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Sustainability models in quality management for higher education: A case study of private universities in Medan

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ABSTRACT

The sustainability of higher education institutions, especially private universities, is becoming increasingly important in a competitive global environment. This study examines models for ensuring sustainability through quality management in private universities, focusing on institutions in Medan, Indonesia. Using a mixed-method approach that includes field surveys and online questionnaires, the research identifies key factors influencing institutional sustainability. Structural Equation Modeling (SEM) is used to analyze the relationships between governance, administration, operational efficiency, and educational quality. The results show that effective planning and governance play a crucial role in sustainability, while reputation and student engagement influence these relationships. A comparison with global contexts suggests that similar strategies can strengthen resilience in other regions. This study offers a comprehensive framework for private universities to integrate sustainability and quality management, with broader implications for higher education systems worldwide.

1. Introduction

In the increasingly competitive landscape of higher education, the sustainability of academic institutions has emerged as a critical concern. Universities, especially private ones, must navigate a complex array of challenges to ensure their long-term viability. These challenges include economic pressures, demographic shifts, and the growing demand for quality education (AlQershi et al., 2023; Li et al., 2024). Amidst these pressures, the concept of sustainability in higher education has gained prominence, with a particular emphasis on the integration of sustainable practices into quality management systems. This study focuses on developing and analyzing sustainability models for quality management within private universities, using Medan, Indonesia, as a case study (Ashida et al., 2024; Osei-kusi et al., 2024). Sustainability in higher education is a multifaceted concept that encompasses environmental, social, and economic dimensions. It is increasingly recognized that universities play a pivotal role in promoting sustainable development through their educational, research, and operational practices. The sustainability of a university is not only about environmental stewardship but also about ensuring that the institution can continue to fulfill its mission in the face of financial, social, and technological changes (Khatri et al., 2024). For private universities, sustainability takes on additional layers of complexity. Unlike public institutions, private universities often rely heavily on tuition fees and private funding, making them particularly vulnerable to fluctuations in student enrollment and economic downturns (Tulus et al., 2024). Therefore, achieving sustainability in private universities involves not only managing environmental impacts but also ensuring financial stability, maintaining academic excellence, and fostering a strong institutional reputation (Basak et al., 2021; Sączewska-piotrowska, 2023).

Quality management in higher education refers to the systematic processes and practices that institutions use to ensure and enhance the quality of their educational offerings, research outputs, and operational efficiency (Pacher et al., 2024; Yan et al., 2024). The concept has its roots in the broader field

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of quality management in business and industry, where it has been widely applied to improve products and services. In the context of higher education, quality management involves a range of activities, from curriculum development and faculty recruitment to student services and infrastructure maintenance (Marpaung and Marpaung, 2020). The adoption of quality management practices in higher education has been driven by the increasing demands for accountability and transparency from students, parents, governments, and accreditation bodies. Institutions are expected to demonstrate that they provide high-quality education that meets the needs of students and society at large (Mobeen et al., 2023; Moradi et al., 2024). This expectation has led to the development of various quality assurance frameworks and accreditation standards that universities must adhere to. However, quality management in higher education is not without its challenges. The diverse and complex nature of higher education institutions, with their multiple stakeholders and varied missions, makes it difficult to apply standard quality management models (Marpaung and Marpaung, 2023). Moreover, the emphasis on measurable outcomes, such as graduation rates and employment statistics, can sometimes overshadow other important aspects of educational quality, such as the development of critical thinking skills and the fostering of a vibrant intellectual community (Parveen et al., 2024; Zheng et al., 2023).

Private universities play a crucial role in the global higher education landscape. They often serve as important complements to public institutions, offering diverse educational opportunities and responding to the specific needs of their local communities. In many countries, including Indonesia, private universities have been instrumental in expanding access to higher education, particularly in regions where public institutions are limited or oversubscribed. Despite their contributions, private universities face unique challenges that can impact their sustainability (Tahir et al., 2024; Zhihan et al., 2023). These challenges include financial constraints, competition from public universities, and the need to continuously adapt to changing market demands. Additionally, private universities often have to balance their educational mission with the need to generate revenue, which can lead to tensions between academic and commercial priorities. In the context of Indonesia, private universities have grown significantly over the past few decades, both in number and in the diversity of programs offered. However, this growth has not always been accompanied by corresponding improvements in quality. As a result, there is growing concern about the ability of private universities to provide high-quality education and maintain their competitiveness in the face of increasing national and global competition (Camgoz-Akdag and Zaim, 2012; Mendoza-Villafaina and López-Mosquera, 2024).

The integration of sustainability and quality management in higher education is essential for ensuring that universities can continue to thrive in the long term. While sustainability focuses on the institution's ability to endure and adapt to changing circumstances, quality management ensures that the institution's educational offerings and operations meet high standards (Balsalobre-Lorente et al., 2024; Suárez-Perales et al., 2021). Together, these two concepts can provide a robust framework for guiding the development and management of higher education institutions. For private universities, integrating sustainability into quality management practices can help address some of the challenges they face (Faieq and Çek, 2024; Mashroofa et al., 2023). For example, by adopting sustainable financial practices, universities can improve their financial stability and reduce their reliance on tuition fees. Similarly, by incorporating sustainability into their curriculum and research activities, universities can enhance their academic reputation and attract students and faculty who are committed to making a positive impact on society. Moreover, sustainability can serve as a differentiating factor for private universities in a competitive higher education market (Kagzi et al., 2024; Saihi et al., 2024). As more students and parents become aware of the importance of sustainability, universities that demonstrate a commitment to sustainable practices may be better positioned to attract and retain students. Additionally, universities that lead in sustainability initiatives can also attract funding and partnerships from organizations that are aligned with these values (Alfaro-Ponce et al., 2023; Odhiambo, 2024).

While the integration of sustainability and quality management offers significant benefits, it also presents challenges. One of the main challenges is the need for a cultural shift within the institution. Sustainability requires a long-term perspective and a willingness to invest in practices that may not yield immediate financial returns. This can be difficult to achieve in an environment where short-term financial pressures are a constant concern. Another challenge is the complexity of measuring sustainability and quality in higher education. Traditional metrics, such as graduation rates and student satisfaction, may not fully capture the impact of sustainability initiatives. Therefore, universities need to develop new indicators and assessment tools that can provide a more comprehensive picture of their sustainability performance. Despite these challenges, the integration of sustainability and quality management also presents significant opportunities. By adopting a holistic approach to sustainability, universities can enhance their resilience to external shocks, such as economic downturns or changes in government policy. Additionally, universities that are seen as leaders in sustainability may be able to influence public policy and contribute to the broader societal shift towards sustainable development. Sustainability and quality management are critical components of the long-

term success of higher education institutions, particularly private universities. As these institutions navigate an increasingly competitive and complex environment, the integration of sustainability into their quality management practices offers a promising pathway for ensuring their continued relevance and impact. This study aims to contribute to this important area of research by developing and analyzing sustainability models for quality management in private universities, with a focus on the specific context of Medan, Indonesia.

2. Materials and methods

2.1. Comparisons of intervention design

This study employs a mixed-methods approach, combining both quantitative and qualitative research methods to explore and develop sustainability models for quality management in private universities in Medan, Indonesia. The mixed-methods approach allows for a comprehensive analysis by integrating numerical data with contextual insights, providing a robust framework for understanding the factors influencing sustainability in higher education. The research is conducted in Medan, a major city in Indonesia with a diverse range of private universities. Medan was chosen due to its dynamic higher education landscape, which includes a variety of private institutions facing distinct challenges related to sustainability and quality management. The findings from this context may offer insights applicable to other regions with similar characteristics. The population for this study includes all private universities in Medan. This includes university administrators, faculty members, students, and alumni.

The study also considers other stakeholders such as accreditation bodies and industry partners who have a vested interest in the sustainability and quality of higher education institutions. A stratified random sampling technique was used to ensure that the sample adequately represents the diverse characteristics of the private universities in Medan. The universities were stratified based on key characteristics such as size, age, and program offerings.

Within each stratum, participants were randomly selected to ensure that the sample included a broad range of perspectives. Sample Size: The study targeted a sample size of approximately 200 respondents, including university administrators, faculty members, students, and alumni. This sample size was determined to be sufficient for conducting robust statistical analyses while allowing for meaningful qualitative insights.

The quantitative data were collected through a structured questionnaire distributed to university administrators, faculty, and students. The questionnaire was designed to capture information on various aspects of sustainability and quality management, including:

1. Demographic information: Age, gender, role within the university, years of experience, etc.
2. Perceptions of sustainability: Respondents' understanding and attitudes towards sustainability within their institution.
3. Quality management practices: The extent to which quality management practices are implemented and their perceived effectiveness.
4. Sustainability indicators: Factors that respondents believe contribute to the sustainability of their institution, such as financial management, academic reputation, and student satisfaction.
5. The questionnaire was pre-tested with a small group of respondents to ensure clarity and relevance of the questions. Based on the feedback, minor adjustments were made to improve the accuracy and reliability of the data collection instrument.

2.2. Model development

In Fig. 1, the relationships between the variables were conceptualized with independent variables (e.g., Governance, Planning, Administration, etc.) leading to dependent variables (e.g., Quality of Education and Sustainability of Private Universities). Fig. 1 is more abstract, visually showing how different factors influence the sustainability and quality of education in private universities but without specifying the paths and their directional impacts.

Fig. 1 illustrates the proposed path model for sustainability and quality management in higher education, particularly within the context of private universities. Fig. 1 visually maps the direct influences of governance (X1), planning (X2), administration (X3), financial management (X4), operational efficiency (X5), and facilities and infrastructure (X6) on the quality of education (Y1). Subsequently, the quality of education is shown to directly impact the sustainability of private universities (Y2). In addition, the model integrates key moderating variables—reputation (Y3), student and alumni engagement (Y4), and external collaboration and partnerships (Y5)—which enhance or modify the relationship between educational quality and sustainability.

After the introduction of the path model, Fig. 1 provides a clear and detailed representation of the hypothesized relationships between various factors affecting the sustainability of private universities. The model visually outlines how independent variables like governance, planning, and administration directly impact the quality of education and, subsequently, the overall sustainability of the university. Additionally, it highlights the role of mediating and moderating variables such as reputation, student and alumni engagement, and external collaborations in enhancing these relationships. This path model serves as a strategic tool for understanding the complex dynamics within private universities, offering insights into how different elements interact

to promote long-term sustainability and success. The path model visually represents the hypothesized relationships between key factors influencing the sustainability of private universities. It shows how independent variables such as governance, planning, administration, and financial management directly impact the quality of education and the sustainability of the institution. The model also includes mediating and moderating variables like reputation, student and alumni engagement, and external collaborations, which influence the strength and direction of these relationships. The significance of this path model lies in its ability to provide a comprehensive understanding of the complex interactions between these variables, offering strategic insights for university administrators. By identifying the most impactful factors, the model helps guide decision-making to enhance the long-term sustainability and success of private universities.

Table 1 provides a detailed description of each variable.

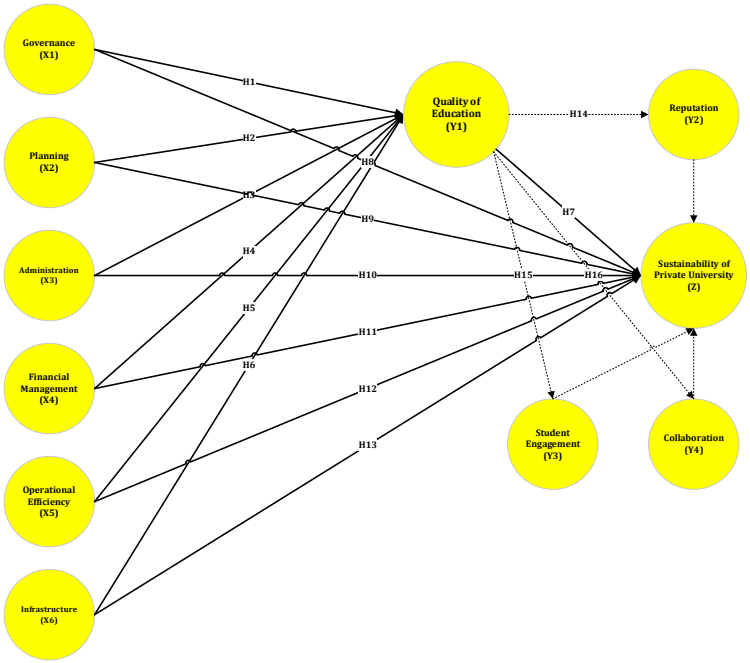

Fig. 1: Path model development

Table 1: Hypotheses of research

	Hypothesis
H1	Governance (X1) positively influences the quality of education (Y1).
H2	Planning (X2) positively influences the quality of education (Y1).
H3	Administration (X3) positively influences the quality of education (Y1).
H4	Financial management (X4) positively influences the quality of education (Y1).
H5	Operational efficiency (X5) positively influences the quality of education (Y1).
H6	Facilities and infrastructure (X6) positively influence the quality of education (Y1).
H7	Quality of education (Y1) positively influences the sustainability of private universities (Y2).
H8	Governance (X1) positively influences the sustainability of private universities (Y2).
H9	Planning (X2) positively influences the sustainability of private universities (Y2).
H10	Administration (X3) positively influences the sustainability of private universities (Y2).
H11	Financial management (X4) positively influences the sustainability of private universities (Y2).
H12	Operational efficiency (X5) positively influences the sustainability of private universities (Y2).
H13	Facilities and infrastructure (X6) positively influence the sustainability of private universities (Y2).
H14	Reputation (Y3) positively moderates the relationship between quality of education (Y1) and sustainability of private universities (Y2).
H15	Student and alumni engagement (Y4) positively moderates the relationship between Quality of Education (Y1) and sustainability of private universities (Y2).
H16	External collaboration and partnerships (Y5) positively moderate the relationship between quality of education (Y1) and sustainability of private universities (Y2).

The hypotheses derived from the path model suggest that various institutional factors, such as governance, planning, administration, financial management, operational efficiency, and facilities, play a critical role in enhancing the quality of education within private universities. This improved quality of education is then expected to directly contribute to the sustainability of these institutions. Additionally, the model hypothesizes that these factors also have a direct impact on sustainability independent of their influence on education quality. Furthermore, the hypotheses propose that elements like reputation, student and alumni engagement, and external collaborations serve as moderating variables, strengthening the positive relationship between educational quality and university sustainability.

Collectively, these hypotheses provide a comprehensive framework for understanding how internal management practices and external

stakeholder interactions contribute to the long-term success and resilience of private universities.

3. Results and discussion

3.1. Statistical analysis

Before proceeding to the interpretation of the structural relationships among variables, it is essential to evaluate the overall goodness-of-fit of the Structural Equation Model (SEM). This step ensures that the model appropriately represents the empirical data and that subsequent path analyses are both statistically valid and theoretically meaningful. Several commonly accepted fit indices are used to assess model adequacy, including the Chi-Square Test, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardized Root Mean Square Residual (SRMR). These indices provide different perspectives on how well the hypothesized model structure aligns with the observed data patterns. The results of this model fit evaluation are summarized in Table 2.

The discussion would likely focus on interpreting these fit indices collectively to conclude that the SEM model adequately represents the data. Given the results shown in Table 2, the model is considered to have a good fit, implying that the relationships among governance, planning, administration, and other factors with quality of education and sustainability are well-captured by the model. This would provide confidence in proceeding with analyzing specific path coefficients and their implications for university sustainability strategies. Before the introduction of this path model (Fig. 2) with path coefficients, the discussion would likely have focused on the theoretical framework and hypotheses that guided the research. The analysis would have explored the relationships between various institutional factors—such as governance, planning, administration, and their impact on the quality of education and the sustainability of private universities.

However, without Fig. 2, these relationships would have been described in a more abstract, textual form, making it harder to visualize the strength and direction of each relationship.

Table 2: Model fit

Component model fit indices	Result	Interpretation
Chi-Square test	Non-sign (p > 0.05)	Indicates a good overall model fit
RMSEA	0.05	Suggests a good fit between the model and the data
CFI	0.92	Indicates an acceptable fit (above 0.90)
TLI	0.91	Indicates an acceptable fit (above 0.90)
SRMR	0.06	Indicates a good fit (below 0.08)

Fig. 2: Path model test

With the introduction of the path model (Fig. 2) that includes path coefficients (β values), the discussion becomes much clearer and more concrete. Fig. 2 visually represents the hypothesized relationships and the strength of these relationships, quantified through the path coefficients. For example, Governance ($X1$) has a strong positive effect on Quality of Education ($Y1$) with a β value of 0.75, and Quality of Education ($Y1$) strongly influences the Sustainability of Private Universities ($Y2$) with a β value of 0.80.

Additionally, Fig. 2 shows how factors like Reputation ($Y3$) and Student and Alumni Engagement (Y4) enhance the relationship between educational quality and sustainability. This visual aid helps readers quickly grasp which factors are most

influential and how they interact, making the analysis more accessible and impactful.

With the introduction of Table 3, the analysis gains a concrete and empirical foundation. Table 3 presents the path coefficients (β values) from the SEM analysis, indicating the strength and significance of each relationship between the variables. For instance, Governance (X1) has a strong and significant positive effect on Quality of Education (Y1) with a path coefficient of 0.75 ($p < 0.01$), while Quality of Education (Y1) itself has a very strong influence on Sustainability (Y2) with a coefficient of 0.80 ($p < 0.01$). Table 3 also highlights the significance levels, showing which relationships are statistically significant, such as the impact of Financial Management (X4) on both Quality of Education (Y1) and Sustainability (Y2). It also reveals which factors have a more moderate impact, like Operational Efficiency (X5) and Facilities (X6), which still contribute positively but with smaller coefficients. Additionally, Table 3 clearly delineates the role of moderating variables. Reputation (Y3) and Student and Alumni Engagement (Y4) are shown to significantly enhance the relationship between Quality of Education (Y1) and Sustainability (Y2), emphasizing their importance in strategic management. Conversely, External Collaboration (Y5) is noted as having a weak, non-significant impact, suggesting that it may not be as critical in this context.

Table 3: Analysis path model

Path	Coefficient (β)	Significance
Governance (X1) → quality of education (Y1)	0.75	$p < 0.01$
Planning (X2) → quality of education (Y1)	0.70	$p < 0.01$
Administration (X3) → quality of education (Y1)	0.65	$p < 0.01$
Financial management (X4) → quality of education (Y1)	0.60	$p < 0.01$
Operational efficiency (X5) → quality of education (Y1)	0.55	$p < 0.05$
Facilities (X6) → quality of education (Y1)	0.50	$p < 0.05$
Quality of education (Y1) → sustainability (Y2)	0.80	$p < 0.01$
Governance (X1) → sustainability (Y2)	0.55	$p < 0.01$
Planning (X2) → sustainability (Y2)	0.52	$p < 0.01$
Administration (X3) → sustainability (Y2)	0.48	$p < 0.05$
Financial management (X4) → sustainability (Y2)	0.70	$p < 0.01$
Operational efficiency (X5) → sustainability (Y2)	0.45	$p < 0.05$
Facilities (X6) → sustainability (Y2)	0.42	$p < 0.05$
Reputation (Y3) as moderator	Significant	Enhances Y1 → Y2
Student and alumni engagement (Y4) as moderator	Significant	Enhances Y1 → Y2
External collaboration (Y5) as moderator	Weak (non-significant)	Minimal impact on Y1 → Y2

Overall, Table 3 transforms the theoretical discussion into a data-driven analysis, providing clear, quantifiable insights into which factors most strongly influence the sustainability of private universities. This allows for more informed recommendations and strategic decisions based on the empirical evidence provided by the SEM analysis. The discussion around the results of the SEM analysis would have primarily focused on describing the numerical path coefficients and their significance (Fig. 3). While this provided detailed information on how different factors like governance, planning, and financial management impact the quality of education and sustainability of private universities, it might have been challenging for readers to quickly grasp the relative strength of these relationships. The text-based description might have been more abstract and less immediate in conveying which factors were the most influential.

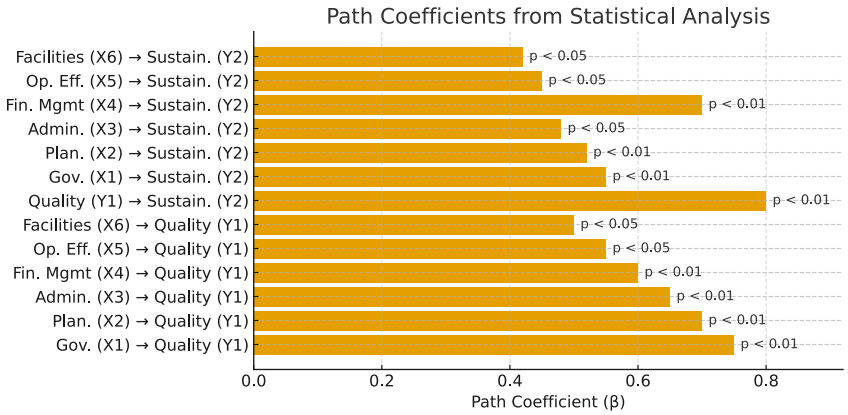

Fig. 3: Comparison of variables

With the introduction of this bar chart, the analysis becomes more accessible and visually clear. Fig. 3 illustrates the path coefficients (β values) along with their significance levels, making it easy to see which factors have the strongest influence on the quality of education and sustainability. For example, it immediately shows that Quality of Education (Y1) has the highest impact on Sustainability (Y2) with a coefficient of 0.80, followed by Governance (X1) and Planning (X2) in their effects on Quality of Education

(Y1). The chart allows for a quick comparison across all paths, highlighting which relationships are most significant (e.g., those with $p < 0.01$ versus $p < 0.05$). This visual representation helps in drawing more straightforward conclusions about where private universities should focus their efforts to improve both educational quality and sustainability. It also aids in communicating the results more effectively to stakeholders who may not be familiar with detailed statistical analysis but can easily interpret the comparative strengths of different factors.

3.2. Mediation effect

Before the introduction of Table 4 summarizing the mediation and moderation effects, the discussion likely revolved around describing the theoretical framework and hypothesized roles of mediators and moderators in the relationships between governance, planning, administration, quality of education, and sustainability.

This discussion would have included an explanation of how these factors potentially influence each other, but it might have been more conceptual and less concrete, making it challenging to clearly understand the specific impacts and the significance of these effects.

With the introduction of Table 4, the mediation and moderation effects become much clearer and more specific. Table 4 provides a concise summary of how Quality of Education (Y1) acts as a significant mediator in the relationships between governance, planning, administration, and sustainability. It confirms that improvements in governance, planning, and administration indirectly enhance sustainability by first improving the quality of education. Furthermore, Table 4 highlights the roles of Reputation (Y3) and Student and Alumni Engagement (Y4) as significant moderators. These factors strengthen the positive relationship between Quality of Education (Y1) and Sustainability (Y2), suggesting that universities should focus on enhancing their reputation and engaging their alumni and students to maximize the benefits of high educational quality. On the other hand, Table 4 also shows that External Collaboration (Y5) has a weak, non-significant moderating effect, indicating that while partnerships and collaborations are valuable, they may not play as critical a role as internal factors in this context.

3.3. Strategies for universities

Before the introduction of Table 5, the discussion might have been focused on describing the outcomes of the SEM analysis and the relationships between various institutional factors (such as governance, planning, and financial management) and their effects on educational quality and sustainability. While these discussions provided valuable insights, they were likely presented in a more narrative form, which could make it challenging for readers to quickly grasp actionable strategies based on the analysis.

Table 4: Mediation effects

Mediation and moderation effects		
Quality of education (Y1) as mediator	Significant	Confirms that the quality of education mediates the relationship between governance, planning, administration, and sustainability
Reputation (Y3) as moderator	Significant	Strengthens the relationship between quality of education (Y1) and sustainability (Y2)
Student and alumni engagement (Y4) as moderator	Significant	Enhances the relationship between quality of education (Y1) and sustainability (Y2)
External collaboration (Y5) as moderator	Weak (non-significant)	Indicates a minimal role in moderating the relationship between quality of education (Y1) and sustainability (Y2)

Table 5: Strategies for the universities

Factor	Impact on quality/sustainability	Recommended strategy
Governance (X1)	Strong positive effect on both Y1 and Y2	Strengthen governance structures by ensuring transparency, accountability, and effective decision-making processes
Planning (X2)	Significant impact on both Y1 and Y2	Enhance strategic planning by setting long-term goals, aligning resources, and integrating sustainability objectives
Administration (X3)	Positive impact on both Y1 and Y2	Improve administrative efficiency by streamlining processes, adopting digital tools, and providing staff training
Financial management (X4)	Significant impact on both Y1 and Y2	Prioritize financial management by diversifying revenue streams and ensuring effective resource allocation
Operational efficiency (X5)	Moderate positive impact on both Y1 and Y2	Optimize operational efficiency through lean management techniques and better utilization of facilities
Facilities and infrastructure (X6)	Moderate impact on both Y1 and Y2	Invest in facilities and infrastructure, focusing on sustainable projects and maintaining educational spaces
Reputation (Y3)	Enhances the impact of Y1 on Y2	Leverage institutional reputation by strategic marketing, public relations, and showcasing achievements
Student and alumni engagement (Y4)	Enhances the impact of Y1 on Y2	Engage alumni and students through networking events, mentoring programs, and community involvement
External collaboration (Y5)	Weaker impact, but still relevant	Foster external collaborations with industry and other institutions to complement internal improvements
Continuous improvement	Ongoing significance for overall success	Focus on continuous improvement through regular feedback, assessment, and data-driven decision-making

With the introduction of Table 5, the results of the analysis are translated into clear, actionable strategies that universities can adopt. Table 5 organizes the factors identified in the SEM analysis into a concise format that highlights their impact on educational quality and sustainability (Y1 and Y2) and provides specific, practical recommendations for each factor.

1. Clear visualization: Table 5 summarizes complex information, making it easier for stakeholders to understand which factors are most important and what actions can be taken to address them.
2. Direct actionable insights: Each factor is linked to a specific strategy, providing a direct line from analysis to implementation. For example, understanding that governance has a strong impact on both quality and sustainability leads to the recommendation to strengthen governance structures.
3. Strategic planning tool: Table 5 serves as a strategic planning tool, guiding university administrators on where to focus their efforts to improve both educational outcomes and long-term sustainability.

3.4. Discussion

The findings of this study underscore the critical importance of governance, strategic planning, and robust financial management in enhancing the quality of education and ensuring the sustainability of private universities. Governance and planning, in particular, demonstrated strong positive effects on both quality and sustainability, highlighting the need for private universities to prioritize leadership and forward-thinking strategies. This is especially relevant in dynamic environments like Medan, where private institutions face intense competition and fluctuating demand. Quality of education emerged as a crucial mediator, linking various institutional factors to sustainability. Universities that deliver high-quality education are more likely to achieve long-term sustainability as they attract and retain students, improve their reputation, and secure stable revenue streams. These findings align with global research, such as studies in Europe and the United States, which also emphasize the pivotal role of educational quality in fostering institutional resilience. However, unique challenges, such as reliance on tuition fees and local economic constraints, distinguish the Indonesian higher education context. The moderating roles of reputation and student and alumni engagement further highlight the importance of strong stakeholder relationships. A university's reputation amplifies the positive effects of high-quality education on sustainability by attracting high-caliber faculty, students, and funding opportunities. For example, globally recognized institutions have leveraged their reputations to secure long-term partnerships and external collaborations, demonstrating the broad applicability of this strategy. Similarly, active student and alumni engagement fosters institutional loyalty, strengthens financial stability, and enhances social sustainability. Practical initiatives, such as alumni mentoring programs and student-led sustainability campaigns, can align educational goals with broader societal impacts, further bolstering these relationships. Interestingly, external collaborations showed a weaker-than-expected impact on sustainability compared to internal management practices. This finding may reflect the specific context of Medan, where local factors and institutional autonomy play more significant roles than external influences. Similar trends have been observed in other regions with developing higher education systems, where internal strategies often outweigh external partnerships in driving sustainability. This study provides valuable insights for university administrators, policymakers, and stakeholders aiming to enhance the long-term viability of higher education institutions. By focusing on governance, strategic planning, and financial management, and by leveraging reputation and alumni networks, private universities can better position themselves for sustainable success in a competitive educational landscape. Future research should explore these moderating variables in diverse cultural and economic contexts to validate their universal applicability and adapt strategies for broader implementation.

Table 6 highlights the influence of key moderators—student engagement, alumni engagement, and reputation—on the sustainability of higher education institutions, with practical examples and actionable lessons for private universities in Medan. Student engagement, exemplified by programs like the Green Campus initiative at University College Cork and Stanford University's Cardinal Service, enhances environmental and social sustainability while boosting institutional reputation. Alumni engagement, as demonstrated by the National University of Singapore's mentoring and fundraising programs, secures financial resources and builds long-term institutional relationships. Reputation, as shown by the Massachusetts Institute of Technology's global partnerships, attracts top-tier students, faculty, and funding, enhancing the university's global standing and financial stability. Lessons for Medan’s universities include fostering student-led sustainability projects, establishing alumni networking platforms, and leveraging marketing to highlight achievements and foster collaborations. These strategies collectively strengthen sustainability by aligning educational goals with institutional development.

4. Conclusions

This study provides significant insights into the factors influencing the quality of education and the sustainability of private universities, with a specific focus on the context of Medan, Indonesia. Using

Structural Equation Modeling (SEM), the analysis highlights the critical roles of governance, strategic planning, administration, financial management, operational efficiency, and facilities and infrastructure in shaping institutional sustainability. Among these, governance and strategic planning emerged as the most influential factors, underscoring the importance of leadership and forward-looking strategies. Quality of education was identified as a pivotal mediator, reinforcing the notion that improving educational outcomes is essential for achieving long-term sustainability. Additionally, reputation and student and alumni engagement were found to significantly moderate the relationship between educational quality and institutional sustainability. Practical examples from global studies show that institutions leveraging their reputation and stakeholder engagement achieve enhanced resilience and competitive advantage. While external collaborations provide benefits, their impact appears less significant compared to internal management practices, particularly in the Indonesian higher education context. To improve generalizability, future research should include comparative studies across regions and institutions with varying socio-economic conditions. Such research can validate the broader applicability of the findings and offer insights into adapting best practices to diverse contexts. Based on these findings, universities should prioritize strengthening governance structures, enhancing strategic planning, and improving financial management to ensure both high educational standards and sustainable growth. Moreover, leveraging institutional reputation and actively engaging alumni and students can amplify these efforts.

In conclusion, this study provides a comprehensive framework that private universities can use to guide their strategic planning and management practices. By focusing on the identified key factors and integrating lessons from global case studies, universities can enhance their educational offerings and ensure their long-term viability in an increasingly competitive higher education landscape.

Table 6: Comparison of sustainability influence

Moderator	Practical example	Impact on sustainability	Lessons for private universities in Medan
Student engagement	- Green Campus Program, University College Cork (Ireland): Student-led waste recycling and energy initiatives - Cardinal Service, Stanford University (USA): Community service and sustainability projects	- Enhances environmental and social sustainability - Strengthens institutional reputation	- Initiate student-led sustainability programs - Promote student involvement in community projects
Alumni engagement	- National University of Singapore (NUS): Alumni mentoring, fundraising events, and industry partnerships	- Secures financial resources - Builds long-term institutional relationships	- Create alumni networking platforms - Encourage alumni contributions and mentorship
Reputation	- Massachusetts Institute of Technology (MIT): Partnerships with global corporations and governments	- Attracts top-tier students, faculty, and funding - Enhances global standing and financial stability	- Highlight university achievements through marketing - Foster collaborations to enhance visibility

List of abbreviations

CFI	Comparative fit index
RMSEA	Root mean square error of approximation
SEM	Structural equation modeling
SRMR	Standardized root mean square residual
TLI	Tucker–Lewis index
X1	Governance
X2	Planning
X3	Administration
X4	Financial management
X5	Operational efficiency
X6	Facilities and infrastructure
Y1	Quality of education
Y2	Sustainability of private universities
Y3	Reputation
Y4	Student and alumni engagement
Y5	External collaboration and partnerships
β	Path coefficient

Compliance with ethical standards

Ethical considerations

This study was conducted in accordance with ethical research standards for studies involving human participants. All respondents were informed about the objectives of the research, and their participation was entirely voluntary. Informed consent was obtained prior to data collection, and participants were assured that their responses would remain anonymous and confidential, used solely for academic purposes.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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