THESIS OF THE DOCTORAL (PhD) DISSERTATION

ENHANCING THE SUSTAINABILITY OF HIGHER EDUCATION IN INDONESIA: A SIX-SIGMA APPROACH

FITTY VALDI ARIE

Supervisor

Dr.Adrián Szilárd Nagy

Associate professor

UNIVERSITY OF DEBRECEN

Doctoral School of Management and Business

Debrecen

2025

TABLE OF CONTENTS

1. INTRODUCTION OF THE TOPIC AND OBJECTIVES

In the contemporary era characterized by rapid information exchange, the education sector encounters evolving challenges, such as the proliferation of teaching learning mechanism and the emergence of a digitally native generation. Higher education institutions are also expected to be able to meet these problems by maintaining focused on developing exceptional human resources, global competitiveness, and noble character, resulting in world-class education (Findler et al., 2019). The vision of "Golden Indonesia 2045" embodies aspirations for a more prosperous and developed nation. This goal of an advanced, esteemed, and thriving Indonesia serves as a source of motivation, inspiring the Indonesian people to exert greater effort and adopt more strategic approaches in their endeavors. Universities are expected to contribute with more focus in developing human resources that are superior, have global competitiveness, and have noble character (Elmassah et al., 2022).

Thus, higher education institutions are not only responsible for producing quality graduates, but also in providing world-class education that is able to support the achievement of the ideals of the “Golden Indonesia 2045” (Malihah, 2015). Thus, necessitates transformation and collaboration among the corporate world and industry (DUDI), government, non-governmental institutions, professional groups, the general public, and the media. Transformation and collaboration are also required to make higher education world class, through revitalizing the management of the education system and developing research by prioritizing good university governance through values such as transparency, accountability, responsibility, independence, fairness, quality assurance, and relevance (Serafini et al., 2022). Higher education institutions play an important role as leaders in knowledge creation and dissemination by setting the grounds for society to advance and to improve welfare (Sunder M & Mahalingam, 2018).

Various studies has been carried out in various fields of science to solve problems and phenomena of sustainable higher education, one of which is an operational approach with the tools used in this research is Six-Sigma (Sabtu & Matore, 2024). According to the American Society of Quality, Six-Sigma is a tool or way companies can develop business process capacity (Hahn et al., 2000). The purpose of this method is to improve performance and reduce the possibility of error. Six-sigma gets its name from the words “six” which means six (6) and

“sigma” which means standard deviation, which is one measure of the distribution of data in statistics. Six-Sigma has indeed made many and amazing changes for the manufacturing, services and healthcare industries (Stankalla et al., 2018). This methodology is derived from the bell curve in statistics, where one sigma represents one standard deviation from the mean or mean, if a process has six-sigma consisting of three sigma above and below, the failure rate is rated low.

Applying the Six-Sigma technique to higher education (HE) can still be very successful, even though it is true that the area does not have the same standard metrics as manufacturing fields, such as inventory, real income, or equipment. Despite the absence of conventional metrics, Six-Sigma's emphasis on continuous improvement, defect reduction, and efficiency enhancement applies to education (Sunder M & Antony, 2018). Low student retention, subpar instruction, or inefficient administrative procedures could all be considered "defects" in the context of education (Clemons & Jance, 2024). Instead of depending just on measurable measures like production or inventory, higher education institutions can use Six-Sigma techniques to improve procedures, improve the learning environment, and increase overall outcomes

1.1 Aim and Research Question

The purpose of this study is to identify and analyze the impact of implementing Six-Sigma methods on improving sustainability in higher education institutions. Specifically, this research aims to understand how the application of Six-Sigma can help higher education institutions improve operational efficiency, reduce waste, and improve the quality of educational services. This research aims to identify barriers that may arise, such as limited human resources, lack of understanding of Six-Sigma methods, or resistance to change. In addition, this research also aims to explore opportunities that can be utilized, such as improving the quality of academic services, operational process efficiency, and developing a culture of continuous improvement. By understanding these challenges and opportunities, the research is expected to provide strategic recommendations for higher education institutions in Indonesia to implement Six-Sigma effectively and sustainably. The aim of this research is to explore the potential of the Six-Sigma approach in supporting the sustainability of higher education in Indonesia. Specifically, it aims:

1. To investigate how Six-Sigma principles can contribute to the long-term sustainability and improvement of higher education in Indonesia.
2. To identify and analyze the challenges associated with the implementation of Six-Sigma in Indonesian higher education institutions.
3. To examine how sustainability can be effectively measured and achieved in the context of higher education in Indonesia through the application of Design for Six-Sigma (DFSS) methodology.

1.2 Research Benefits

1.2.1. Theoretical Contribution

The theoretical contribution of research that examines Six-Sigma's contribution to the development of quality management methods in higher education is significant. The following is an in-depth description of its contribution.

1. This research contributes to the academic literature related to quality management, particularly in the context of higher education. Six-Sigma, which initially developed in the manufacturing industry, is rarely applied in the education sector.
2. This research can reduce variability in processes and ensure consistent results. In the context of higher education, this means that standards of teaching, evaluation, and services to students can be improved to be more consistent and measurable.
3. This research can encourage innovation in university management by introducing a more efficient and structured management system through Six-Sigma.

Academically, this research has the potential to enrich and develop the literature in the field of quality management in higher education by introducing Six-Sigma as an effective tool to improve efficiency, consistency, and sustainability. In addition, this approach could change the way Indonesian universities run their operations, focusing not only on educational outputs (such as the number of graduates), but also on continuous improvement of overall quality.

1.3.2. Higher Education Relevance Perspective

The practical benefits of the research provide important recommendations for university managers in adopting Six-Sigma to create sustainable education. The following is a full

description of these benefits:

1. Six-Sigma helps universities to identify and reduce waste in operational processes, such as the use of electricity, water, and other resources. By applying this approach, universities can optimize the use of resources in a more efficient and environmentally friendly manner, supporting sustainability efforts through energy savings and better waste management through the use of Information technology and digital infrastructure are essential in modern education.
2. In creating sustainable education, the implementation of the green campus concept is essential. Six-Sigma can be used to measure and monitor environmental sustainability initiatives, such as carbon emission reduction, energy efficiency, and waste management. Universities can use the data generated by this method to make more informed decisions in environmental initiatives.
3. Trough Six-Sigma approach, university managers can make more informed and measurable decisions based on data analysis. For example, in terms of budget allocation, investment prioritization, or human resource management, as well as periodic continuous evaluation of institutional performance in areas such as resource management, curriculum effectiveness, or administrative efficiency.

2. MATERIAL AND METHODS

2.1. Research Design

The research approach plays a vital role in ensuring this dissertation is systematically structured, relevant, and effective in addressing the research questions and achieving its objectives (Reosekar & Pohekar, 2014). A mixed-methods approach, integrating both qualitative and quantitative methods, is employed in this study to provide a comprehensive understanding of the research problem. Specifically, the study adopts a sequential exploratory design, which begins with the collection and analysis of qualitative data to gain in-depth insights into the phenomenon. These insights are then expanded and generalized through the subsequent collection and analysis of quantitative data, ensuring a well-rounded and robust exploration of the topic. This approach is particularly suited for analyzing complex processes, identifying factors influencing the sustainability of higher education, and delivering evidence-based, measurable recommendations through the Six-Sigma framework (Ray & Das, 2010). It emphasizes practical solutions to sustainability challenges in higher education by leveraging data-driven insights, process evaluation, and actionable improvements. The mixed-methods strategy is designed to tackle the multifaceted nature of sustainability issues, encompassing interactions among management, operations, human resources, and environmental dimensions. This study employs a case study design centered on higher education institutions in Indonesia. This approach was selected to gain a comprehensive understanding of sustainability phenomena across diverse higher education contexts. The research design encompasses several key stages:

- Identifying critical issues related to sustainability.
- Analyzing data and measuring process quality.
- Applying the Six-Sigma methodology to drive continuous improvements.

2.2. Qualitative Data Analysis

The goal of this study's qualitative data analysis was to have a thorough grasp of sustainability concerns at Indonesian colleges, especially as they relate to applying the Six Sigma methodology. According to Mezmir (2020) the procedure was carried out in a methodical manner, beginning with the gathering of qualitative data via in-depth interviews with important stakeholders, such as staff, management, students, and lecturers, to investigate their perspectives

on operational effectiveness and sustainability. Document analyses of sustainability policies, annual reports, and operational documents were also carried out, along with field observations that offered firsthand insights into academic and non-academic processes and focus group discussions (FGDs) to gather a variety of ideas and suggestions for improvement (Bulmer, 2017). Following data collection, data reduction was the next step in the analysis process.

2.3. Quantitative Data Analysis

Quantitative analysis plays a crucial role in Six-Sigma research as it centers on evaluating and enhancing quality through objective data collection. The goal of Six-Sigma is to minimize variation in processes and achieve minimal error rates (Shokri, 2017). By leveraging quantitative analysis, the performance of processes can be accurately measured and tracked, forming the foundation for improvements driven by data. In Six-Sigma, quantitative analysis is used to assess data and pinpoint issues within processes, such as non-conformance in quality or inefficiency, helping identify areas for improvement in higher education in Indonesia.

By offering unbiased insights that support decision-making and process enhancements, quantitative data analysis is crucial to the Six-Sigma approach, especially within the DMAIC (Define, Measure, Analyze, Improve, and Control) framework (Muraliraj et al., 2018). In order to properly identify the main causes and make sure that troubleshooting efforts are focused and supported by evidence, statistical tools like regression analysis and hypothesis testing are used during the analyze phase (da Silva et al., 2018). This study employs Structural Equation Modeling (SEM) to examine variations in data from various sources, such as differences in output resulting from variations in inputs, processes, or other factors. By using multiple regression, Six-Sigma can determine if significant differences exist in the data that may influence process performance (Kumar et al., 2013). SEM enables the identification of factors or variables contributing to variations in the process (Ruben. et al., 2020).

2.4 Integration with Six-Sigma Framework

In this phase, Six-Sigma defines the improvement goals and the issues to be addressed in higher education in Indonesia. SIPOC is used to map the entire process. By utilizing SIPOC, the team can outline the connections between suppliers, inputs, processes, outputs, and customers, which

help in understanding the current system and establishing the scope of the problem to be tackled (Salah et al., 2010). Once the problem is defined, the measure stage focuses on gathering data to assess the performance of the existing process. SIPOC proves useful here to ensure all elements of the process—from suppliers and inputs to outputs and customers—are clearly identified. This allows the team to gather relevant data and assess the performance of each component within the higher education system. In the Analyze phase, the data collected is analyzed to pinpoint the root causes of the problem. SIPOC aids the team in examining the process flow and identifying where issues occur—whether in the inputs from suppliers or at specific stages of the process (Ameen Abdulla & Kavilal, 2022).

Table 1: Latent Variables and Manifest Variables (Indicators)

Element/Acronym	Description	Sources
Six-Sigma Implementation (SS)	- DMAIC - KPI (*Merdeka Belajar* Program) - Quality Improvement - Data-Driven Decision Making	(Cudney et al., 2020), (Svensson et al., 2015)
Human Resources (HR)	- Resource Management - Curriculum Development - Training and Development	(Sunder M & Mahalingam, 2018)
Infrastructure Facilities (IF)	- Information Technology and Systems - Security and Safety Systems - Advanced Laboratories & Equipment - Physical Infrastructure	(Davidson et al., 2020)
Organizational culture (OC)	- Relevant curriculum and teaching materials - Integrated sustainability programs on campus - Green Universities	(Ameen Abdulla & Kavilal, 2022)
Leadership (LD)	- Visionary Leadership - Transformational Leadership - Ethical Leadership	(Davis & Fifolt, 2018)
Budget and	- Financial Planning and Allocation	(Li et al., 2019)

Financial Resources (BF)	- Revenue Generation and Diversification - Financial Accountability and Transparency - Cost Efficiency and Resource Optimization	
Stakeholder Engagement (SE)	- Students and Alumni - Society - Government	(Haerizadeh & Sunder, 2019)
Sustainability of Higher Education (SHE)	- Environmental Sustainability - Economic Sustainability - Social Sustainability - IT and Data Management Systems	(Adina-Petruţa & Roxana, 2014)

Sources: Base own work, 2025

2.5. Sampling

This study involve 15 top universities in Indonesia with 588 respondents, which can be selected based on national university rankings or other relevant factors, such as the university's contribution to research, innovation, and community development. This research uses a mixed-methods approach with the stratified random sampling technique for quantitative data collection and purposive sampling for qualitative data, This approach guarantees that each subgroup is represented proportionately from a quantitative standpoint, minimizes prejudice, and investigates sustainability challenges from a qualitative standpoint as well as strategic viewpoints (Nguyen et al., 2021).

2.6. Data Analysis

Following the completion of the data collection procedure, a thorough analysis will be carried out utilizing both descriptive and inferential statistical techniques. The features of the data will be described using descriptive statistics, which will give a summary of important variables including academic achievement, satisfaction levels, and institutional efficiency. Structural Equation Modeling (SEM) using SMART PLS 4 will be used for inferential analysis, in order to investigate correlations further and test for significant of variable (Rosak-Szyrocka & Tiwari, 2023). This method makes it possible to comprehend the elements affecting perceptions and satisfaction in higher education institutions on a deeper level. Transcripts of focus groups and

interviews will be analyzed using NVivo 15 for qualitative data as suggest research by (Allsop et al., 2022).

2.7. Research Framework

The research framework serves as a structured guide that outlines the key concepts, relationships, and processes underlying the study. It provides a clear roadmap to connect the research objectives with theoretical foundations and methodologies, ensuring a systematic approach to addressing the research problem as shown by Figure 1. In the context of the research titled 'Enhancing of Sustainability Higher Education in Indonesia: A Six-Sigma Approach', the framework integrates sustainability principles, higher education management, and Six-Sigma methodology to address critical challenges in achieving long-term sustainability.

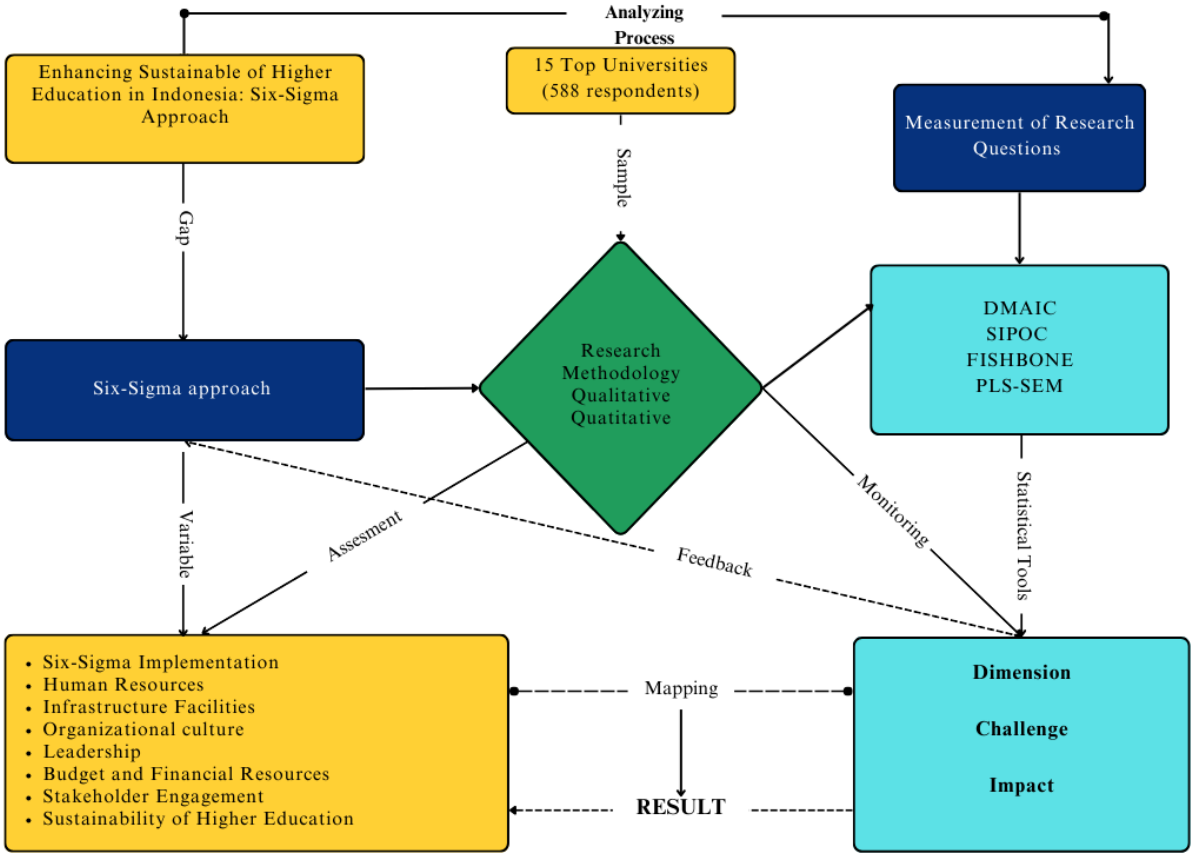

Figure 1: Research Framework

Sources: Based on own work, 2025

3. MAIN FINDINGS

3.1. Qualitative Analysis

This chapter presents the findings of a study examining the use of the Six-Sigma approach to enhance the sustainability of higher education in Indonesia. Using a qualitative methodology, data collected through in-depth interviews, observations, and document analysis offer a thorough understanding of the factors that impact the quality and sustainability of higher education. The study's findings aim to offer valuable insights and strategic recommendations for higher education institutions on how to apply Six-Sigma to boost operational efficiency and secure long-term sustainability in addressing global challenges. The data analysis was supported by the use of NVivo software, which facilitated the coding process and the organization of complex qualitative data. NVivo's advanced capabilities allowed for the systematic identification of key themes and patterns across the data, providing a deeper understanding of the factors influencing sustainability in higher education. Through this software, the research efficiently processed large volumes of qualitative data, ensuring that the findings were both comprehensive and grounded in empirical evidence. To address the challenges faced by higher education in Indonesia, the study applied the DMAIC (Define, Measure, Analyze, Improve, Control) methodology as a structured approach to identify and resolve key issues. In the define phase, the study clearly identified the primary challenges related to the sustainability of higher education, including resource management, quality assurance, and alignment with global standards. During the measure phase, data was gathered to quantify the extent of these challenges and their impact on institutional performance. The analyze phase involved a detailed examination of the data to identify root causes and patterns, while the improve phase generated targeted interventions, focusing on improving operational efficiency and student satisfaction.

3.2. Data Coding

In the initial stage of coding, NVivo was used to conduct open coding, which identifies small segments of data that can provide insights into the variables under study. Each segment or piece of text relevant to the research elements, such as Six-Sigma implementation, human resources, infrastructure facilities, organizational culture, leadership, budget and financial resources, stakeholder engagement and sustainability of higher education. For this research, some relevant codes are:

- Six-Sigma implementation: codes relating to Six-Sigma practices, the use of Six-Sigma tools and methodologies in higher education institutions.
- Human resources: codes for data relating to HR skills, training and management in the context of Six-Sigma.
- Infrastructure facilities: codes related to physical and technological infrastructure that supports Six-Sigma implementation and educational sustainability.
- Organizational culture: codes that touch on aspects of organizational culture that support learning and continuous improvement.
- Leadership: codes that describe the role of leadership in supporting and driving Six-Sigma implementation.
- Budget and financial resources: codes that relate to budget allocation, fund management, and financial sustainability.
- Stakeholder engagement: codes that record interactions with various stakeholders such as the government, industry sector, and campus community.
- Sustainability of higher education: codes relating to factors that affect the long-term sustainability of higher education institutions.

Once the clustering of nodes is complete, the next step is to perform advanced coding by revisiting more specific data. In this case, NVivo allows researchers to create additional codes based on narrower or more detailed themes, according to the research objectives. For example, under the node 'Six-Sigma Implementation,' the researcher could add further codes, such as 'DMAIC Process' or 'Six-Sigma Training,' which refer to important elements of Six-Sigma implementation in higher education. These codes would then be interconnected to provide a more comprehensive picture of the factors that contribute to the success or failure of Six-Sigma in the context of higher education. Once all the data is coded, NVivo allows researchers to use various query features (e.g. text search query, word frequency query, or matrix coding query) to analyses the relationships between codes and explore patterns. With the text search query, researchers can search for terms or concepts that appear frequently in the text, for example searching for keywords such as 'sustainability' or 'quality.' Matrix coding query allows researchers to analyze the relationships between various nodes, for example, to identify how leadership relates to human resources and six-sigma implementation in supporting higher

education sustainability. In this study, qualitative data analysis was conducted to identify key themes related to the implementation of the Six-Sigma approach in supporting higher education sustainability in Indonesia. To simplify the analysis process and increase objectivity, the Auto Code Themes feature in NVivo was used to automatically recognize and classify themes that emerged from interview data, institutional documents, and open-ended surveys as shown in Table 2. Auto Code Themes in NVivo is a feature used to automatically identify and organize key themes or patterns in qualitative data, such as interviews, open-ended surveys, or other texts (Jackson & Bazeley, 2019). It utilizes text-based analytics algorithms to find frequently occurring or relevant words or phrases, and then groups them into themes or categories that allow researchers to explore relevant key patterns, such as Six-Sigma implementation challenges, sustainability enablers, and innovations in the higher education system. Auto-coding in NVivo showed that high levels in each variable reflected factors that contributed significantly to the research objectives. In this case:

- Six-Sigma Implementation focuses on operational effectiveness and implementation challenges.
- Sustainability of Higher Education emphasizes the need for strategic cooperation and policy support.

Table 2: Auto Code Themes Result Sustainability Higher Education in Indonesia

	Child Node													
Parents Node	A : energy consumption	B : external experts	C : failure modes	D : financial savings	E : Financial Support	F : insufficient knowledge	G : programs	H : reputation	J : research projects	K : DMAIC	M : stakeholder engagement	N : sustainability	O : training	P : waste production
Codes\\Budget and Financial Resources	11.79%	14.9%	11.9%	11.73%	20.49%	15.66%	18.48%	13.33 %	15.98%	15.26%	13.1%	17.93 %	17.2 %	18.87%
Codes\\Human Resources	4.47%	0%	3.86%	3.98%	4.68%	0%	4.27%	12.73 %	5.22%	4.21%	0%	3.08%	4.84 %	3.11%
Codes\\Infrastructure Facilities	18.7%	17.79%	28.62 %	17.04%	21.16%	24.56%	20.62%	12.73 %	16.3%	20.16%	20.42%	22.83 %	20.97%	18.09%
Codes\\Leadership	10.98%	12.74%	4.18%	10.62%	5.35%	11.74%	9.95%	10.3 %	9.97%	9.23%	10.21%	6.88%	9.68 %	8.95%
Codes\\Organizational culture	13.41%	14.18%	9.97%	13.72%	10.24%	11.74%	10.9%	12.73 %	13.45%	12.19%	13.29%	9.96%	10.75%	12.84%
Codes\\Six-Sigma Implementation	21.54%	21.88%	26.69 %	23.01%	20.49%	20.64%	18.01%	20%	21.68%	19.7%	22.93%	21.56 %	18.82%	22.18%
Codes\\Stakeholder Engagement	3.66%	0%	1.93%	2.65%	3.12%	0%	0.95%	5.45 %	3.48%	1.82%	3.08%	3.08%	1.08 %	2.33%
Codes\\Sustainability of Higher Education	15.45%	18.51%	12.86 %	17.26%	14.48%	15.66%	16.82%	12.73 %	13.92%	17.43%	16.96%	14.67 %	16.67%	13.62%

Description
High
Medium
Low

Sources: Author Data Processing (NVivo) 2025

Notes: NVivo displays the frequency of data encoded in each theme or node. This can be interpreted as a 'level' that indicates the intensity or dominance of a particular theme in the dataset

3.3. Thematic Analysis

Thematic Analysis (TA) is a qualitative analysis method used to identify, analyze and report patterns (themes) in data. This technique is often used in social research to provide deep insights into the experiences, views, or phenomena being studied (Nowell et al., 2017) . This study employs the Six-Sigma approach to enhance the sustainability of higher education in Indonesia. Utilizing data coding conducted through NVivo software, the subsequent thematic analysis seeks to identify and examine the predominant patterns and themes associated with the application of Six-Sigma in the context of higher education sustainability.

The analysis reveals a variety of critical factors influencing sustainability, encompassing Six-Sigma implementation, human resources, infrastructure facilities, organizational culture, leadership, budget and financial resources, and stakeholder engagement. Based on the thematic analysis of the key variables, the main themes that explain the contribution of each variable to the sustainability of higher education are described in Table 3.

Table 3: Thematic Analysis sustainability of Higher Education in Indonesia

Themes	Statement	Score based on coding
Six-Sigma implementation as the basis for operational sustainability in Indonesia	Six-Sigma Implementation is at the core of the approach used in this study. The DMAIC (Define, Measure, Analyze, Improve, Control) methodology contributes to: • Identification of Key Issues: the College used Six-Sigma to determine critical areas that needed improvement, such as waste management, energy efficiency, and effectiveness of educational programs. • Fact-based Data Collection and Analysis: Through measuring operational performance, Six-Sigma helps institutions to understand	High

	weak points in their processes and develop more efficient solutions. • Continuous Improvement: Six-Sigma promotes sustainability through better resource management, reduction of wastage, and improved service quality.	
Human resources as the main driver of sustainability	Human resources play a central role in successful Six-Sigma implementation. The thematic analysis revealed several important contributions: • Internal Capacity Building: staff training in Six-Sigma methodology enabled the development of technical and managerial skills relevant for sustainability. • Commitment to Sustainability: staff that are empowered and involved in decision-making processes shows higher levels of commitment to the institution's goals. • Knowledge Management: knowledge management and sharing through training and hands-on experience are keys in creating a culture of sustainability in the institution.	Low
Infrastructure facilities to support physical sustainability	Infrastructure is a vital element in supporting higher education sustainability programs. Some of the key aspects found include: • Energy Efficiency and Green Technology: the use of green technologies, such as LED lighting and renewable energy sources, contributes to the reduction of energy consumption. • Facility Management: optimization of campus	High

	space, waste management, and implementation of technology-based facilities help create a more sustainable environment. • Support for Educational Innovation: adequate infrastructure supports academic activities such as sustainability-orientated research and learning.	
Organizational culture as a pillar of sustainability	An organizational culture that supports sustainability is a key success factor for the programs. Thematic analysis identified: • Adaptation of Sustainability Culture: Institutions that start to integrate sustainability in organizational values show progress in sustainability practices. • Resistance to Change: a rigid culture remains a challenge, with some internal parties not fully understanding the urgency of sustainability. • Collaboration and Inclusiveness: an inclusive organizational culture increases staff and student engagement in sustainability initiatives.	Medium
Leadership as a catalyst of change	Strong leadership fuelled the success of sustainability initiatives. Themes found include: • Strategic Vision: leaders with a clear sustainability vision can steer institutions towards achieving long-term targets. • Effective Communication: leadership that is able to effectively communicate sustainability goals helps create awareness and commitment at all levels of the organization. • Staff Empowerment: leaders who empower	Medium

	staff through training, rewards and active engagement increase program effectiveness.	
Budget and financial resources as the foundation of sustainability	Sustainability cannot be achieved without adequate budget support. Thematic analysis shows that: • Budget Transparency: transparent budget management increases trust and accountability in the use of funds. • Diversification of Funding Sources: colleges that rely on multiple funding sources, such as government grants, industry partnerships and alumni funds, tend to be more financially stable. • Funding Limitations: despite their importance, many institutions face challenges in allocating budget for sustainability initiatives, given other pressing priorities.	Medium
Stakeholder engagement as a determinant of success	Stakeholder engagement, both internal and external, is an important element in higher education sustainability. The thematic analysis shows: • Multi-stakeholder collaboration: partnerships with government, industry and non-governmental organizations strengthen institutions' capacity to implement sustainability programs. • Role of Students and Lecturers: active participation from students and lecturers in research, community service, and sustainable campus activities creates significant positive impacts. • Local Community Involvement: the	Low

	development of programs that involve the surrounding community increases social acceptance of sustainability initiatives.	

Sources: Base Author Own Work 2025

Through a comprehensive and in-depth thematic analysis, this study demonstrates that the sustainability of higher education in Indonesia can be significantly enhanced through the implementation of the Six-Sigma approach. This methodology serves not only as a systematic framework for identifying and resolving institutional challenges but also as a strategic tool for improving operational efficiency and fostering innovation within higher education settings. Within this framework, the analyzed variables are interdependent and play a critical role in cultivating an academic environment that prioritizes efficiency, innovation, and long-term sustainability. Despite these promising findings, the research identifies several critical barriers that must be addressed to achieve optimal sustainability outcomes. These challenges include organizational resistance to cultural change, limited financial and human resources, and insufficient collective awareness among stakeholders regarding the importance of sustainability. Such constraints pose significant obstacles that can hinder the comprehensive implementation of sustainability initiatives.

After conducting thematic analysis, this study presents a word cloud visualization generated through NVivo providing an in-depth visual depiction of the most frequently occurring keywords in the data shown by Figure 2. These words reflect the main themes related to the research variables, such as Six-Sigma implementation, human resources, infrastructure facilities, organizational culture, leadership, budget and financial resources, and stakeholder engagement. This word cloud helps identify conceptual relationships between these variables and highlights the most dominant aspects in discussions related to the sustainability of higher education. Thus, this visualization serves as a supporting tool to further understand relevant thematic patterns and provide additional perspectives on the results of the analysis.

Figure 2: World Cloud Sustainability Higher Education in Indonesia

Sources: Author Data Processing (NVivo) 2025

3.4. Quantitative Analysis

3.4.1 Descriptive Statistic

Descriptive analysis is crucial in research because it guarantees that the data used is legitimate, interpretable, and prepared for additional testing by the study's goals. Researchers can identify patterns, trends, and potential anomalies that could impact the study's findings by using descriptive analysis to obtain a comprehensive picture of the distribution and variation of the data. This study aids in determining whether the data satisfies fundamental presumptions for more intricate inferential studies, such as homogeneity of variance or normality of distribution, by using *the SPSS 28* version. Furthermore, descriptive analyses give the reader the background information they need to comprehend the relationships between the study's variables, facilitate their comprehension of the sample's characteristics, and offer a strong foundation for understanding the study's findings.

Based on 588 respondents with no missing data, this table displays descriptive statistics for seven

variables: gender, age, job title, academic degree, university status, university origin, and significance (Table 4). The mean and median values indicate the data trend; for example, according to the scale used, most respondents fall into the third age group and have code 1 for gender. Compared to other variables, University Origin has the highest standard deviation (4.63359), indicating higher volatility in this variable. A relatively symmetrical distribution is shown by skewness values primarily close to zero, except University Status (0.967), which tends to the right. In addition, almost all variables have negative kurtosis values, indicating that the data distribution is flatter than a normal distribution. The variable University Origin (1-15), which represents the variation of respondents' university origin, is one example of how the range of data fluctuates. Before additional studies were conducted, these data provided a preliminary picture of the sample characteristics.

Table 4: Frequency Table

		Gender	Age	Position	Academic Title	University Status	University Origin	Department
N	Valid	588	588	588	588	588	588	588
	Missing	0	0	0	0	0	0	0
Mean		1.398	2.641	3.170	1.918	1.561	8.494	3.139
Median		1.000	3.000	3.000	2.000	1.000	9.000	3.000
Std. Deviation		0.489	1.273	2.148	0.789	0.826	4.633	1.589
Skewness		0.418	0.303	0.244	0.146	0.967	-0.237	0.575
Std. Error of Skewness		0.101	0.101	0.101	0.101	0.101	0.101	0.101
Kurtosis		-1.83	-0.921	-1.654	-1.382	-0.839	-1.359	-0.282
Minimum		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum		2.00	5.00	6.00	3.00	3.00	15.00	7.00

Sources: SPSS Author Processing, 2025

3.4.2 Validity and Reliability Test

Quantitative methods were used in this study to examine the influence of key variables on the sustainability of higher education in Indonesia using the Six-Sigma approach. The variables analyzed include Six-Sigma implementation, human resources, infrastructure facilities, organizational culture, leadership, budget and financial resources, and stakeholder engagement which have been tested through a qualitative approach. This research uses Structural Equation

Modeling (SEM) processed with the help of Smart PLS software to identify causal relationships and direct and indirect effects between variables. This approach allows researchers to comprehensively evaluate the contribution of each variable to the achievement of higher education sustainability in Indonesia.

The latent variable testing stage begins with an evaluation of the measurement model (outer model), which includes construct validity and reliability. Validity is tested through convergent validity, by assessing the loading factor value of each indicator (≥ 0.7) and the Average Variance Extracted (AVE) value (≥ 0.5) (Barcia et al., 2022). Meanwhile, reliability is tested through Composite Reliability (CR) and Cronbach's Alpha, both of which must have a value ≥ 0.7 (Hair, 2018). After the measurement model met the validity and reliability criteria, the research continued with the evaluation of the structural model (inner model). At this stage, the relationship between latent variables is analyzed to test the research hypothesis. The analysis was carried out by looking at the path coefficient value, t-statistics, and p-value obtained through bootstrapping with 588 samples. The R-squared (R^2) value is used to measure the ability of the model to explain the variability of the dependent variable, while the Q-squared (Q^2) assesses the predictive ability of the model. Upon completion of the convergent validity assessment, the subsequent critical step involves evaluating the reliability of the measurement model. The reliability analysis is essential to ensure that the indicators consistently and stably measure their corresponding latent variables over time. This evaluation is carried out by examining Composite Reliability (CR) and Cronbach's Alpha, with values exceeding 0.7 considered indicative of satisfactory internal consistency of the constructs. As shown in Table 5, each latent variable demonstrates a Cronbach's Alpha value greater than 0.7, thereby confirming that the measurement model meets the reliability criteria. The reliability threshold of 0.7 signifies that the indicators are sufficiently consistent in measuring the latent variables, ensuring that the results obtained from these measurements are stable and dependable across different contexts and over time. Thus, the constructs in this study exhibit a high degree of internal consistency, further validating the robustness of the measurement model. The assessment of Composite Reliability (CR) and Average Variance Extracted (AVE) for the latent variables of budgeting and financial resources, human resources, infrastructure facilities, leadership, organizational culture, Six-Sigma implementation, stakeholder engagement, and sustainability of higher education reveals that both indicators meet the established criteria for validity and reliability.

Table 5: Construct Reliability and Validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Budgeting and Financial	0.882	0.882	0.919	0.739
Human Resources	0.850	0.851	0.909	0.770
Infrastructure Facilities	0.892	0.899	0.926	0.757
Leadership	0.861	0.868	0.915	0.783
Organizational Culture	0.870	0.883	0.921	0.797
Six-Sigma Implementation	0.901	0.903	0.931	0.773
Stake Holder Engagement	0.848	0.861	0.907	0.766
Sustainability Higher Education	0.895	0.897	0.927	0.762

Sources: Author Data Processing (Smart PLS.4) 2025

The regression model's R-square and Adjusted R-square values for the analysis of continuing higher education are displayed in Table 6. The model is excellent, as evidenced by the R-square (0.956), which can explain 95.6% of the variability in continuing higher education. After accounting for the number of predictors in the model, the Adjusted R-square (0.955) is marginally lower, but it still shows that 95.5% of the variability can be explained. While the Adjusted R-square corrects the R-square value if there are irrelevant variables in the model, a higher R-square value implies a high-quality model explaining the dependent variable.

Table 6: *R*-Square

	***R*-square**	**R-square adjusted**
Sustainability Higher Education	0.956	0.955

Sources: Smart PLS 4. Authors Processing, 2025

3.4.3 Outer Loading

In this study, the primary focus of the analysis is directed toward the evaluation of outer loading values rather than path coefficients, given that the study does not propose a hypothesis-based model testing causal relationships between variables. As such, greater emphasis is placed on the validity of the latent variable measurements, specifically through the assessment of outer loading, which indicates the degree to which the indicators effectively represent the latent constructs under examination. In contrast to testing inter-variable relationships via path

coefficients, this approach prioritizes ensuring that each indicator accurately reflects its corresponding construct.

Within the framework of Structural Equation Modeling (SEM), particularly using the Partial Least Squares (PLS) method, outer loading quantifies the extent to which an indicator (or item) measures its associated latent variable. In other words, it reflects the strength of the relationship between the indicator and the latent construct it is intended to represent. A high outer loading value, typically ≥ 0.7, signifies that the indicator significantly contributes to the construct, thereby ensuring the validity of the measurement. Conversely, a low outer loading value (e.g., < 0.4) suggests that the indicator may not adequately capture the construct, warranting potential removal from the model. Ultimately, outer loading serves as a key tool for assessing the quality and relevance of indicators in accurately measuring latent constructs, as illustrated in Table 7, thereby reinforcing the reliability and validity of the SEM model.

Table 7: Outer Loading

	BF	HR	IF	LD	OC	SE	SHE	SS
BF1	**0.851**							
BF2	**0.897**							
BF3	**0.868**							
BF4	**0.822**							
HR1		**0.868**						
HR2		**0.920**						
HR3		**0.842**						
IF1			**0.884**					
IF2			**0.923**					
IF3			**0.878**					
IF4			**0.789**					
LD1				**0.898**				
LD2				**0.913**				
LD3				**0.842**				
OC1					**0.804**			
OC2					**0.965**			
OC3					**0.901**			
SE1							**0.862**	
SE2							**0.918**	
SE3							**0.844**	
SHE1								**0.825**

SHE2								**0.915**
SHE3								**0.898**
SHE4								**0.852**
SS1						**0.829**		
SS2						**0.921**		
SS3						**0.927**		
SS4						**0.835**		

Sources: Author Data Processing (Smart PLS.3) 2025

The budgeting and financial resources variable shows significant outer loading, with indicator values exceeding the 0.7 threshold, indicating that these indicators accurately describe the management of funds in the context of sustainable higher education. Similarly, human resources showed high outer loading values, with most indicators exceeding 0.7, reflecting the strong influence of the quality and skills of human resources on the sustainability of higher education and their ability to adapt to environmental changes. In the Infrastructure Facilities variable, the indicators used also show a strong relationship with the construct, with an outer loading value that meets the criteria (> 0.7), which indicates that physical and technological facilities support the achievement of higher education sustainability goals.

3.4.4. Bootstrapping

For bootstrapping analyses that focus on the outer model in Partial Least Squares Structural Equation Modeling (PLS-SEM), there are several criteria values that need to be met so that the relationship between indicators and latent variables can be considered significant. The qualified t-statistics value for the significance of the relationship between indicators and latent variables should generally be greater than 1.96 for a significance level of 5% ($\alpha = 0.05$). That is, if the t-statistics are greater than 1.96, then the relationship is considered significant at the 5% level. The p-value indicates the probability that the result obtained is due to chance. A p-value smaller than 0.05 ($\alpha = 0.05$) indicates a significant relationship between the indicator and the latent variable. If the p-value is smaller than 0.01, it indicates a higher level of significance otherwise if the p-value is greater than 0.05, the relationship between the indicator and the latent variable is not significant (Hair, 2018). If the t-statistics and p-value meet these criteria, it can be concluded that the indicators used in the outer model have a significant and valid relationship with the latent variable being measured.

A path map that depicts the connections between several elements leading to "Sustainable Higher Education" is shown in Figure 3.

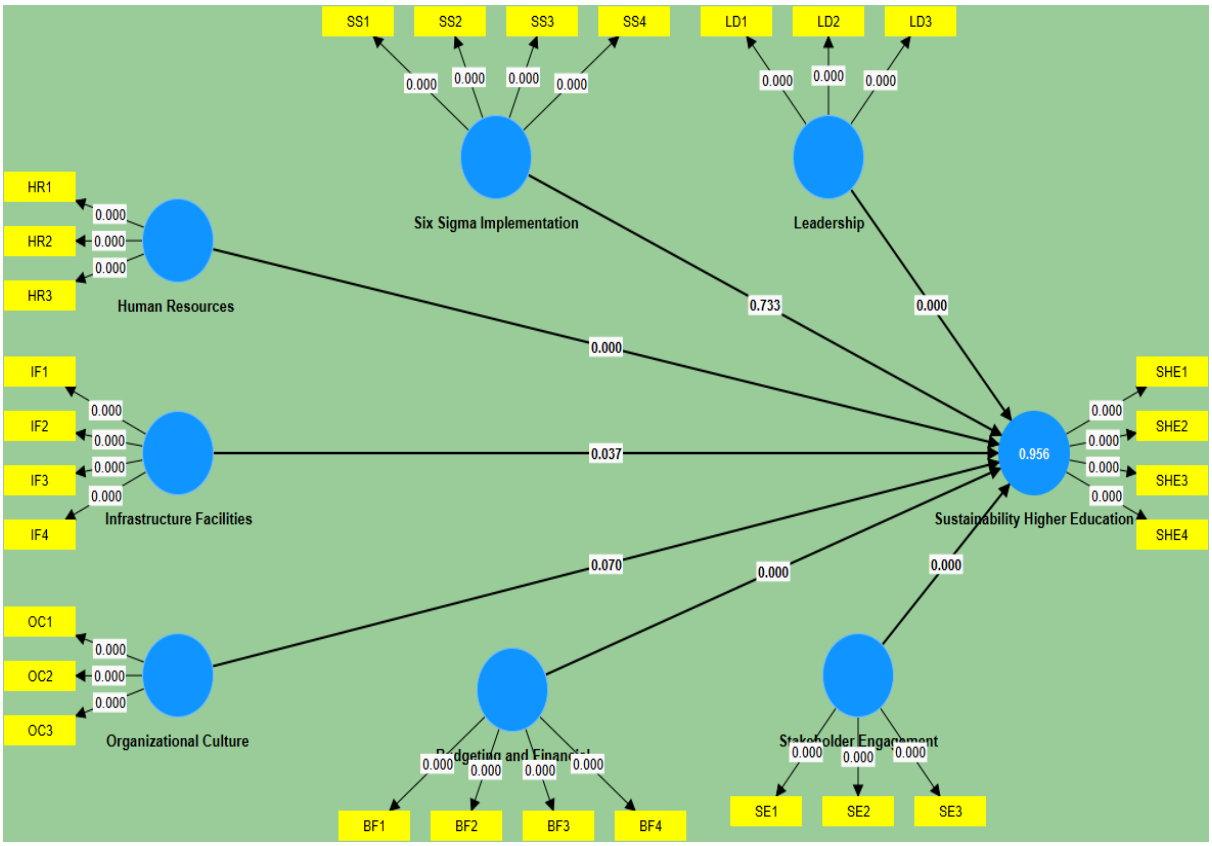

Figure 3: Bootstrapping Result

Sources: Smart PLS 4 Author Processing, 2025

The route coefficients that characterize the impact of several factors on sustainability in higher education are displayed in Table 8. This path coefficient indicates the contribution of each independent variable to the sustainability of higher education. With a coefficient of 0.443, budgeting and financial management have the most significant impact, suggesting that they are crucial to enhancing the sustainability of higher education. Infrastructure facilities (0.188) and human resources (0.321) are other essential characteristics that great impact to sustainability. With a coefficient of 0.177, leadership contributes favorably, whilst organizational culture has a lesser but noteworthy impact (0.117). However, with a value of -0.264, stakeholder engagement harms sustainability, suggesting that less-than-ideal stakeholder involvement may have unfavorable effects. In the meantime, Six Sigma Implementation displays a very low p-value (0.003) but has a very modest effect (0.023) and is not statistically significant. With a p-value of

less than 0.05, most of the parameters examined demonstrated a substantial impact on the overall sustainability of higher education.

Table 8: Path Coefficient

	O	M	STDEV	(O/STDEV)	*P* values
Budgeting and Financial -> Sustainability Higher Education	0.443	0.447	0.060	7.402	0.000
Human Resources -> Sustainability Higher Education	0.321	0.318	0.048	6.725	0.000
Infrastructure Facilities -> Sustainability Higher Education	0.188	0.185	0.090	2.090	0.037
Leadership -> Sustainability Higher Education	0.177	0.180	0.037	4.729	0.000
Organizational Culture -> Sustainability Higher Education	0.117	0.123	0.065	1.810	0.028
Six Sigma Implementation -> Sustainability Higher Education	0.023	0.023	0.067	0.341	0.007
Stakeholder Engagement -> Sustainability Higher Education	-0.264	-0.271	0.070	3.777	0.000

Sources: Smart PLS 4. Authors Processing, 2025

In the context of this research, bootstrapping is applied to analyze the outer model that measures the relationship between indicators (observed variables) and latent variables such as budgeting and financial resources, human resources, infrastructure facilities, leadership, organizational culture, Six-Sigma implementation, stakeholder engagement, and sustainability of higher education.

The fit between the estimated model and the saturated model using several model fit metrics is displayed in Table 9. Given that SRMR values below 0.08 are deemed sufficient, the 0.086 SRMR value for both models indicates a reasonable fit. Similarly, there is a slight discrepancy between the estimated and saturated models, as indicated by the values of d_ULS and d_G, which are 3.008 and 6.057, respectively. The NFI of 0.84 indicates a good match, as NFI values above 0.8 indicate a satisfactory fit. In contrast, the similar Chi-square value for both models (14284.189) shows that the estimated model is nearly identical to the saturated model. All things

considered, these findings show that the estimated model matches the data quite well, suggesting that the model is trustworthy for additional research.

Table 9: Model Fit

	Saturated model	Estimated model
SRMR	0.086	0.086
d_ULS	3.008	3.008
d_G	6.057	6.057
Chi-square	14284.189	14284.189
NFI	0.84	0.84

Sources: Smart PLS 4. Authors Processing, 2025

3.5 Integration Qualitative and Quantitative Analysis

3.5.1. Fishbone Diagram

Fishbone diagram, or commonly referred to as a cause-and-effect diagram or Ishikawa diagram, is a methodological tool employed to systematically and structurally identify the underlying causes of a particular issue (Shinde et al., 2018). To comprehensively understand the various factors influencing the sustainability of higher education in Indonesia, this study employs fishbone analysis as a primary tool for identifying the root causes of existing challenges. This method facilitates a systematic mapping of the relationships among key variables, including budgeting and financial resources, human resources, infrastructure facilities, leadership, organizational culture, Six-Sigma implementation, stakeholder engagement, and the sustainability of higher education. The subsequent step involves analyzing the interactions between each sub-factor and assessing their collective contribution to the overarching problem. For instance, limited financial resources may result in constrained infrastructure, which subsequently impacts the quality of education and the institution's sustainability. Similarly, an organizational culture that resists change and innovation may impede the implementation of Six-Sigma, a methodology essential for enhancing operational efficiency and educational quality. Once the relationships between these factors are thoroughly analyzed, the next phase is to identify the root causes that have the most significant impact and require immediate attention. Through the use of a fishbone diagram, this analysis facilitates the prioritization of the most critical causes that must be addressed to achieve optimal outcomes. Each proposed solution will be designed to address the factors identified in the fishbone diagram, as illustrated in Figure 4.

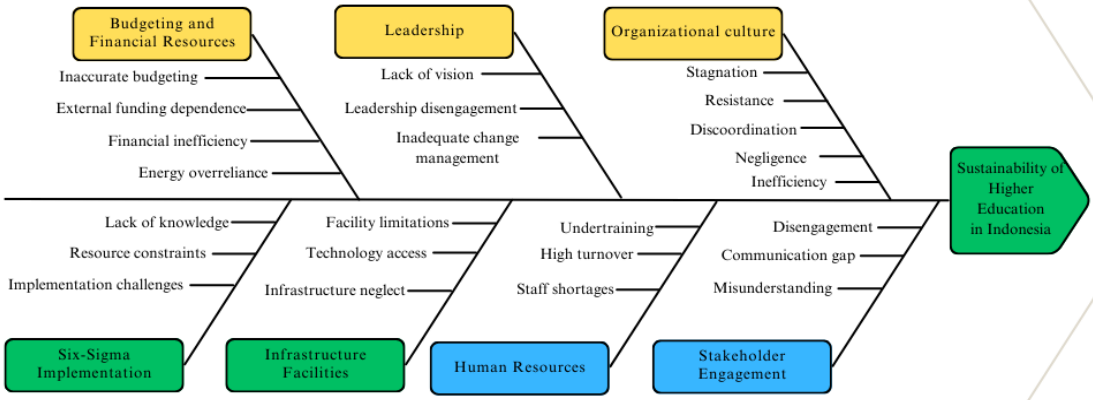

Figure 4: Fishbone Diagram of Sustainability Higher Education in Indonesia

Sources: Based own work, 2025

3.5.2. DMAIC

After conducting an analysis using Fishbone diagrams to identify the root causes of various challenges affecting higher education sustainability in Indonesia, the next step in this research is to apply the DMAIC (Define, Measure, Analyze, Improve, Control) approach as a framework to formulate systematic and data-driven solutions. Through DMAIC, this research will explore how continuous improvement can be applied to the identified variables, such as financial resources, infrastructure, teaching quality and stakeholder engagement, to achieve better and more effective higher education sustainability in Indonesia. The DMAIC approach will help optimize each stage in the process, starting with defining the problem clearly and measurably, then collecting relevant data to evaluate the extent to which the factors contribute to the challenge. In the analysis stage, the relationships between variables will be analyzed in depth to find the root causes that affect the quality and sustainability of higher education. After that, data-driven solutions will be implemented to improve sub-optimal aspects, with a focus on improving resource efficiency and education quality. Finally, the control step will ensure that the improvements made can be maintained in the long term, thus creating a sustainable and adaptive

higher education system to the evolving changes. Through the implementation of DMAIC, it is hoped that higher education institutions in Indonesia can face the existing challenges and create a more advanced and sustainable future for higher education.

Furthermore, the implementation of DMAIC will enable more precise measurement of the achievement of sustainability goals, as well as provide useful feedback for continuous improvement in the management of higher education. It will also encourage the use of technology and innovation in the education process, which in turn can accelerate digital transformation in the education sector. With a more structured and efficient system in place, higher education institutions will be better able to adapt to rapid global changes, such as the need for a workforce based on digital and other global skills. As a result, higher education in Indonesia will not only be more responsive to future needs, but also more capable of creating greater value for society and the economy as a whole, thus supporting the achievement of sustainable development goals at the national and international levels.

The application of DMAIC will strengthen higher education institutions' ability to manage resources more efficiently, enabling them to improve the quality of education services without compromising financial sustainability. More efficient processes can also reduce waste and improve budget utilization, which is important in the face of increasingly complex education financing challenges. With a focus on improving quality and efficiency, DMAIC can help create a more inclusive and sustainable education ecosystem that provides access to quality education for all. Finally, by integrating this Six-Sigma approach, higher education in Indonesia can optimize the potential of existing resources, improve global competitiveness, and contribute to sustainable social and economic progress as shown in Figure 5.

This approach allows higher education institutions to identify gaps in operational and management processes, so that solutions can be designed that are not only effective but also relevant to local and global needs. With improved efficiency, institutions can allocate resources more strategically, including for educational technology innovation, market-driven curriculum development, and faculty competency enhancement.

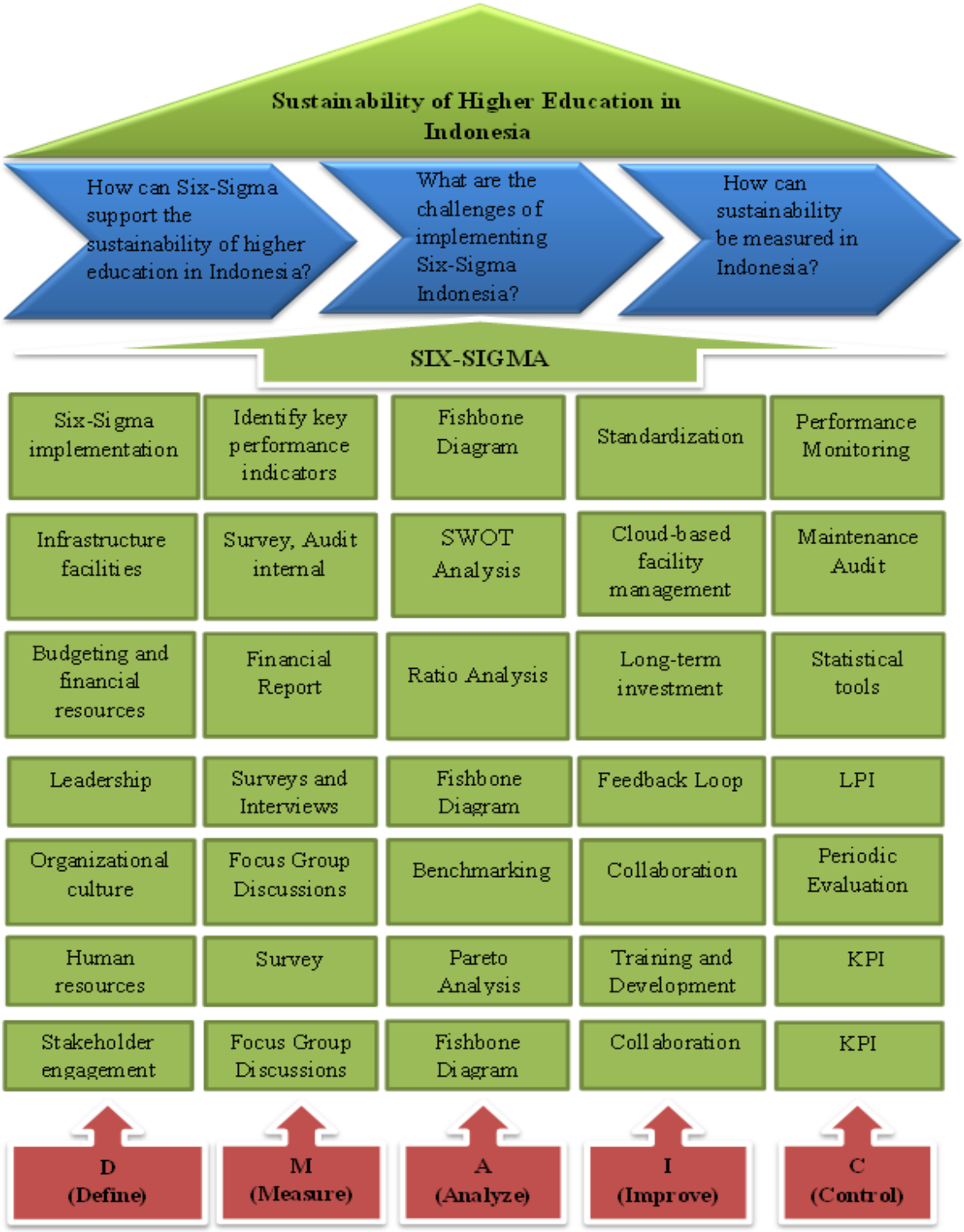

Figure 5: Proposed DMAIC Model

Sources: Based on own work, 2025

3.5.3. SIPOC

As an integral part of implementing the Six-Sigma approach, SIPOC (Suppliers, Inputs, Processes, Outputs, and Customers) analysis provides a clear framework for understanding and identifying the key elements that affect the sustainability of higher education in Indonesia. By illustrating the relationships between suppliers, inputs, processes, outputs, and customers, SIPOC helps map existing workflows and provides strategic insights in improving the efficiency and effectiveness of the higher education system, which in turn contributes to the long-term sustainability of the sector. Through such mapping, SIPOC enables stakeholders to identify potential problems and areas that require improvement in the higher education value chain. This analysis also helps in setting priorities for improvement based on their impact on the quality of education services, student satisfaction, and the relevance of the curriculum to labor market needs. Thus, the application of SIPOC in the context of Six-Sigma not only improves operational performance, but also supports the achievement of higher education sustainability goals that are more inclusive, innovative, and adaptive to global change.

Furthermore, these analyses provide a solid basis for data-driven decision-making, which facilitates policy adjustments that are more responsive to social, economic, and technological dynamics. Within this framework, SIPOC serves as an important tool to integrate the perspectives of various stakeholders, ranging from institutional managers, lecturers, to students, in creating a sustainable and relevant education system. By fostering collaboration across these diverse groups, SIPOC aids in aligning institutional goals with broader societal needs, ensuring that higher education not only meets current expectations but also anticipates future challenges. This collaborative approach enhances the agility and resilience of the education system, enabling it to adapt more effectively to global trends such as digital transformation, demographic shifts, and evolving labor market requirements. Ultimately, the application of SIPOC within the Six-Sigma methodology contributes to a higher education system that is not only efficient but also capable of delivering long-term value to students, employers, and society at large.

Overall, the application of SIPOC within the Six-Sigma methodology contributes to a higher education system that is not only efficient but also capable of delivering long-term value to students, employers, and society at large. In the context of sustainability in higher education in

Indonesia, the integration of key variables such as Six-Sigma implementation, human resources, infrastructure facilities, organizational culture, leadership, budget and financial resources, and stakeholder engagement becomes critical. Six-Sigma implementation provides a structured framework for continuous improvement, ensuring that resources - whether human, financial or infrastructure - are optimally utilized. Effective Human Resources management and leadership are critical in driving these improvements, fostering an organizational culture that embraces innovation, accountability and collaboration. Infrastructure facilities must be aligned with technological advances to meet the evolving needs of students and the labor market, while budgetary and financial resources must be strategically allocated to sustain long-term development. Stakeholder engagement, which includes students, lecturers and external partners, ensures that the education system remains responsive to the needs of its various constituencies, facilitating greater buy-in and ensuring the long-term sustainability of reforms as displayed by Figure 6.

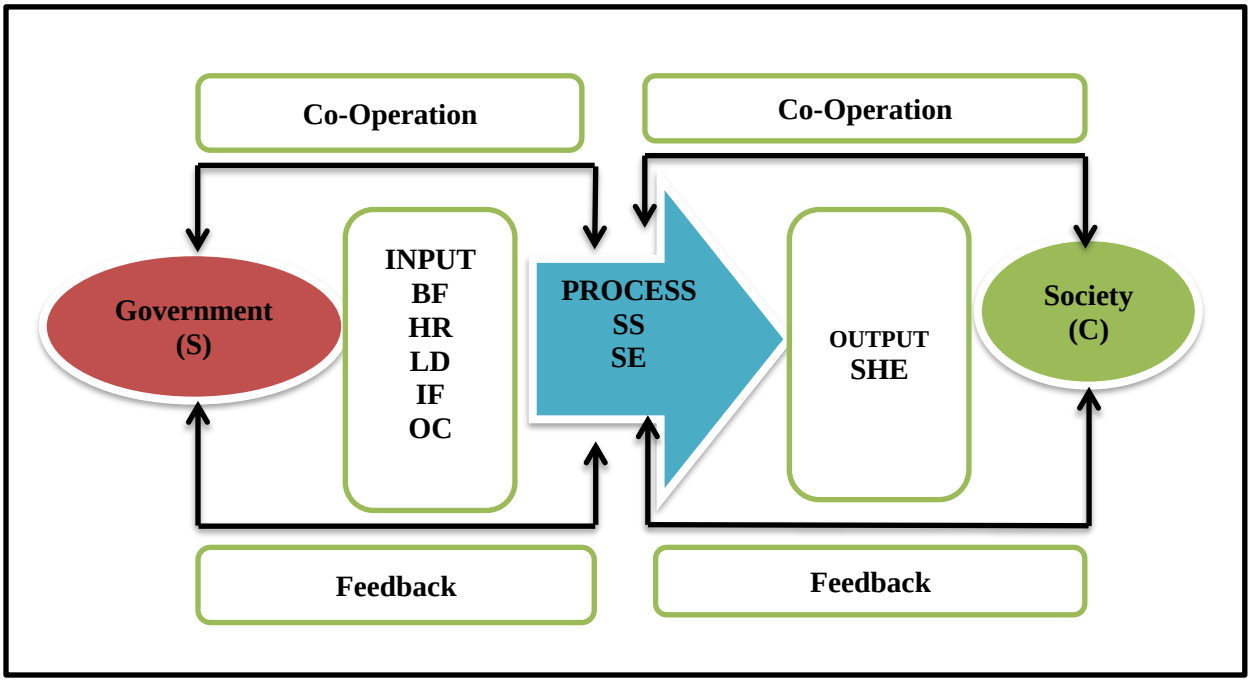

Figure 6: SIPOC Proposed Model

Sources: Based on own work, 2025

4. CONCLUSIONS AND RECOMMENDATIONS

Over the past decade, ‘Golden Indonesia 2045’ has become a slogan to mobilize the nation's potential, reflecting Indonesia's great hopes for 2045. This vision describes Indonesia's ambition to become a developed, modern country, and equal to the world's major powers, while creating better and more equitable welfare for the people, with improved quality of human resources. In addition, this vision aims to place Indonesia among the five largest economic powers in the world. This idea is in line with Indonesia's national vision, which is to realize an independent, united, sovereign, just and prosperous country. The achievement of the grand vision of ‘Golden Indonesia 2045,’ which has become a symbol of hope and mobilization of the nation's potential over the past decade, is highly dependent on the quality of human resources as the main foundation. In this context, the role of higher education becomes crucial as a catalyst to produce individuals who are competitive, innovative, and adaptive to global dynamics. This research, entitled ‘Enhancing Sustainability of Higher Education in Indonesia: Six-Sigma Approach,’ aims to contribute to realizing this vision through the development of sustainability in the higher education sector. By integrating the Six-Sigma approach, this research focuses on improving service quality and operational efficiency, which in turn can support the achievement of national strategic goals towards an advanced and competitive Indonesia in 2045.

To ensure a bright future for Indonesia's young generation, the government needs to base higher education policy on the latest data and trends. Investing in responsive, inclusive and sustainable education is a strategic step to ensure that Indonesia is not only able to keep up with global developments, but can also lead in innovation and development that suits the needs and potential of the nation, especially in the context of the ongoing demographic bonus. In recent decades, the world has witnessed rapid advances in information technology, biotechnology and renewable energy. However, these developments are just the beginning of the transformation that will take place in the future. Amidst the ever-changing dynamics of globalization, the ability to anticipate and understand future knowledge, otherwise known as tapping future knowledge, is crucial. Identifying and following the direction of scientific development is not just an option, but an urgent need to prepare the next generation to remain relevant and competitive. Thus, the ability to predict and master future knowledge will be one of the key factors in determining the progress of a nation. To achieve the strategic role of higher education in producing excellent and resilient

human resources, the Six-Sigma approach can be an effective framework in improving the quality and efficiency of the higher education system in Indonesia. Six-Sigma, which focuses on reducing variation and improving process consistency, can be applied to ensure that every stage in the education process-from curriculum to teaching to student services-is carried out to high quality standards.

By using Six-Sigma, higher education institutions can identify and eliminate bottlenecks or weaknesses in the system that hinders the achievement of graduate competencies. For example, the data-driven analysis at the core of Six-Sigma enables universities to deeply understand the needs of the labor market and align them with educational programs. This ensures that graduates not only master knowledge, but also possess relevant character, skills, and competencies, including critical thinking, innovation, and emotional intelligence. Furthermore, the continuous improvement principle of Six-Sigma encourages institutions to continuously improve their service quality, create a supportive learning environment, and integrate project-based learning and entrepreneurship training. Thus, Six-Sigma can be a strategic tool to produce graduates who are able to compete globally while pushing Indonesia out of the middle income trap.

The implementation of Six-Sigma in higher education cannot be separated from the role of various key variables that support its success. Variables such as human resources, infrastructure facilities, organizational culture, leadership, budget and financial resources, and stakeholder engagement have a significant contribution in creating an environment that supports the transformation of the education system.

- **Human resources**: Six-Sigma implementation requires faculty and staff who are competent, innovation-oriented, and skilled in analyzing data for evidence-based decision-making. By building human resource capacity through training and development, institutions can ensure that Six-Sigma processes are optimized. Looking at the current condition of Indonesia, one of the biggest challenges faced is the low quality of human resources. This is reflected in the data on the education level of the labour force, where 24.62% have the highest education at primary school level, 22.74% at junior high school level, and 30.22% at high school level. Meanwhile, only 10.15% have pursued higher education, and another 12.26% do not have a diploma (BPS, 2024). Qualified human resources (HR) play a key role in supporting Indonesia's progress.

Excellent human resources can utilize the potential of natural resources to build the nation's glory, reduce dependence on imports, make Indonesia a strong producer country, and encourage sustainable economic growth and get out of the middle income trap. In addition, reliable human resources also contribute to global competitiveness, the development of future science and technology, and the sustainable management of megacity trends without ignoring natural preservation.

- **Infrastructure facilities**: adequate infrastructure, including supporting technology and modern learning facilities, is an important foundation to support Six-Sigma implementation. An environment equipped with high-quality facilities allows the teaching-learning process to run more efficiently and effectively. Higher education in Indonesia must seriously develop STEAM (Science, Technology, Engineering, Arts, and Mathematics) fields to catch up with other developing and developed countries. To support the strengthening of science and technology, the government needs to strengthen existing universities or open new institutes of technology, as well as provide adequate research facilities and human resources. The government also needs to encourage more in-country postgraduate scholarships for master's and doctoral programs, so that universities can focus more on their research missions, which in turn will accelerate the down streaming of Indonesia's natural resource potential. This effort is needed to address the shortage of human resources in science and engineering, which is caused by the limited number of exact studies programs that tend to be more expensive to organize compared to social studies programs. One strategy that can be implemented is to require universities to open at least one study program in mathematics and natural sciences every time they open a medical or social science study program.
- **Organizational Culture**: An organizational culture that supports innovation, collaboration, and continuous improvement is keys to Six-Sigma success. Institutions should promote values that encourage openness to change and quality orientation. As part of the organizational culture, universities need to develop a relevant and up-to-date curriculum, covering the knowledge and skills needed to meet industry demands. This curriculum development process should involve data collected from various sources; including the results of labor market needs analysis and feedback from alumni, which is aligned with Six-Sigma principles to continuously improve the quality of learning. In

addition, an organizational culture that supports sustainability is also in line with the implementation of Six-Sigma, which encourages universities to integrate sustainability programs that include efficient management of natural resources, waste reduction, and promotion of environmental awareness as stipulated in the education policy enshrined in the constitution, especially as elaborated in the National Education System Law (Law No. 20 of 2003) and other related regulations, such as the Teachers and Lecturers Law (Law 14/2005), the Education Legal Entity Law (Law 9/2009), and the Higher Education Law (Law 12/2012), providing a strong legal foundation for the development of education in Indonesia as an organization.

- **Leadership:** Visionary leadership capable of steering the organization towards sustainable transformation is an essential element. Leaders must facilitate Six-Sigma implementation by providing strategic guidance, motivation, and support in managing change. Where we want our higher education to go will be greatly influenced by the policies of the leaders that have been taken and decided in relation to higher education. Indonesia's Vision 2045 has been formulated to portray Indonesia as a developed, modern country that is on par with global superpowers. This vision aims to improve the welfare of the people through improving the quality of human resources (HR), significant economic growth, and equitable distribution of development. This vision is supported by five main targets, namely per capita income on par with developed countries, poverty and inequality reduction, increased competitiveness of human resources, a greater global role, and reduced greenhouse gas emissions towards Net Zero Emission.
- **Budget and Financial Resources**: Sufficient financial resources are required to support the implementation of Six-Sigma programs, including training, infrastructure investment, and technology development. Budget efficiency must also be well managed to maximize the return on these investments. Education financing should be seen as a long-term investment that is as important as basic infrastructure development. The government needs to demonstrate a strong commitment to strengthening investment in the education sector, which includes supporting the expansion of scholarship programs, promoting culture, strengthening international universities, and developing research and innovation. As part of the effort to realize superior, innovative, integrity and competitive human resources for Golden Indonesia 2045, the government has allocated an education budget

of IDR 660.8 trillion or 20 per cent of the 2024 State Budget. The allocation consists of central government spending of IDR 237.3 trillion, transfers to regions of IDR 346.6 trillion, and investment financing of IDR 77.0 trillion, which includes endowment funds for pesantren, research, universities, and culture. The education budget in 2024 shows and increase compared to 2023, which was recorded at IDR 612.2 trillion.

- **Stakeholder Engagement**: stakeholder engagement, including students, faculty, industry, and government, ensures that Six-Sigma implementation is aligned with labor market needs and socio-economic developments. This engagement also helps in receiving relevant feedback for continuous improvement. To achieve a "Golden Indonesia" 2045, it has been agreed that synergies are needed involving various parties that support sustainability. The approach used is no longer limited to the triple-helix model involving government, business, and higher education, but has evolved into a hexa-helix, which includes a wider range of stakeholders, including government, business, higher education, NGOs (e.g. professional associations, THES, QSWorld, Webo, and others), mass media, and higher education-related communities (e.g. IKOMA). This is due to the fact that higher education accountability is not only determined by the government, especially the Ministry of Education, Culture and Research, but also by all the stakeholders mentioned above. Therefore, the higher education development strategy in order to achieve the Golden Indonesia 2045 needs to be supported by an ecosystem that involves all relevant parties.

5. NOVELTY FINDINGS OF THE DISSERTATION

This research makes a significant academic contribution by innovatively adapting Six Sigma methodologies - typically used in manufacturing and service industries - to the higher education sector, aiming to improve the sustainability and long-term viability of higher education institutions in Indonesia. By applying a systematic, data-driven approach to quality improvement, this research addresses a critical gap in the existing literature by demonstrating how Six Sigma principles can be effectively used to optimize academic quality, operational efficiency, and institutional governance in the higher education landscape. The main novelty of this research lies in its comprehensive and in-depth analysis of Six Sigma's potential role in driving sustainable educational practices, which differentiates it from previous studies that emphasize more on general quality improvement in education. Unlike conventional research that focuses on broader educational reforms, this research provides a targeted examination of Six Sigma as a structured framework for continuous quality improvement, supported by empirical evidence and contextualized to the specific challenges faced by Indonesian higher education institutions. In addition, this research offers a nuanced exploration of the barriers and opportunities associated with implementing Six Sigma in academic settings, an area that remains under-explored in scholarly discourse. By integrating key principles from quality management, higher education reform, and sustainability studies, this research contributes to the advancement of interdisciplinary scholarship in education management. Beyond its academic significance, this research carries important practical implications for policymakers, university administrators, and stakeholders seeking to improve institutional resilience and global competitiveness. The findings from this research have the potential to serve as a strategic foundation in driving national economic development, in line with Indonesia's long-term vision of a Golden Indonesia 2045. Through the enhancement of human capital capabilities and the establishment of strong and sustainable educational institutions, this research underscores the critical role of higher education in positioning Indonesia as a leading global economy in the future.

Additionally, by highlighting the necessity of ongoing evaluation and iterative improvement procedures, this study emphasizes the relationship between data-driven decision-making and sustainable educational progress. Through the use of empirical data, this study provides policymakers in higher education with specific recommendations, including the implementation

of performance indicators based on Six Sigma to improve curriculum relevance, promote institutional responsibility, and fortify research and innovation ecosystems. By doing thus, it contributes to the larger global conversation on quality assurance in higher education by offering a reproducible model that may be modified for use in various educational environments outside of Indonesia. Broadly speaking, this novelty also answers the research question, which is part of the hypothesis in this study as mention in introduction part show by table 9.

Table 9: Summary of Research Novelty

Six-Sigma's Contribution to Higher Education Sustainability	• Integrating Six Sigma **(SS)** to enhance operational efficiency and resource optimization in Indonesian higher education. • Utilizing DMAIC methodology to improve human resources management **(HR)**, infrastructure facilities utilization **(IF)**, and budgeting and financial **(BF)** efficiency for long-term sustainability. • Strengthening leadership **(LD)** and stakeholder engagement **(SE)** strategies through data-driven decision-making in sustainability initiatives.
Challenges in Implementing Six-Sigma in Higher Education	• Human resource **(HR)** constraints include resistance to change and lack of Six Sigma expertise. • Infrastructure **(IF)** and organizational culture **(OC)** challenges include outdated systems and limited integration of Six Sigma practices in academic and administrative processes. • Budgeting and financial **(BF)** constraints impacting the feasibility of Six-Sigma training and implementation. • Leadership **(LD)** and governance barriers, where organizational culture **(OC)** may hinder structured quality improvement efforts.
Measuring Sustainability Using Design for Six-Sigma (DFSS)	• Developing qualitative and quantitative metrics for sustainability **(SHE)** performance in higher education using DMAIC principles required. • Assessing human resources **(HR)** engagement, infrastructure facilities efficiency **(IF)**, budgeting and financial **(BF)** sustainability, stakeholder engagement **(SE)** and leadership **(LD)** effectiveness through Six-Sigma-based evaluation models. • Creating a predictive framework to forecast the long-term impact of sustainability **(SHE)** initiatives in higher education.

Sources: Based on own works, 2025

6. PRACTICAL APPLICAPIBILITY OF DISSERTATION

Based on the novelty description, there are four main recommendations for higher education policy in Indonesia that are relevant to the findings of this research by considering the results of data-based qualitative and robust analysis (quantitative) such as Six-Sigma, Fishbone diagram, DMAIC cycle findings (Define, Measure, Analyze, Improve, Control), SIPOC diagram synergized with SEM approach by utilizing Six-Sigma methodology to elaborate and answer research questions.

- University Mission Differentiation in Indonesia. Higher education has a strategic role in facing challenges through higher education, by making significant contributions in three main aspects. First, producing superior and resilient human resources (HR) as graduates who are ready to face global dynamics. Second, developing competent lecturers and academic staff to produce various innovations in science and technology (IPTEK). Third, acting as a guardian of national and human values. These three roles are interconnected, where lecturers are not only a key element in producing quality human resources but also a driving force in producing superior innovations that support the noble values of humanity and nationality. The major challenges of higher education include the creation of resilient human resources, increasing national innovation capacity, developing the nation's industrial and economic sectors, and preserving national and human values. To realize this, it is necessary to implement a mission differentiation policy for universities, which gives a specific mandate to each institution according to its role. With this approach, universities can focus more on carrying out their duties, both in strengthening human resources, developing innovation, improving the industrial, economic and health sectors, as well as in supporting the quality of primary and secondary education. This mission differentiation policy is expected to strengthen the contribution of higher education in various sectors of national development.
- Strengthening Science and Technology. To become a developed country with high innovation productivity, strengthening the STEAM (Science, Technology, Engineering, Arts, and Mathematics) field is a major capital that cannot be ignored. In order to realize this, the establishment of new technology institutes, including vocational education, as well as the strengthening of existing universities are strategic steps that need to be taken,

especially in areas outside Java. This is important given Indonesia's vast territory, the potential for great natural wealth, the significant population, and the inequality of development between regions. New institutes of technology act as a guarantee of the availability of a high skill-labor force to support the strengthening of the industrial sector in the face of rapid changes in the business environment, as well as supporting a knowledge-based economy. Strengthening existing universities can be done through the opening of strategic study programs, construction of research laboratory facilities, and cooperation with the industrial sector to utilize the potential of regional natural resources.

- Equitable Education Funding. Equitable funding plays a vital role in the recruitment, development, and retention of qualified faculty and staff by allocating resources for capacity-building programs such as training and advanced studies, thereby enhancing human resource competence across all regions, including underserved areas, to bridge gaps in educational quality. Additionally, adequate infrastructure, as a cornerstone of quality education, benefits from equitable funding by ensuring sufficient investment in state-of-the-art laboratories, libraries, and digital learning tools, particularly for universities in remote or underdeveloped regions, fostering inclusive learning environments and driving regional innovation and development. Furthermore, building a robust organizational culture requires targeted funding initiatives to promote collaboration, inclusivity, and continuous improvement, with alignment to Six-Sigma principles such as data-driven decision-making and quality enhancement, enabling operational excellence and addressing inequities in educational outcomes. Equitable funding also facilitates the development of strong leadership through well-funded training programs, equipping leaders with the skills to manage resources effectively and adapt to challenges such as regional disparities and evolving stakeholder expectations. Moreover, equitable funding ensures meaningful stakeholder engagement by providing institutions with resources to build partnerships with governments, industries, communities, and international actors, thereby enhancing educational relevance, bridging funding gaps, and supporting sustainable innovation. Through the structured methodology of Six-Sigma, funding allocation is optimized to reduce variability and inefficiencies, ensuring resources are distributed effectively to address disparities and improve educational

outcomes, ultimately supporting the vision of a sustainable, inclusive, and competitive higher education system in Indonesia.

- Autonomous Higher Education Policies. The concept of Autonomous Higher Education Policies, as explored in the study "Enhancing Sustainable Higher Education in Indonesia: Six-Sigma Approach," emphasizes the importance of granting universities greater flexibility in managing their resources, governance, and academic programs. This autonomy is recognized as a pivotal mechanism for fostering innovation, enhancing efficiency, and achieving long-term educational sustainability. The study integrates Six-Sigma principles to assess how autonomy interacts with key indicators, including human resources, infrastructure facilities, organizational culture, leadership, stakeholder engagement, and budgeting, thereby shaping a more robust and sustainable higher education ecosystem. By allowing institutions to implement tailored policies for human resources, such as recruitment, professional development, and retention, autonomy facilitates the creation of a skilled workforce aligned with institutional goals, with Six-Sigma ensuring data-driven improvements. In terms of infrastructure facilities, autonomous policies enable institutions to prioritize investments in critical areas like laboratories, libraries, and digital platforms, addressing regional disparities in access to quality education. Furthermore, autonomy promotes a strong organizational culture, fostering collaboration, inclusivity, and continuous improvement, in line with Six-Sigma's principles. It also empowers leadership, allowing university leaders to craft strategic visions, manage resources efficiently, and make decisions responsive to institutional challenges, all while ensuring operational excellence through Six-Sigma methodologies. Additionally, autonomy enhances stakeholder engagement, enabling universities to form impactful partnerships with governments, industries, and local communities, furthering innovation and educational relevance. Lastly, budgeting is optimized under autonomous policies, enabling institutions to allocate financial resources effectively to support areas that will have the most significant impact. Ultimately, the integration of Six-Sigma in the context of autonomous higher education policies provides a structured approach that enables institutions to achieve sustainability, address regional disparities, and enhance their global competitiveness, creating a more equitable and effective higher education system in Indonesia.

Overall, this study concludes that the application of Six-Sigma principles can significantly support the sustainability of higher education in Indonesia. The research findings show that Six-Sigma not only improves the efficiency and effectiveness of higher education management, but also affects various important aspects, such as human resources, infrastructure facilities, organizational culture, leadership, budget and financial resources, and stakeholder engagement. In particular, Six-Sigma plays a role in strengthening Human Resources management through data-driven policies for recruitment and development, which in turn improves the competence of lecturers and staff. The implementation of Six-Sigma also ensures a more efficient allocation of infrastructure resources, enabling colleges, especially in remote areas, to access better educational facilities and technology. In addition, Six-Sigma-based policies encourage the creation of an organizational culture that prioritizes collaboration, innovation and continuous improvement, ultimately improving college performance.

REFERENCES

Adina-Petruța, P., & Roxana, S. (2014). Integrating Six-Sigma with Quality Management Systems for the Development and Continuous Improvement of Higher Education Institutions. Elsevier BV. https://doi.org/10.1016/j.sbspro.2014.07.456

Allsop, D. B., Chelladurai, J. M., Kimball, E. R., Marks, L. D., & Hendricks, J. J. (2022). Qualitative Methods with Nvivo Software: A Practical Guide for Analyzing Qualitative Data. Psych, 4(2), 142–159. https://doi.org/10.3390/psych4020013

Ameen Abdulla, M. S., & Kavilal, E. G. (2022). Analytical Investigation of Higher Education Quality Improvement by Using Six Sigma Approach. High-tech and Innovation Journal, 3(2), 196–206. https://doi.org/10.28991/HIJ-2022-03-02-07

Barcia, K. F., Garcia-Castro, L., & Abad-Moran, J. (2022). Lean Six-Sigma Impact Analysis on Sustainability Using Partial Least Squares Structural Equation Modeling (PLS-SEM): A Literature Review. Sustainability (Switzerland). MDPI. https://doi.org/10.3390/su14053051

Bulmer, M. (1979). Concepts in the Analysis of Qualitative Data. The Sociological Review, 27(4), 651–677. https://doi.org/10.1111/j.1467-954X.1979.tb00354.x

Clemons, R., & Jance, M. (2024). Defining Quality in Higher Education and Identifying Opportunities for Improvement. Sage Open, 14(3)https://10.1177/21582440241271155

Cudney, E. A., Venuthurumilli, S. S. J., Materla, T., & Antony, J. (2020). Systematic review of Lean and Six Sigma approaches in higher education. Total Quality Management and Business Excellence, 31(3–4), 231–244. https://doi.org/10.1080/14783363.2017.1422977

da Silva, F. F., Filser, L. D., Juliani, F., & de Oliveira, O. J. (2018). Where to direct research in lean six sigma?: Bibliometric analysis, scientific gaps and trends on literature. International Journal of Lean Six Sigma, 9(3), 324–350. https://doi.org/10.1108/IJLSS-05-2017-0052

Davis, M., & Fifolt, M. (2018). Exploring employee perceptions of Six-Sigma as a change management program in higher education. Informa UK Limited. https://doi.org/10.1080/1360080x.2017.1377970

Elmassah, S., Biltagy, M., & Gamal, D. (2022). Framing the role of higher education in sustainable development: a case study analysis. International Journal of Sustainability in Higher Education, 23(2), 320–355. https://doi.org/10.1108/IJSHE-05-2020-0164

Findler, F., Schönherr, N., Lozano, R., Reider, D., & Martinuzzi, A. (2019). The impacts of higher education institutions on sustainable development: A review and conceptualization. *International Journal of Sustainability in Higher Education*. Emerald Group Holdings Ltd. https://doi.org/10.1108/IJSHE-07-2017-0114

Haerizadeh, M., & Sunder M, V. (2019). Impacts of Lean Six Sigma on improving a higher education system: a case study. International Journal of Quality and Reliability Management, 36(6), 983–998. https://doi.org/10.1108/IJQRM-07-2018-0198

Hahn, G. J., Doganaksoy, N., & Hoerl, R. (2000). The evolution of six sigma. Quality Engineering, 12(3), 317–326. https://doi.org/10.1080/08982110008962595

Hair, J. F., & Brunsveld, N. (2018). Essentials of business research methods. Essentials of Business Research Methods (pp. 1–507). Taylor and Francis. https://doi.org/10.4324/9780429203374

Jackson, K., Bazeley, P., & Bazeley, P. (2019). Qualitative Data Analysis with NVivo. SAGE.

Kumar, S., Satsangi, P. S., & Prajapati, D. R. (2013). Improvement of Sigma level of a foundry: A case study. TQM Journal, 25(1), 29–43. https://doi.org/10.1108/17542731311286414

Li, N., Laux, C. M., & Antony, J. (2019). How to use lean Six-Sigma methodology to improve service process in higher education. Emerald. https://doi.org/10.1108/ijlss-11-2018-0133

Malihah, E. (2015). An ideal Indonesian in an increasingly competitive world: Personal character and values required to realize a projected 2045 'Golden Indonesia.' Citizenship, Social and Economics Education. SAGE Publications Inc. https://doi.org/10.1177/2047173415597143

Mezmir, Esubalew Aman. (2020). Qualitative Data Analysis: An Overview of Data Reduction, Data Display and Interpretation. Research on Humanities and Social Sciences. https://doi.org/10.7176/rhss/10-21-02

Muraliraj, J., Zailani, S., Kuppusamy, S., & Santha, C. (2018). Annotated methodological review of Lean Six Sigma. International Journal of Lean Six Sigma. Emerald Group Publishing Ltd. https://doi.org/10.1108/IJLSS-04-2017-0028

Nguyen, T. D., Shih, M. H., Srivastava, D., Tirthapura, S., & Xu, B. (2021). Stratified random sampling from streaming and stored data. Distributed and Parallel Databases, 39(3), 665–710. https://doi.org/10.1007/s10619-020-07315-w

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. International Journal of Qualitative Methods, 16(1). https://doi.org/10.1177/1609406917733847

Ray, S., & Das, P. (2010). Six-Sigma project selection methodology. International Journal of Lean Six-Sigma, 1(4), 293–309. https://doi.org/10.1108/20401461011096078

Reosekar, R. S., & Pohekar, S. D. (2014). Six-Sigma methodology: A structured review.

International Journal of Lean Six-Sigma, 5(4), 392–422. https://doi.org/10.1108/IJLSS-12-2013-0059

Rosak-Szyrocka, J., & Tiwari, S. (2023). Structural Equation Modeling (SEM) to Test Sustainable Development in University 4.0 in the Ultra-Smart Society Era. Sustainability (Switzerland), 15(23). https://doi.org/10.3390/su152316167

Ruben, R. B., Vinodh S., & P, A. (2020). Development of structural equation model for Lean Six Sigma system incorporated with sustainability considerations. International Journal of Lean Six Sigma, 11(4), 687–710. https://doi.org/10.1108/IJLSS-11-2018-0123

Sabtu, S. H., & Matore, M. E. M. (2024). Systematic literature review on the implementation of the Six-Sigma approach in education. International Journal of Evaluation and Research in Education (IJERE), 13(1)https://10.11591/ijere.v13i1.26196

Salah, S., Rahim, A., & Carretero, J. A. (2010). The integration of Six Sigma and lean management. International Journal of Lean Six Sigma, 1(3), 249–274. https://doi.org/10.1108/20401461011075035

Serafini, P. G., Moura, J. M. de, Almeida, M. R. de, & Rezende, J. F. D. de. (2022). Sustainable Development Goals in Higher Education Institutions: A systematic literature review. Journal of Cleaner Production, 370. https://doi.org/10.1016/j.jclepro.2022.133473

Shokri, A. (2017). Quantitative analysis of Six-Sigma, Lean and Lean Six-Sigma research publications in last two decades. International Journal of Quality and Reliability Management. Emerald Group Publishing Ltd. https://doi.org/10.1108/IJQRM-07-2015-0096

Shinde, D. D., Ahirrao, S., & Prasad, R. (2018). Fishbone Diagram: Application to Identify the Root Causes of Student–Staff Problems in Technical Education. Wireless Personal Communications, 100(2), 653–664. https://doi.org/10.1007/s11277-018-5344-y

Stankalla, R., Koval, O., & Chromjakova, F. (2018). A review of critical success factors for the successful implementation of Lean Six Sigma and Six Sigma in manufacturing small and medium sized enterprises. Quality Engineering, 30(3), 453–468. https://doi.org/10.1080/08982112.2018.1448933

Sunder M., V., & Mahalingam, S. (2018). An empirical investigation of implementing Lean Six-Sigma in Higher Education Institutions. Emerald. https://doi.org/10.1108/ijqrm-05-2017-0098

Sunder M., V. and Antony, J. (2018), "A conceptual Lean Six Sigma framework for quality excellence in higher education institutions", International Journal of Quality & Reliability Management, Vol. 35 No. 4, pp. 857-874. https://doi.org/10.1108/IJQRM-01-2017-0002

Svensson, C., Antony, J., Ba-Essa, M., Bakhsh, M., & Albliwi, S. (2015). A Lean Six-Sigma program in higher education. Emerald. https://doi.org/10.1108/ijqrm-09-2014-0141

LIST OF PUBLICATION

UNIVERSITY of DEBRECEN

UNIVERSITY AND NATIONAL LIBRARY
UNIVERSITY OF DEBRECEN
H-4002 Egyetem tér 1, Debrecen
Phone: +3652/410-443, email: publikaciok@lib.unideb.hu

Registry number: DEENK/157/2025.PL
Subject: PhD Publication List

Candidate: Fitty Valdi Arie
Doctoral School: Doctoral School of Management and Business
MTMT ID: 10085750

List of publications related to the dissertation

Articles, studies (18)

1. Nagy, A. S., Tumiwa, J. R., **Arie, F. V.**, Erdey, L., Alsoud, A. R., Al-Dalahmeh, M.: A Meta-Analysis of the Impact of TOE Adoption on Smart Agriculture SMEs Performance.
   Plos One. 20 (2), 1-23, 2025. ISSN: 1932-6203.
   DOI: https://doi.org/10.1371/journal.pone.0310105
   IF: 2.9 (2023)

2. Nagy, A. S., Tumiwa, J. R., **Arie, F. V.**, Erdey, L.: An exploratory study of artificial intelligence adoption in higher education.
   Cogent Education. 11 (1), 1-15, 2024. ISSN: 2331-186X.
   DOI: https://doi.org/10.1080/2331186X.2024.2386892
   IF: 1.5 (2023)

3. **Arie, F. V.**, Kissiya, E.: Geopolitical Risk and Higher Education in Indonesia: A Systematic Literature Review.
   Cross-Cultural Management Journal. 26 (2), 139-153, 2024. ISSN: 2286-0452.
   DOI: http://dx.doi.org/10.70147/c26139153

4. **Arie, F. V.**, Nagy, A. S.: Emerging Automotive Sector in Hungary: A Comparative Study.
   Global Academic Journal of Economics and Business. 5 (4), 60-66, 2023. ISSN: 2706-9001.
   DOI: http://dx.doi.org/10.36348/gajeb.2023.v05i04.001

5. **Arie, F. V.**, Nagy, A. S.: Impact of Six Sigma on tourism industries performance in Indonesia: evidence from structural equation model.
   Analele Universitatii din Oradea. Stiinte economice = Annals of University of Oradea. Economic science. 32 (1), 33-42, 2023. ISSN: 1222-569X.

6. Nagy, A. S., **Arie, F. V.**: Panel estimating exports and imports of the automotive industry on economic growth: evidence of Austria, Hungary, and Romania.
   Network Intelligence Studies. 11 (22), 137-146, 2023. EISSN: 2344-1712.

7. Keintjem, K., Tulung, J. E., **Arie, F. V.**: Supply Chain Analysis of Copra in Pakuure Village Tenga of South Minahasa.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 11 (1), 204-212, 2023. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v11i1.45000

8. **Arie, F. V.**, Nagy, A. S.: Sustainability of independent campus policy in Indonesia: is higher education more efficient and effective?
In: EDULEARN23 : 15th International Conference on Education and New Learning Technologies : Conference Proceedings. Szerk.: Luis Gómez Chova, Chelo González Martínez, Joanna Lees, International Academy of Technology, Education and Development, Valencia, 293-300, 2023.

9. Rawung, C. G., Lapian, S. L. H. V. J., **Arie, F. V.**: The effect of halal label, product quality, and price on consumer loyalty of chicken meat at Golden Supermarket Manado.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 11 (1), 613-624, 2023. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v11i1.45725

10. Binowo, M., Worang, F. G., **Arie, F. V.**: The effect of service quality elements on customer satisfaction at BRI unit UNSRAT Manado.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 11 (1), 645-655, 2023. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v11i1.45999

11. Worotikan, D. A., Tumbuan, W. J. F. A., **Arie, F. V.**: The Impact of Workload, Reward and Work Environment On Employees Productivity Of Ud. Rodamas.
Jurnal EMBA: Jurnal riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 11 (3), 902-912, 2023. ISSN: 2303-1174.
DOI: https://doi.org/10.35794/emba.v11i3.50024

12. Lydda, J. Y. E., Saerang, D. P. E., **Arie, F. V.**: The influence of product placement and influencer marketing towards brand awareness in Manado.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 11 (1), 98-107, 2023. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v11i1.45658

13. Lengkong, A. G., Mangantar, M., **Arie, F. V.**: The influence of service quality and consumer trust towards customer satisfaction on shopee in Manado.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 11 (2), 1-10, 2023. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v11i02.47537

14. Indrawan, Y. P., Tulung, J. E., **Arie, F. V.**: The Effectiveness of Facebook Advertising on Consumer Purchase Intention on Millennial Generation in Manado.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 10 (3), 184-192, 2022. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v10i3.41628

15. Poniskori, Y. I., Mangantar, M., **Arie, F. V.**: The factor influencing impulse buying of Sam Ratulangi University students at Mr. D.I.Y Manado Town Square.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 10 (3), 605-614, 2022. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v10i3.42430

16. Londa, D. R., Worang, F. G., **Arie, F. V.**: The Influence of Perceived Credibility, Perceived Ease of Use, and Perceived Usefulness toward Customer Satisfaction in Using BSGtouch.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 10 (4), 934-945, 2022. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v10i1.37674

17. Afifah, L. I. N., Worang, F. G., **Arie, F. V.**: The Influences of E-Wom of Reference Group And Instagram Influencer toward Wardah And Maybelline Brand Image.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 10 (1), 143-151, 2022. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v10i1.37674

18. Parengkuan, V. J. J., Tulung, J. E., **Arie, F. V.**: Influence of product placement in movies and television programs towards brand recall of millennials.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 8 (1), 2085-2094, 2020. ISSN: 2303-1174.

List of other publications

Articles, studies (6)

19. Julianto,, **Arie, F. V.**: Does the Core Capital Requirement Affect Bank Performance?
SEA: Practical Application of Scienc. 13 (37), 15-24, 2025. EISSN: 2360-2554.
DOI: http://dx.doi.org/10.70147/s371524

20. **Arie, F. V.**, Nagy, A. S., Dhita, W. P.: Exploring the Social-Economic Approach on the Production Level of Rice: Panel Data Analysis from 34 Province in Indonesia.
SEA: Practical Application of Science. 12 (36), 243-255, 2024. EISSN: 2360-2554.
DOI: http://dx.doi.org/10.70147/s36243255

21. Tampi, J. L. A., Tulung, J. E., **Arie, F. V.**: Determinants affecting the intention to use e-wallet during Covid-19 in Manado.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 11 (1), 1094-1105, 2023. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v11i1.47133

22. Bacharudin, A. M., Massie, J. D., **Arie, F. V.**: Financial Performance Analysis of PT. Pegadaian Cabang Bisnis Mikro Manado Selatan before and During Financial Restructuring.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 11 (4), 173-182, 2023. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v11i1.45657

23. Engka, N. H. J., Tulung, J. E., **Arie, F. V.**: Exploring the Emergence of Online Games and the Impact to Other Conventional Gaming Platforms in Manado.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 9 (4), 43-52, 2021. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v9i4.36132

24. Dewantara, I. M. J., **Arie, F. V.**: Importance and Performance Analysis of Hotel Selection Factors at Four Points by Sheraton Manado.
Jurnal EMBA : Jurnal Riset Ekonomi, Manajemen, Bisnis dan Akuntansi. 7 (4), 5870-5878, 2019. ISSN: 2303-1174.
DOI: http://dx.doi.org/10.35794/emba.v7i4.26522

Total IF of journals (all publications): 4,4
Total IF of journals (publications related to the dissertation): 4,4

The Candidate's publication data submitted to the Tudóstér have been validated by DEENK on the basis of the Journal Citation Report (Impact Factor) database.

23 April, 2025