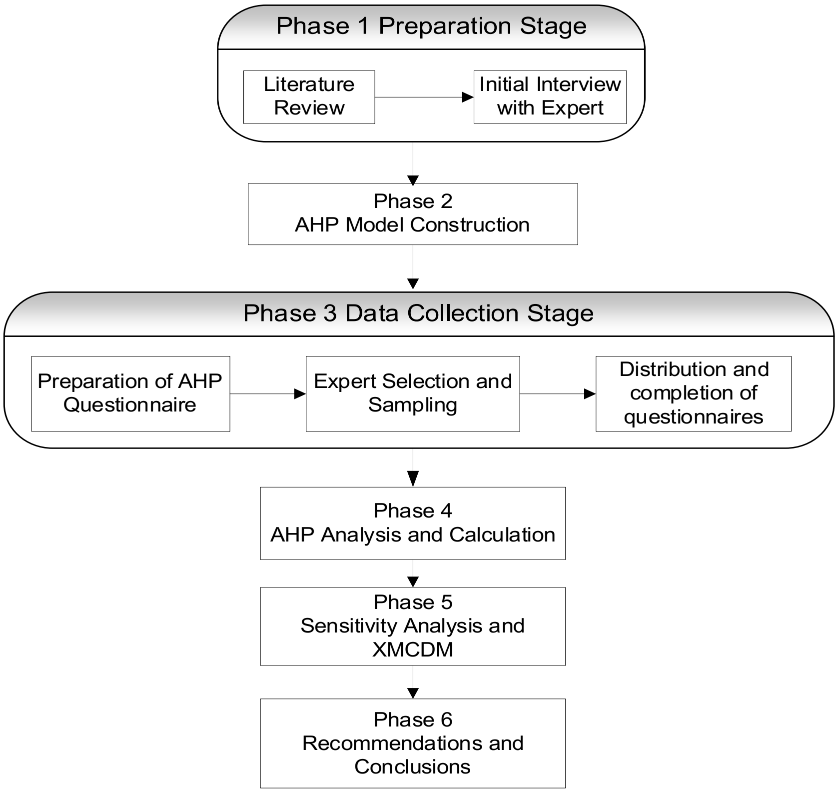

Figure 1. Research Steps

2) AHP Model Construction

Based on the literature review and initial expert interview, the AHP hierarchy was constructed. The initial criteria framework was reviewed by three experts (academic and IT governance specialists) to assess content validity. Through an iterative consensus process, the final hierarchy was refined, including the addition, removal, or merging of sub-criteria [64]. This structure consists of four levels: Goal (Level 1), Criteria (Level 2), Sub-Criteria (Level 3), and Alternatives (Level 4) [64], [65].

3) Data Collection Stage

A pairwise comparison questionnaire was designed based on Saaty's fundamental scale (1–9), where a value of 1 indicates equal importance and 9 indicates extreme importance[64]. The questionnaire covered comparisons at all hierarchy levels: criteria versus criteria, sub-criteria versus sub-criteria within each criterion, and alternatives versus alternatives under each sub-criterion. Five academic stakeholders were purposively selected as respondents based on the following inclusion criteria: (a) having a strategic role in IT planning at the university level, (b) possessing an in-depth understanding of both operational and academic needs, and (c) having at least 5 years of experience in IT project decision-making in a higher education environment[50], [59].

4) AHP Analysis and Calculation

Each pairwise comparison matrix was tested for consistency. Matrices with Consistency Ratio (CR) < 0.1 were accepted. Local and global weights were calculated using the eigenvector method. Individual judgments were aggregated using the geometric mean[65], [66].

5) Sensitivity Analysis and XMCDM

Sensitivity analysis was conducted to test the robustness of the results and provide explainability. Three "what-if" scenarios were simulated to determine the breakpoint at which the alternative ranking would reverse. This analysis answers: (1) What happens if the weight of Strategic Alignment is decreased by 20%? (2) What happens if the weight of Benefits & Impact is increased? (3) At what breakpoint does the ranking change from LMS to Super-App? [62], [66].

6) Recommendations and Conclusions

Based on the AHP results and sensitivity analysis, final recommendations were formulated. The LMS was recommended with a narrow margin (50.7%) over the Super-App (49.3%), along with explanations of why and under what conditions this preference would change. This phase also includes practical implications for university leaders and suggestions for future research [62] [67].

2.2. Population and Sample

This study involved a population of all stakeholders involved in strategic IT decision-making in higher education, with a case study at *ISB Atma Luhur*. A sample of 5 respondents was selected using purposive sampling with the following inclusion criteria: (a) having a strategic role in IT planning at the university level, (b) possessing an in-depth understanding of both operational and academic needs, and (c) having at least 5 years of experience in IT project decision-making in a higher education environment.

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Justification for sample size (n=5): In expert-based AHP studies, sample sizes between 3 and 7 experts are considered sufficient when the experts are homogeneous and represent distinct strategic functions [64], [67]. Saaty (2008) emphasized that AHP relies on the quality of expert judgment rather than statistical representativeness [65]. The five respondents in this study represent five key strategic perspectives: academic leadership (Vice Rector for Academic Affairs), faculty leadership (Dean of the Faculty of Information Technology), program-level academic management (Head of Information Systems Study Program, Head of Informatics Engineering Study Program), and IT operations (Head of Information Systems Section). This composition ensures that all relevant stakeholder perspectives—academic, managerial, and technical—are adequately represented.

The respondents consisted of: 1. Vice Rector for Academic Affairs (strategic academic direction); 2. Dean of the Faculty of Information Technology (faculty-level resource allocation); 3. Head of the Information Systems Study Program (program-level academic needs); 4. Head of the Informatics Engineering Study Program (program-level technical needs); and 5. Head of the Information Systems Section (IT operational feasibility).

2.3. Data Collection Technique

The primary data collection process was carried out using an AHP questionnaire in the form of a tiered pairwise comparison matrix starting from goals, criteria, sub-criteria, and alternatives, by giving a value of 1-9 based on the Saaty Fundamental Scale [64]. Each respondent completed a series of pairwise comparison matrices: one matrix for criteria (4×4), four matrices for sub-criteria under each criterion, and sub-criterion matrices for alternatives (2×2). Supporting data were obtained from a literature study of 62 relevant journals to support the theory and framework for decision-making criteria.

2.4. Data Analysis Technique

Data analysis techniques were performed in accordance with the data synthesis steps in the AHP method [65], with additional steps for explainability:

1) Step 1: Pairwise Comparison Matrix Design → Each respondent filled out a comparison matrix for each level of the hierarchy (goal, criteria, sub-criteria, alternatives). The pairwise comparison scale followed Saaty's fundamental scale (1 = equal importance to 9 = extreme importance).

2) Step 2: Consistency Test → The Consistency Ratio (CR) was calculated for each matrix using the formula: CR = CI / RI, where CI = (λ max - n)/(n-1) and RI is the Random Index [64]. A matrix was declared consistent if CR < 0.1. If CR ≥ 0.1, respondents were asked to revise their assessments.
3) Step 3: Local and Global Weight Calculation → Local weights for each element in the hierarchy were calculated using the eigenvector method. Global weights were obtained by multiplying local weights by the weight of the corresponding parent element in the hierarchy.
4) Step 4: Aggregation of Final Assessments → The weights of all consistent respondents were combined using the geometric mean, as recommended by Saaty for aggregating individual judgments in AHP group decision-making[64].
5) Step 5: Sensitivity Analysis for Explainability → Sensitivity analysis was conducted to test the robustness of the results and provide explainability to the model. This analysis answers "what-if" scenarios:
    a) Scenario 1: What happens to the final ranking if the weight of Strategic Alignment (the highest-weighted criterion) is decreased by 20%?
    b) Scenario 2: What happens to the final ranking if the weight of Benefits & Impact (the third-ranked criterion) is increased?
    c) Scenario 3: At what exact breakpoint does the ranking preference change from LMS to Super-App, or vice versa?

The sensitivity analysis and priority calculations in this study used Ideal Mode in Expert Choice software. The selection of this mode was based on the research objective of identifying the single most strategic project, where each alternative is assessed independently against an ideal standard rather than as part of an interdependent portfolio [66]. In Ideal Mode, the alternative with the highest weight is assigned a score of 1.0, and all other alternatives are scaled relative to it. This mode is particularly appropriate when decision-makers seek to identify the best single project for implementation, rather than allocating resources across a portfolio of interdependent projects[67].

Breakpoint identification procedure**:** Using the dynamic sensitivity feature in Expert Choice, the weight of a selected criterion was gradually increased or decreased while keeping other criterion weights proportionally adjusted. The breakpoint was recorded

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when the alternative ranking reversed (i.e., when the LMS score fell below the Super-App score). This procedure was repeated for each criterion to identify the most influential criteria on the final ranking.

2.5. Proposed Explainable MCDM Framework

To explain the proposed explainable MCDM framework integrated into the AHP procedure, Figure 2 provides a transparent and structured flow from data input to producing the final decision, ensuring that the reasons behind each recommendation can be traced and explicitly understood by decision-makers. This framework is the core methodological contribution of this study, distinguishing it from conventional AHP applications.

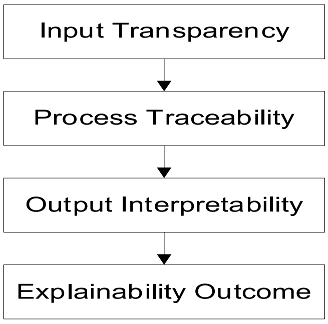

Figure 2. Proposed Explainable MCDM Framework

The framework consists of four layers:

Layer 1: Input Transparency**.** This layer ensures that all criteria, sub-criteria, and expert assessments have been validated. The content validity process (described in Section 2.7) guarantees that the criteria hierarchy is relevant and complete. Each pairwise comparison matrix is tested for consistency ($CR < 0.1$), and only consistent matrices proceed to the next layer.

Layer 2: Process Traceability. This layer represents the AHP computational stage designed to ensure that each step in the transformation from raw data to global weights can be reproduced and verified. The eigenvector method, geometric mean aggregation, and consistency calculations are fully documented. This ensures that the decision model is not a "black box" and that each weighting can be explained and replicated by other researchers.

Layer 3: Output Interpretability. This layer generates priority scores using sensitivity analysis and criterion contribution decomposition to clarify why one alternative outperforms another. "What-if" scenarios simulated through Expert Choice show how small changes in key criteria can alter the ranking results. This provides a rationale that can be explained to decision-makers, including the exact contribution of each criterion to the final score (see Table 6 in Results section).

Layer 4: Explainability Outcome. This layer transforms traditional AHP into an interpretively transparent decision support system. It ensures that the decision-making process meets two criteria: (1) accuracy (the recommendation is based on consistent, validated judgments) and (2) explainability (the reasoning behind the recommendation can be articulated in terms of criterion contributions, sensitivity thresholds, and scenario simulations).

2.6. Content Validity and Reliability

Content Validity: The initial criteria and sub-criteria framework was developed from a systematic literature review of 62 journal articles. To ensure content validity, the framework was reviewed by three experts in the fields of information systems, higher education management, and MCDM methods. The expert panel consisted of: (1) a professor in information systems with 15 years of experience in IT governance, (2) a university senior manager responsible for strategic planning, and (3) an AHP methodologist with published work on MCDM applications. The validation process followed a two-round modified Delphi consensus method:

1) Round 1 (Independent review): Each expert independently reviewed the initial criteria hierarchy, providing written feedback on the relevance, clarity, and completeness of each criterion and sub-criterion. Experts rated each item on a 4-point relevance scale (1 = not relevant, 4 = highly relevant) and suggested additions, deletions, or modifications.
2) Round 2 (Consensus meeting): A facilitated discussion was conducted to resolve disagreements. Criteria or sub-criteria with an average relevance score < 3.0 were discussed and either revised or removed. Consensus was defined as 100% agreement among the three experts on the final hierarchy.

The final hierarchy consists of 4 criteria and 12 sub-criteria, as shown in Table 1. No criteria were removed; however, three sub-criteria were reworded for clarity based on

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expert feedback. Reliability was ensured through the internal consistency test (Consistency Ratio) using the AHP method [65]. As shown in the Results section (Table 4 and Table 5), all respondents had CR values < 0.1, indicating high consistency. Inconsistent responses were not used in the aggregation of results.

2.7. Proposed AHP Hierarchy Structure

Based on the literature review and content validity process described above, the proposed AHP analytical hierarchy structure for strategic IT project prioritization in higher education is presented in Figure 3. This structure consists of four levels: Goal (Level 1), Criteria (Level 2), Sub-Criteria (Level 3), and Alternatives (Level 4). The structure includes four main criteria and 12 sub-criteria, as detailed in Table 1.

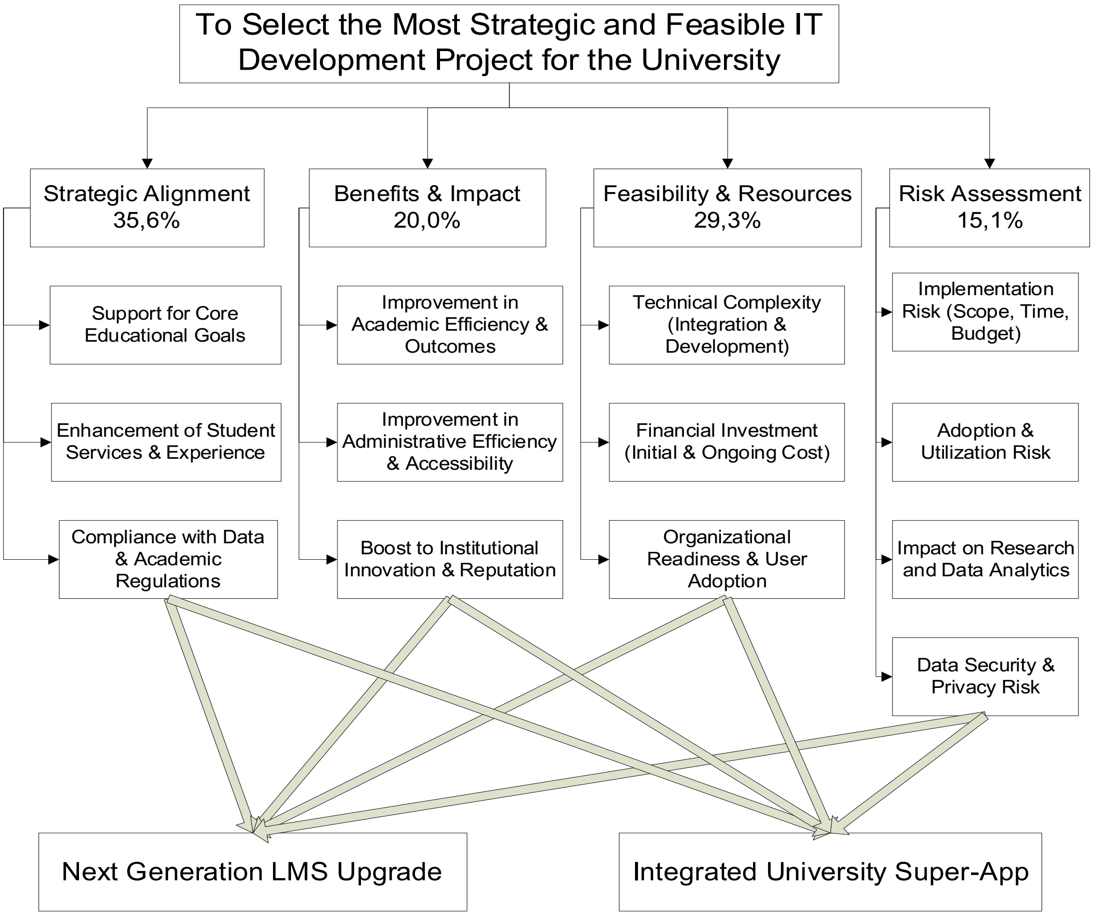

Figure 3. Proposed AHP Analytical Hierarchy Structure

The criteria definitions as follows:

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1) Strategic Alignment (C1): The extent to which the IT project supports the university's core academic mission, enhances student experience, and complies with regulations.
2) Benefits & Impact (C2): The expected improvements in academic efficiency, administrative efficiency, and institutional reputation.
3) Feasibility & Resources (C3): The technical complexity, financial investment required, and organizational readiness for adoption.
4) Risk Assessment (C4): The potential risks related to implementation, adoption, research impact, and data security.

3. RESULTS AND DISCUSSION

The results of data processing are displayed in the form of graphs and tables, which form the basis for decision-making and explanations.

3.1. Global Priorities and Decision Determinants

Based on the results of content validity from experts, the following analytical hierarchy structure was compiled based on the AHP method consisting of goals, criteria, sub-criteria, and alternatives. Table 1 presents the complete AHP hierarchy structure with local weights for each criterion and sub-criterion.

Table 1. AHP Hierarchy Structure with Local Weights

Criteria	Local Weight	Sub-Criteria	Local Weight
Strategic Alignment	0.356	Support for Core Educational Goals	0.474
		Enhancement of Student Services & Experience	0.185
Benefits & Impact	0.200	Improvement in Academic Efficiency & Outcomes	0.480
		Improvement in Administrative Efficiency & Accessibility	0.193
Feasibility & Resources	0.293	Technical Complexity (Integration & Development)	0.374

Criteria	Local Weight	Sub-Criteria	Local Weight
Risk Assessment	0.151	Financial Investment (Initial & Ongoing Cost)	0.338
		Implementation Risk (Scope, Time, Budget)	0.367
		Impact on Research and Data Analytics	0.172
		Data Security & Privacy Risk	0.208

For quick reference, Table 2 summarizes the main criteria weights and their respective rankings.

Table 2. Main Criteria Weights and Ranking

Criteria	Local Weight	Rank
Strategic Alignment	0.356	1
Feasibility & Resources	0.293	2
Benefits & Impact	0.200	3
Risk Assessment	0.151	4

Based on Table 2, the Strategic Alignment criterion has the highest weight (35.6%), indicating that stakeholders consider alignment with the university's core academic mission as the most important factor in strategic IT project prioritization. The second most important criterion is Feasibility & Resources (29.3%), followed by Benefits & Impact (20.0%), and finally Risk Assessment (15.1%). This ranking reflects a predominantly strategy-oriented decision-making culture, where long-term institutional alignment outweighs immediate benefits or risk considerations. Figure 4 presents the sensitivity summary of global priorities for the two alternatives.

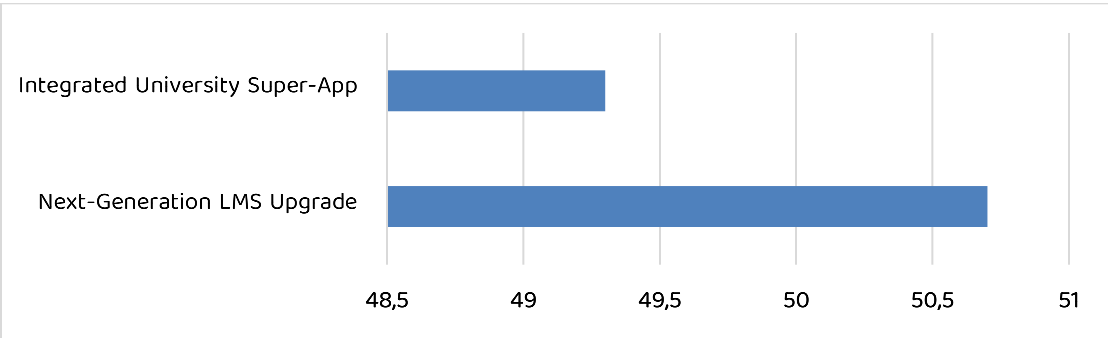

Figure 4. Sensitivity Summary Global

As shown in Figure 4, the Next-Generation LMS alternative has a global weight of 50.7%, while the Integrated University Mobile Super-App has a weight of 49.3%. The difference between the two alternatives is only 1.4 percentage points, indicating a very narrow preference for the LMS. This narrow margin suggests that the decision is not clear-cut and that the ranking is potentially sensitive to changes in stakeholder priorities—a finding that will be explored further in the sensitivity analysis (Section 3.4). To understand the drivers behind this narrow result, an analysis of the criteria weights and local performance of each alternative is necessary

Table 3. Main Criteria Weights and Alternative Scores (Normalized)

Main Criteria	Criteria Weight	LMS Score	Super-App Score
Strategic Alignment	0.356	0.553	0.447
Benefits & Impact	0.200	0.532	0.468
Feasibility & Resources	0.293	0.491	0.509
Risk Assessment	0.151	0.394	0.606

Table 3 reveals the key drivers of the LMS's narrow victory. The LMS outperforms the Super-App on the two highest-weighted criteria: Strategic Alignment (LMS 0.553 vs Super-App 0.447) and Benefits & Impact (LMS 0.532 vs Super-App 0.468). Conversely, the Super-App outperforms the LMS on Feasibility & Resources (0.509 vs 0.491) and Risk Assessment (0.606 vs 0.394). However, because Strategic Alignment carries the highest weight (35.6%), the LMS's advantage on this criterion (+0.106) outweighs the Super-App's advantages on lower-weighted criteria.

Specifically, the overall victory of the LMS was primarily due to its superiority on the most important criterion, Strategic Alignment. Although the Mobile Super-App excelled in Feasibility & Resources and Risk Assessment, the lower weighting of these two criteria (29.3% and 15.1%, respectively) was not enough to offset the LMS's strategic advantage. In other words, the model recommended the LMS because stakeholders collectively valued alignment with the long-term academic vision more importantly than ease of implementation or risk mitigation. Figure 5 displays the dynamic sensitivity results showing criteria and alternatives with their respective weightings.

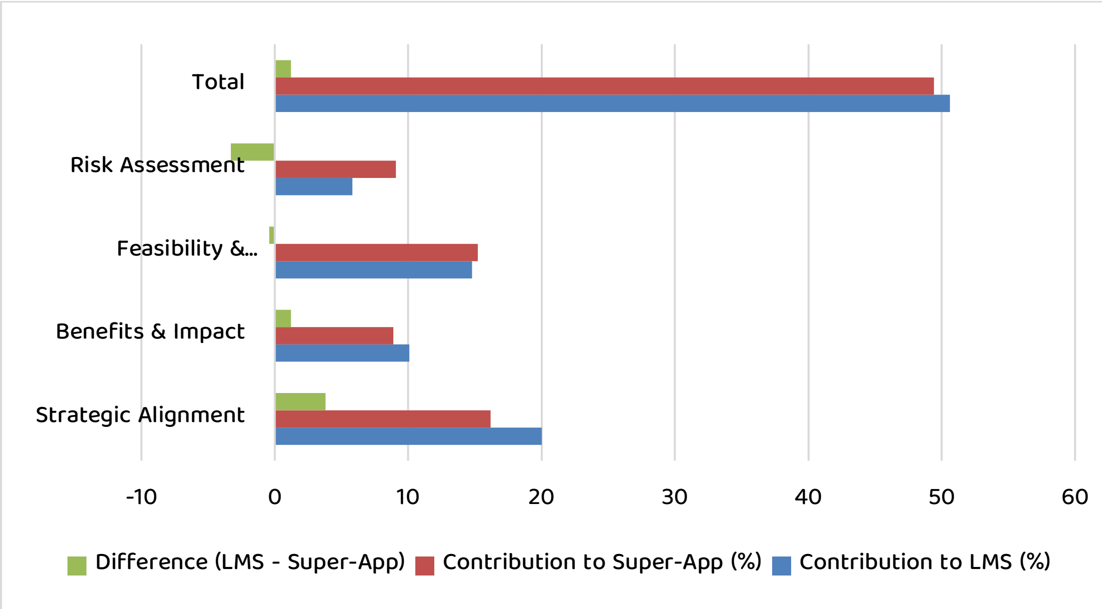

Figure 5. Dynamic Sensitivity

Figure 5 provides an interactive visualization of how changes in criterion weights affect the final ranking. The vertical axis represents the priority scores of the two alternatives, while the horizontal axis represents the weight of the selected criterion (in this case, Strategic Alignment). The figure shows that the LMS (blue line) maintains a consistent advantage over the Super-App (red line) across a wide range of Strategic Alignment weights, but the margin narrows as the weight decreases. This visualization is a key component of the explainability framework, as it allows decision-makers to visually assess the stability of the recommendation.

The aggregated results of the expert assessments yielded global priorities as shown in Figure 4 (sensitivity summary). Quantitatively, LMS Upgrade had a slight lead with a score of 0.507 compared to Mobile Super-App (0.493). Further analysis revealed that this lead was driven by the LMS's performance on the Strategic Alignment criterion (weight: 0.356), where it achieved a very high score (0.553). Conversely, the Mobile Super-App had a clear lead on the Feasibility & Resources criterion (score: 0.509), but due to the lower weight of this criterion (0.293), this lead was not sufficient to secure the top spot. These very stringent results require further investigation with sensitivity analysis to provide a transparent explanation (XMCDM).

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3.2. Data Quality and Consistency

Before analyzing the priority results, a consistency test was first conducted on the assessments given by all respondents. The results of the Consistency Ratio (CR) calculation for all models showed that all respondents had a CR value < 0.1 [62]. The combined CR value (Facilitator) of 0.053 indicates that overall, the experts' assessments have a very high level of consistency.

Table 4. Respondent Consistency Ratio Test

Respondent Code	CR (All Models)	CR (Criteria Level)	Information
Respondent 1	0,053	0,070	Very Consistent
Respondent 2	0,019	0,027	Very Consistent
Respondent 3	0,043	0,054	Very Consistent
Respondent 4	0,075	0,091	Consistent
Respondent 5	0,065	0,089	Consistent
Average	**0,051**	**0,066**	**Very Consistent**

Based on Table 4, the high level of consistency provides strong confidence in the internal validity of the model. After presenting the respondents' Consistency Ratios, Table 5 shows the Consistency Ratios for each criterion and sub-criterion, derived from the aggregated results of all respondents.

Table 5. Results of the Combined Respondent Consistency Ratio

No.	Criteria	Ratio
1.	Goal To Select the Most Strategic and Feasible IT Development Project for the University	0,03
2.	Criteria Strategic Alignment	0,01
3.	Sub Criteria Support for Core Educational Goals	0,00
4.	Sub Criteria Enhancement of Student Services & Experience	0,00
5.	Sub Criteria Compliance with Data & Academic Regulations	0,00
6.	Criteria Benefits & Impact	0,00
7.	Sub Criteria Improvement in Academic Efficiency & Outcomes	0,00
8.	Sub Criteria Improvement in Administrative Efficiency & Accessibility	0,00
9.	Sub Criteria Boost to Institutional Innovation & Reputation	0,00

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No.	Criteria	Ratio
10.	Criteria Feasibility & Resources	0,00
11.	Sub Criteria Technical Complexity (Integration & Development)	0,00
12.	Sub Criteria Financial Investment (Initial & Ongoing Cost)	0,00
13.	Sub Criteria Organizational Readiness & User Adoption	0,00
14.	Criteria Risk Assessment	0,01
15.	Sub Criteria Implementation Risk (Scope, Time, Budget)	0,00
16.	Sub Criteria Adoption & Utilization Risk	0,00
17.	Sub Criteria Impact on Research and Data Analytics	0,00
18.	Sub Criteria Data Security & Privacy Risk	0,00

The results shown in Table 5 demonstrate a very high level of consistency, with a CR at the goal level of 0.03, indicating high consistency. The CR value is 0.01 at the criterion level and 0.00 at the sub-criterion level. These results confirm that all pairwise comparison matrices satisfy Saaty's recommended threshold (CR < 0.1), thereby ensuring the reliability of subsequent calculations.

3.3. Priority Decomposition and Criteria Contribution

Transparency in the decision-making process, which is the core of Explainable MCDM (XMCDM), begins with ensuring the quality of input data. With each respondent's consistency score < 0.1, this model produces transparent input, process, and output. Table 6 below displays the decomposition of priorities and the contribution of criteria to the final alternative scores.

Table 6. Priority Decomposition and Criteria Contribution to the Final Alternative Score

Main Criteria	Contribution to LMS	Contribution to Super-APP	Difference
Strategic Alignment	**20.0%**	16.2%	**+3.8%**
Benefits & Impact	10.1%	8.9%	+1.2%
Feasibility & Resources	14.8%	**15.2%**	**-0.4%**
Risk Assessment	5.8%	9.1%	-3.3%
Total	**50.7%**	**49.3%**	**+1.4%**

Table 6 shows the distribution of contributions for each alternative, both for the LMS and the Super-App. The largest contributor for the LMS alternative (50.7%) was the Strategic Alignment criterion, contributing 20.0% of the total 50.7% (approximately 39.4% of the LMS's total score comes from this single criterion). Within Strategic Alignment, the largest contributor was the "Support for Core Educational Goals" sub-criterion, contributing 10.5% of the LMS's total score. The Benefits & Impact criterion contributed 10.1%, and the Feasibility & Resources criterion contributed 14.8% to the LMS's total score. For the Super-App alternative (49.3% of total global priority), the Strategic Alignment criterion contributed 16.2% of the total 49.3%, followed by the Feasibility & Resources criterion at 15.2%, the Risk Assessment criterion at 9.1%, and finally the Benefits & Impact criterion at 8.9%.

The priority decomposition analysis reveals the deep reasons (Explainable MCDM) behind the narrow victory of the LMS:

1) The LMS's primary success factor was its focus on "Core Educational Goals." The LMS achieved a decisive advantage in the area most important to stakeholders: the "Support for Core Educational Goals" sub-criterion under Strategic Alignment accounted for 10.5% of the LMS's total score. In other words, the LMS excelled in the most important area as defined by the stakeholders.
2) The Super-App lost due to its perceived lack of focus on the academic mission. While the Super-App excelled in Feasibility & Resources (15.2% vs 14.8%) and Risk Assessment (9.1% vs 5.8%), indicating that stakeholders perceived it as easier to implement and less risky, these advantages were not enough to offset its lag in strategic areas (Strategic Alignment: 16.2% vs 20.0%). The Super-App was perceived as less aligned with the university's core academic mission.
3) The model recommends the LMS not because it is superior in every way, but because it is critically superior in the most crucial factor for strategic decision-makers: its contribution to core educational objectives. This recommendation reflects the strategic values of an institution that prioritizes investment in its core business—namely, teaching and learning—over operational convenience or risk reduction

3.4. Sensitivity Analysis as Explainable MCDM

To provide transparency and explainability—the core contribution of this study—sensitivity analysis was conducted to test the robustness of the results and to identify the conditions under which the ranking would change. Table 7 summarizes the results of three "what-if" scenarios.

Table 7. Sensitivity Analysis Scenarios and Breakpoints

Scenario	Description	Result	Breakpoint
Scenario 1	Decrease Strategic Alignment weight by 20% (from 0.356 to 0.285)	LMS remains preferred (50.1% vs 49.9%)	No reversal within ±20%
Scenario 2	Increase Benefits & Impact weight	Ranking reverses when Benefits & Impact weight exceeds 0.278	Breakpoint: 0.278 (from original 0.200)
Scenario 3	Increase Feasibility & Resources weight	Ranking reverses when Feasibility & Resources weight exceeds 0.410	Breakpoint: 0.410 (from original 0.293)

Scenario 2 (Benefits & Impact) provides the most critical finding: the ranking reverses in favor of the Super-App if the weight of the Benefits & Impact criterion increases from its original value of 0.200 to above 0.278. This represents a 39% increase in the relative importance of Benefits & Impact. In practical terms, this means that if university stakeholders were to shift their priorities toward valuing immediate benefits (such as improved administrative efficiency and student experience) more highly, the Super-App would become the recommended project.

Scenario 1 shows that the recommendation is relatively stable with respect to the Strategic Alignment criterion: even when its weight is decreased by 20% (from 0.356 to 0.285), the LMS remains the preferred alternative, although the margin narrows to 50.1% vs 49.9%. Scenario 3 indicates that the Feasibility & Resources criterion would need to increase by approximately 40% (from 0.293 to 0.410) for the ranking to reverse—a less likely scenario given that stakeholders already rated Strategic Alignment as the most important criterion.

These breakpoints provide actionable explainability for decision-makers. University leaders can use this information to:

1) Understand that the current recommendation (LMS) is contingent on the existing priority structure
2) Recognize that a moderate shift toward valuing immediate benefits (a 39% increase in Benefits & Impact weight) would change the recommendation
3) Engage in strategic discussions about whether such a shift in priorities is desirable given the university's long-term mission

The sensitivity analysis confirms that the model is not a "black box" but rather a transparent decision support tool that reveals the conditions under which different alternatives would be preferred.

3.5. Discussion

This section interprets the findings presented above, compares them with prior studies, discusses the implications of the narrow margin, and addresses the limitations of the study.

3.5.1. Why Does the LMS Slightly Outperform the Super-App?

The results show that the LMS (50.7%) narrowly outperforms the Super-App (49.3%). The primary driver of this outcome is the Strategic Alignment criterion, which carries the highest weight (35.6%) among all criteria. Within this criterion, the sub-criterion "Support for Core Educational Goals" (local weight 0.474) emerged as the most important factor. The LMS was perceived by stakeholders as more aligned with the university's core teaching and learning mission, while the Super-App was viewed as more oriented toward administrative efficiency and student services.

This finding aligns with prior studies on IT prioritization in higher education. [50] found that strategic alignment with academic goals is consistently ranked as the most important criterion by university decision-makers, surpassing technical feasibility or cost considerations. Similarly, [59] reported that in sustainable e-learning implementation, pedagogical alignment outweighs technological readiness. However, unlike previous studies that typically report clear-cut winners, the narrow margin in this study (1.4 percentage points) suggests that the two alternatives are nearly equally attractive to stakeholders—a finding that has not been prominently reported in prior AHP-based IT prioritization literature.

3.5.2. Interpreting the Narrow Margin: Stability and Practical Significance

The 1.4 percentage point difference between the LMS (50.7%) and Super-App (49.3%) raises an important question: Is this difference meaningful, or does it merely reflect random variation in expert judgment?

Several considerations support the interpretation that this narrow margin is analytically meaningful despite its small size:

1) Consistency of judgments: As shown in Tables 4 and 5, all respondents had CR values < 0.1, and the aggregated CR at the goal level was 0.03, indicating high consistency. The narrow margin is not an artifact of inconsistent responses.
2) Clear driver identification: The decomposition in Table 6 clearly shows that the LMS's advantage comes from a specific, theoretically meaningful source: the Strategic Alignment criterion, particularly the "Support for Core Educational Goals" sub-criterion. This is not a random fluctuation but a systematic difference.
3) Sensitivity analysis confirms robustness**:** Scenario 1 in Table 7 shows that even when Strategic Alignment weight is decreased by 20%, the LMS remains preferred. The recommendation is stable within a reasonable range of priority shifts.

However, the authors do not claim that the LMS is definitively or universally superior. The narrow margin should be interpreted as follows:

1) The recommendation is context-specific. It reflects the values and priorities of five stakeholders at a single private university in Indonesia.
2) The recommendation is preference-sensitive. As shown in Scenario 2, a moderate shift in priorities (increasing Benefits & Impact weight by 39%) would reverse the ranking.
3) The recommendation is a starting point for dialogue, not a final verdict**.** The primary contribution of this study is not to declare a winner but to provide a transparent framework that explains *why* and *under what conditions* one alternative is preferred.

3.5.3. Comparison with Prior Studies

The finding that Strategic Alignment dominates other criteria is consistent with prior research. [50] reviewed IT project portfolio management in private universities and identified strategic alignment as the most frequently cited criterion. [53] applied AHP to prioritize smart campus dimensions and found that "educational service quality" (analogous to Strategic Alignment) received the highest weight. [59] evaluated barriers to sustainable e-learning and reported that "institutional strategy and leadership" was the most significant barrier when unaddressed.

However, this study extends prior work in three important ways:

1) Explainability: Previous AHP studies typically report only final weights and rankings. This study provides a decomposition of criterion contributions (Table 6) and sensitivity analysis with exact breakpoints (Table 7), enabling decision-makers to understand *why* the LMS is preferred and *when* that preference would change.
2) Critical interpretation of narrow margins: Most prior studies present their results as definitive rankings without discussing the practical significance of small differences. This study explicitly acknowledges the narrow margin and interprets it cautiously.
3) Contextual specificity: Unlike large-scale surveys that aim for statistical generalizability, this study provides an in-depth, context-rich analysis of a specific university's decision problem, which is appropriate for strategic IT prioritization where local context matters significantly.

3.5.4. Practical Implications for University Leaders

From a practical perspective, this study offers several actionable insights for university leaders and IT managers:

1) Use the framework for scenario planning**.** The sensitivity analysis (Table 7) allows decision-makers to simulate "what-if" scenarios. For example, if the university's strategic plan shifts toward emphasizing student experience and administrative efficiency, the Super-App may become the preferred investment.
2) Focus on core educational goals in LMS implementation**.** The finding that "Support for Core Educational Goals" was the most influential sub-criterion suggests that LMS investments should be explicitly justified in terms of their

contribution to teaching and learning outcomes, not just technological features.

3) Don't ignore narrow margins. A 1.4 percentage point difference should not be dismissed. Instead, it should trigger deeper strategic discussion: Is the university confident that its current priority weights (Strategic Alignment 35.6%, Benefits 20.0%) reflect its long-term strategy? If not, the sensitivity analysis shows how adjusting those weights would change the recommendation.

3.5.5. Limitations

This study has several limitations that should be acknowledged:

1) Sample size and generalizability**:** The findings are based on judgments from five stakeholders at a single private university in Indonesia. While this sample size is appropriate for expert-based AHP [64], the results may not generalize to other universities with different organizational cultures, strategic priorities, or resource constraints.
2) Limited number of alternatives: The study compared only two IT project alternatives (LMS vs Super-App). In practice, universities may have a broader portfolio of potential IT investments (e.g., data warehouses, ERP systems, cybersecurity projects). Future research should expand the number of alternatives.
3) Static priority weights: The AHP model captures stakeholder priorities at a single point in time. In practice, strategic priorities evolve. The sensitivity analysis partially addresses this limitation by simulating priority shifts, but longitudinal research would be valuable.
4) Lack of external validation: The model's recommendations have not been tested against actual implementation outcomes. Future research could track whether the LMS, if implemented, indeed delivers the expected strategic benefits.

4. CONCLUSION

This study developed and tested an explainable AHP framework that integrates sensitivity analysis and priority decomposition to support strategic IT project

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prioritization in higher education, demonstrating that the proposed approach can transform conventional AHP from a black-box ranking tool into a transparent decision support system. Based on assessments from five academic stakeholders at a private university in Indonesia comparing a Next-Generation LMS and an Integrated University Mobile Super-App, the results show a narrow preference for the LMS (50.7%) over the Super-App (49.3%), primarily driven by the LMS's superiority on the highest-weighted criterion, Strategic Alignment (35.6%), particularly the "Support for Core Educational Goals" sub-criterion. However, this recommendation is context-specific (single university), sample-limited (five stakeholders), and sensitive to changes in stakeholder priorities: sensitivity analysis reveals that the ranking would reverse in favor of the Super-App if the weight of the Benefits & Impact criterion increases from 0.200 to above 0.278. The key contribution of this study is not the narrow recommendation itself but the explainable framework that enables decision-makers to understand *why* the LMS is preferred (its alignment with core educational goals) and *under what conditions* that preference would change (a 39% increase in the importance of Benefits & Impact). For university leaders, this framework provides a structured, replicable, and transparent method for scenario planning and strategic dialogue, shifting IT investment decisions from subjective-intuitive to more objective-analytical processes. Future research should apply the model to different higher education contexts, expand the number of project alternatives, and explore integration with other MCDM methods such as Fuzzy AHP or TOPSIS.

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