Education in the Mirror of Institutions: A Systematic Review of Service Quality and Character

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Abstract
Transformation of higher education services demands the integration of digital services and institutional character in facing the challenges of accessibility, inclusion, and digitalization. This study examines the effectiveness of Service Quality and E-Service Quality models in academic and administrative services, the methodological challenges of using Analytical Hierarchy Process (AHP), Fuzzy Logic, and Importance Performance Analysis (IPA), and the role of institutional characteristics as mediators or moderators of student satisfaction and trust. This study uses a Population, Intervention, Comparator, Outcomes, and Context (PICOC) + Urgency of research and research motivation (UM) -based SLR approach to examine higher education services. Through the synthesis of 26 selected articles (2022–2025), multicriteria analysis such as AHP, Fuzzy, IPA reveals supporting factors, service effectiveness, and institutional contributions to its transformation. This study builds the Framework of Service Quality Impact in Higher Education Institutions (FSQIHEI) model to transform higher education digital services through the integration of AHP, Fuzzy, and IPA. Its contributions include literature mapping 2023–2025, emphasis on Service Quality, and differentiation of service strategies between public and private universities. Institutional characteristics are introduced as important variables in measuring student satisfaction and trust in a sustainable manner. This study includes an institutional characteristics-based FSQIHEI model, strengthening the Service Quality literature, and offering an evaluative approach to digital higher education services that is responsive, measurable, and contextual.

Keywords: E-Service Quality, Higher Education, Institutional Characteristics, Cognitive, Student Trust.

Introduction

The quality and character of higher education services, it is important to place accessibility as a strategic dimension in institutional evaluation (Araujo et al., 2012; Nisar, 2015; Pedrosa et al., 2025; Salazar, 2022). A global interactive map displaying educational institutions based on accessibility-related curricula opens up a discussion about how educational services can be assessed not only from an academic perspective, but also from a commitment to social inclusion (Alhasnawi et al., 2023; Boitier & Rivière, 2013; Hanada, 2013; Jahromi & Jahromi, 2021; Rahman & Nasrin, 2024a; Rhoades, 2016; Soria-barreto et al., 2017). This discourse leads to the understanding that service quality is not only measured by overall student satisfaction, but also by the extent to which educational institutions integrate accessibility values, both in learning design, technological support, and institutional policies (AccessCoVE, 2025).

Various universities in Spain, such as Universidad Complutense and Universidad Autónoma de Barcelona, demonstrate a strong commitment to issues of social integration and disability through their Spanish-language graduate and undergraduate programs, focusing on accessibility, the environment, inclusion, and multidisciplinary social interventions (Liu et al., 2023; Zouine et al., 2024). The need to evaluate higher education services lies not only in fulfilling the aspects of accessibility and inclusion, but also in how institutions respond to the challenges of digital transformation holistically (Ghulam & Mousa, 2019; Kosman et al., 2024; Ponomarenko, 2022). This requires strengthening institutional capacity to manage the dynamics between service quality and institutional character, especially amidst the

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acceleration of digitalization, which has revealed disparities in implementation across universities (Ortagus, 2023; Rahman & Nasrin, 2024a).

The transformation of higher education services in the digital era shows a complex dynamic between service quality and institutional character (Dougherty, 2015; Wider et al., 2024a). Various empirical observations of academic and administrative service practices in higher education institutions, both public and private, have revealed significant variations in the effectiveness of digitalization implementation, which appears to be influenced by factors such as technological support, management flexibility, the need for students to have a business spirit, and stakeholder involvement (Altynbassov et al., 2024; Gaspar Pacheco et al., 2024; Romero-Lora et al., 2024).

Amidst the acceleration of digitalization and the complexity of higher education management, the quality of services—both in person and online (e-service)—is a primary concern for educational institutions (Rahman & Nasrin, 2024a; Wider et al., 2024a). However, in reality, many universities are still unable to optimize the implementation of the Service Quality and E-Service Quality models to support the effectiveness of academic and administrative services as a whole (Maghfiroh & Badi, 2025; Prastyabudi et al., 2024). Although a number of supporting factors such as technological infrastructure, internal quality policies, and human resource competencies are available, strategic integration of digital services is still partial and not yet systematic (Borsatto et al., 2024; Khan Eusafzai, 2024).

This indicates a gap between the potential for a quality service model and the reality of its implementation (Casper & Henry, 2001; Said et al., 2024). Furthermore, analytical approaches such as Analytic Hierarchy Process (AHP), fuzzy logic, and Importance-Performance Analysis (IPA) are starting to be widely used in managerial decision-making related to service quality (Aulia et al., 2024; H. V. Nguyen et al., 2024; P. H. Nguyen, 2021; van der Stap et al., 2024)However, practice in the field shows that many institutions face challenges in terms of limited data, technical understanding of the method users, and doubts about the validity of the analysis results when applied to services that are dynamic and subjective (Guillén Perales et al., 2024; Kotima et al., 2024). This is exacerbated by the lack of analytical capabilities at the managerial level and the absence of applicable standard guidelines (Fakir Mohammad et al., 2024). On the other hand, the differences in characteristics between state and private universities create diverse conditions in terms of challenges and supporting factors for improving the quality of services (Firman, 2024; Pan et al., 2024).

Public institutions tend to have longer bureaucracies, while private institutions face high competitive pressures to maintain student satisfaction as their primary customers. Unfortunately, little research has explored how these institutional characteristics mediate students' cognitive trust and perceptions of service quality. This creates an urgency to explore these differences more deeply and contextually within a coherent conceptual framework. Although the Service Quality and E-Service Quality models have been widely discussed, there is still a lack of research integrating the two to understand the effectiveness of academic and administrative services in the context of higher education digitalization, especially in identifying enabling factors empirically.

This study is closely related to higher education in the field of engineering and STEM disciplines, where the effectiveness of academic and administrative services is crucial for supporting complex learning processes, laboratory management, and digital-based technical education. In technical and STEM programs, students rely heavily on efficient service systems for course registration, access to laboratory resources, guidance in research projects, and timely feedback on assessments. However, inconsistencies in service quality, uneven digital infrastructure, and differences in institutional practices between public and private universities often hinder student satisfaction and reduce cognitive trust in the institution. The research problem addressed in this study is the lack of a comprehensive framework that integrates both service quality and institutional characteristics in evaluating academic and administrative services specifically within the context of STEM-focused higher education. By systematically reviewing literature from 2023 to 2025 and analyzing factors such as digital readiness, human resource competence, and management support, this study identifies the key enablers and barriers affecting service effectiveness. The research also applies quantitative evaluation methods, including AHP, Fuzzy Logic, and the Best-Worst Method, to provide a structured and evidence-based assessment of service quality. This approach ensures that the findings are directly applicable to technical and STEM education programs, guiding universities in designing adaptive, digitalized, and high-quality service systems that enhance student learning experiences, satisfaction, and trust in the institution.

Furthermore, measurement approaches such as AHP, Fuzzy Logic, and Importance-Performance Analysis (IPA) are often used separately, even though methodological challenges and data uncertainty require a combination of approaches to produce precise strategic decisions. Furthermore, research that differentiates between public and private institutions in the context of educational services is also limited, particularly in examining how institutional characteristics can act as mediators or moderators of student satisfaction and cognitive trust. Therefore, further exploration of institutional dynamics and the quality of higher education services is needed. This study draws on literature data collection and observations of phenomena to identify recurring patterns that have not been systematically discussed. From these patterns, the research builds new

generalizations about the relationship between digital service quality and educational institution characteristics (Table 1).

The analysis of the three Research Questions provides significant contributions both theoretically and practically. Theoretically, this study broadens the understanding of the integration of Service Quality and E-Service Quality models in the context of digitalization of higher education services, while filling the gap in the literature regarding the influence of institutional characteristics as mediators or moderators on perceived service quality. The methodological approach that combines AHP, Fuzzy Logic, and IPA also provides a more precise evaluation framework in dealing with the complexity of perception data. Practically, these findings can be the basis for strategic decision-making by higher education management in designing adaptive, inclusive, and data-driven academic and administrative services, especially in managing sustainable digital transformation and increasing student satisfaction and trust as key stakeholders.

Research Methods

Research Design

This research design follows a structured and step-by-step Systematic Literature Review (SLR) approach (Oti & Pitt, 2021; Salazar, 2022). The primary objective is to identify trends, methodological contributions, and research gaps in the digitalization of education services. SLR was chosen because it provides a comprehensive synthesis of existing literature with rigorous standards and high replicability, ensuring scientifically sound results (Varghese, 2018).

Quality Standards Research Question

The standard quality approach of Research Question (RQ) using Population, Intervention, Comparator, Outcomes, and Context (PICOC) + Urgency of research and research motivation (UM) is used to compile a literature review systematically and strategically precisely (Wahono, 2015). The framework serves as a sharp focus of the study, starting from who is being studied, the intervention or method used, relevant comparators, and the expected outcomes in the specific context of higher education. By adding elements of urgency and motivation, this approach strengthens the scientific and practical rationale for the research, ensuring its relevance and contribution to gaps in the previous literature, while increasing the accuracy of the literature selection and the validity of the synthesis of findings (Table 2).

Search Strategy

The literature search strategy in this study was systematically designed to ensure relevance, up-to-date coverage, and strong academic contributions to the topic of digital education service quality. The search period focused on 2022 to 2025 to capture the latest developments and current trends in service

Table 1. Research Questions, Motivation and Urgency

ID	Research Question	Motivation	Urgency
RQ1.	How do the Service Quality and E-Service Quality models contribute to improving the effectiveness of academic and administrative services in higher education, and what factors play a significant role as enablers in the service digitalization process?	There is an urgent need to understand the realistic contribution of higher education service quality models in identifying key success factors towards the digital transformation of institutions.	Mapping of supporting factors and the effectiveness of academic services and the role of more efficient administrative activities.
RQ2.	What are the methodological and practical challenges in applying AHP, Fuzzy Logic, and Importance-Performance Analysis (IPA) methods to measure and evaluate perceived quality of educational services, and how does data uncertainty affect the validity of strategic decision-making? and	The complexity of perception data as a challenge to improve accuracy and in-depth validation of methodological limitations and strategic uncertainty solutions for greater precision.	Building strategic decisions on data, facts and a framework to ensure data-based policy evaluation.
RQ3.	To what extent do differences in supporting and inhibiting factors for service quality occur between private and public higher education institutions, and how do institutional characteristics act as mediators or moderators in influencing student satisfaction and cognitive trust?	Educational institutions really need to consider the service quality model, which will enrich institutional factors in mediating or moderating perceptions and expectations empirically.	An in-depth exploration of institutional status in the dynamics of higher education service quality.

Table 2. PICOC + UM Model

ID	Population (P)	Intervention (I)	Comparator (C)	Outcomes (O)	Context (C)	Agency	Motivation
RQ 1	Higher education institutions	Implementation of Service Quality and E-Service Quality models	Institutions without a service digitalization strategy	Effectiveness of academic and administrative services, identification of digitalization enabler factors	Digital transformation of higher education services	Mapping of supporting factors and the effectiveness of academic services and the role of more efficient administrative activities.	There is an urgent need to understand the realistic contribution of higher education service quality models in identifying key success factors towards the digital transformation of institutions.
RQ 2	Users and managers of educational services	Use of the Analytical Hierarchy Process (AHP), Fuzzy Logic, and Importance-Performance Analysis (IPA) methods	Non-multicriteria or intuition-based evaluation methods	Accuracy of service quality perception measurement, validity of strategic decisions	Data-based quality evaluation in educational services	Building strategic decisions on data, facts and a framework to ensure data-based policy evaluation.	The complexity of perception data as a challenge to improve accuracy and in-depth validation of methodological limitations and strategic uncertainty solutions for greater precision.
RQ 3	Private and state universities	Analysis of the role of supporting/inhibiting factors and institutional characteristics	Institutions without considering institutional characteristics	Level of student satisfaction and cognitive trust, the influence of institutional mediation/moderation	Comparison of service quality between types of institutions	An in-depth exploration of institutional status in the dynamics of higher education service quality.	Educational institutions really need to consider the service quality model, which will enrich institutional factors in mediating or moderating perceptions and expectations empirically.

Source: Abusaeed et al., 2023; Vahedi et al., 2023; Wahono, 2015

quality measurement and digitalization in the higher education sector. The search was conducted using Boolean operators combining several key terms, namely:

("Service Quality" OR "E-Service Quality" OR "Servqual Model" OR "Fuzzy Control System" OR "AHP" OR "Fuzzy" OR "Best Worst Method" OR "Importance Performance Analysis") AND ("Higher Education" OR "Private Higher Education Institutions" OR "Public Secondary Schools" OR "Educational Services" OR "In-Service Education" OR "Education Delivery" OR "Education Policy" OR "Quality Education") AND ("Customer Satisfaction" OR "Consumer Satisfaction" OR "Cognitive Trust" OR "Satisfaction" OR "Attitudes") AND ("Cross Border E-Commerce").

This keyword filter was selected to capture quantitative and multi-criteria approaches such as AHP, Fuzzy Logic, BWM, and IPA, as well as the dimensions of user satisfaction and cognitive trust in the digital transformation of education. Furthermore, the incorporation of terms such as Cross-Border E-Commerce aims to explore cross-border digital service models and their adaptability in education. The identified literature comes from various selected journals and is relevant to the topic, including:

1. Acta Psychologica (76th Percentile), access link: https://www.scopus.com/sourceid/29424.
2. Expert Systems with Applications (96th Percentile), access link: https://www.scopus.com/sourceid/24201.
3. Heliyon (82nd Percentile), access link:https://www.scopus.com/sourceid/21100411756.
4. Journal of Cleaner Production (98th Percentile), access link: https://www.scopus.com/sourceid/19167.
5. Plos ONE (89th Percentile), access link: https://www.scopus.com/sourceid/106001533009.
6. Nurse Education Today (96th Percentile), access link: https://www.scopus.com/sourceid/28806.
7. Journal of Management and Innovation (Manova) (SINTA 4), access link: https://sinta.kemdikbud.go.id/journals/profile/8009.

The seven journals reflect a diverse range of disciplines, from service psychology and intelligent systems to open innovation and higher education policy. These journals were selected to accommodate a multidisciplinary approach and ensure the inclusion of

empirical and conceptual research from a variety of global and local perspectives.

Data Extraction and Synthesis

The data extraction and synthesis process was carried out systematically by considering inclusion and exclusion criteria, such as publication year 2022–2025, indexed documents, language, topic relevance, higher education focus, quantitative methodological approach, and relevance to the digitalization of education services (Table 3).

Table 3. Study Inclusion and Exclusion Criteria

No	Selection Category	Inclusion Criteria	Exclusion Criteria
1	Publication Year	Articles published between 2022 and 2025	Articles published before 2022
2	Document Type	Indexed scientific journal articles (Scopus and SINTA)	Opinions, editorials, blogs, proceedings without peer review
3	Language	Written in English or Indonesian	Articles in languages other than English and Indonesian
4	Topic Relevance	Studies that discuss Service Quality, E-Service Quality, AHP, Fuzzy, IPA	Studies outside the context of service quality or not related to education
5	Subject of Study	Focus on higher education, both public and private and the service industry sector.	A study that only discusses service, not physical products.
6	Data & Methods	Using quantitative, multicriteria, or combination methods	Narrative or descriptive studies without a clear methodological approach
7	Digital Context	Discussing aspects of digitalization of services in educational institutions	Does not discuss digital or technology-based services

Source: researcher processing

Systematic Research Flow

The systematic flow of the Systematic Literature Review (SLR) process, based on bibliometrics and visual analysis, focused on the topic of higher education services, specifically related to Service Quality, E-Service Quality, AHP, Fuzzy Logic, and Science. This process began with data collection through two major digital platforms, namely Scopus and SINTA, with a publication year range of 2022 to 2025, and language restrictions of English and Indonesian. All documents were searched using a structured search query, covering the full text of the abstract, introduction, methods, results, and conclusions. From the initial search results, a total of 192 articles were declared eligible. Then, a manual screening process was carried out by the authors in two stages: the first stage involved selection based on title, abstract, future research, and statistical modeling approach, leaving 54 articles. The second stage involved screening based on keyword matching, the presence of a relevant theoretical framework, and a focus on the service industry sector, resulting in 26 final articles as the main sample of the study. Next, the bibliometric mapping and visualization process was carried out with the help of RStudio and VOSviewer, which included analysis of author productivity, number of articles, publisher sources, publication trends, network visualization, and scientific contribution topics. This process was also supported by Excel and SPSS for descriptive data normalization and precise presentation. The final results include data visualization and synthesis used to answer three main research questions (RQ1, RQ2, and RQ3), as well as providing further research directions based on empirical trends and recent scientific contributions in the field of digital transformation of higher education services (Figure 1).

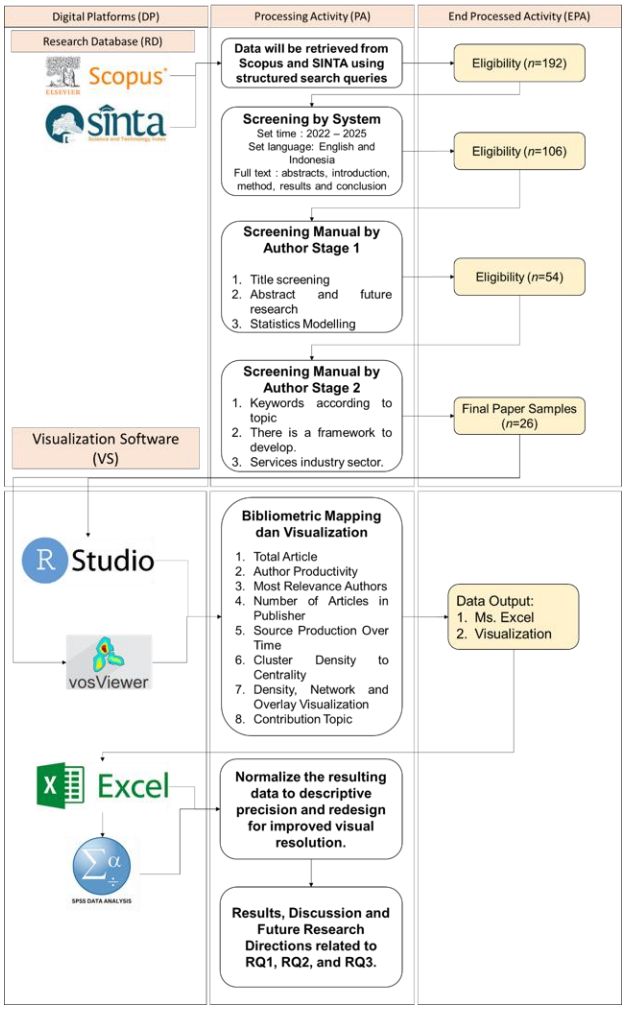


Figure 1. Research methodology (Source: researcher processing)

Result and Discussion

Research Results

RQ1. How do the Service Quality and E-Service Quality models contribute to improving the effectiveness of academic and administrative services in higher education, and what factors significantly act as enablers in the context of service digitalization?

The contribution of Service Quality and E-Service Quality models in improving the effectiveness of academic and administrative services in higher education.

Number of articles from 2022 to 2025, accompanied by predictions up to 2030 using a linear forecasting approach (Fuaddi & Pradana, 2024; Harsito et al., 2024; Idogho et al., 2025). A significant increase from 5 articles in 2022 to 26 articles in 2025, and is expected to stabilize at 7–8 articles per year until 2030. Improving services through digitalization in higher education is a theme that is increasingly attracting the attention of researchers, reflecting the need for a more efficient and adaptive service system. The urgency and potential for sustainable research in the domains of Service Quality and E-Service Quality, especially in digital-based academic and administrative services. This prediction is an indicator that the aspect of service effectiveness through a digitalization approach will be an important topic in the future.

The authors, Nadlifatin R, Ong Aks, Persada SF, and Prasetyo YT, each contributed three articles. These four researchers discuss various strategic aspects, such as the influence of technology support, human resource competency, and student trust in digital campus service systems. Their review of the articles reinforces the understanding that factors such as digital infrastructure readiness and the quality of service interactions are crucial and must be prioritized in developing modern service models.

Author productivity is based on Lotka's principle, where the majority of authors (over 96%) only authored one article. This topic remains open for further exploration and has the potential to become a growing research area. The lack of author dominance also provides an opportunity for new research to offer meaningful contributions, particularly in testing service models that are more relevant to the needs of local institutions.

Distribution of articles by publisher. Heliyon was the most productive journal (34.62%), followed by Social Sciences and Humanities Open (11.54%), while other journals contributed equally. This distribution demonstrates that the themes of digitalization and service quality touch various disciplines, from educational management to information technology, indicating the need for a multidimensional approach to developing a comprehensive service model in higher education.

The sharp increase from 2022 to 2025 suggests that academic attention to technology-based service quality continues to grow, and this topic holds strong appeal for further in-depth study. This fact reinforces the relevance of the research question posed: how service quality, both physical and digital, plays a role in enhancing student satisfaction and institutional effectiveness.

These findings reinforce the importance of examining digitally integrated educational service models. This research not only contributes to the development of modern service theory but also provides an empirical basis for formulating policies to improve campus service quality more clearly and measurably (Figure 2).

The Service Quality and E-Service Quality models have proven to be strategic approaches for measuring, evaluating, and improving the effectiveness of services in higher education, both in academic (registration, assessment, guidance) and administrative (financial services, personnel, IT support). Their contribution is evident in increased student satisfaction, operational efficiency, and increased trust in the campus's digital systems.

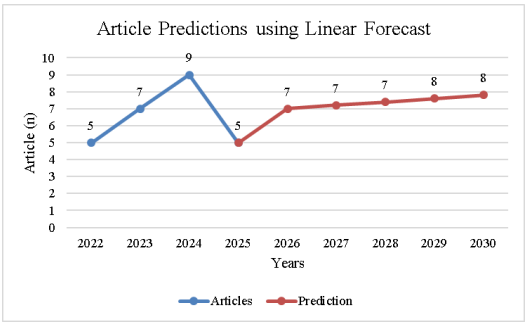
In Service Quality and E-Service Quality, effectiveness is greatly influenced by key enabler factors such as:

a. Availability of information technology and digital systems.
b. Competence of academic staff.
c. Supporting learning infrastructure.
d. Management support for service improvement.
e. Curriculum alignment with industry needs

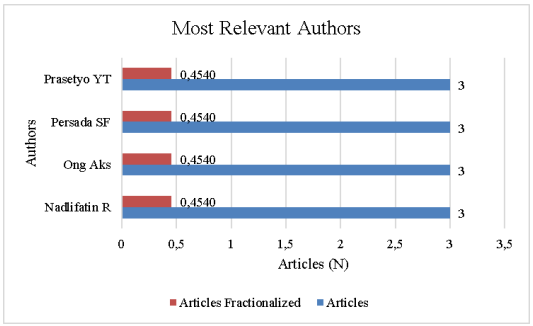
Meanwhile, there are also barriers to the effectiveness of services in higher education, such as:

a. Lack of staff training.
b. Limited operational funding.
c. Resistance to digital transformation.
d. Unclear service procedures (SOPs).
e. Unequal access to services across departments.

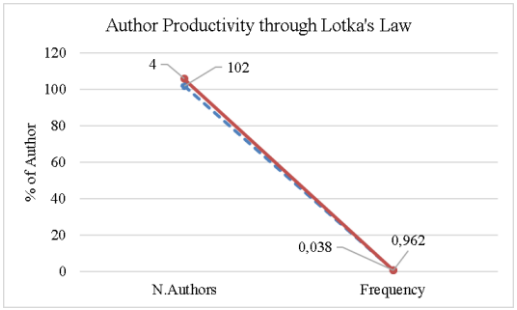
Research by Nadlifatin et al. underscores the importance of technological support, user trust, and a multidimensional approach to service models (Ong et al., 2022, 2023). Furthermore, the wide distribution of publications in journals such as Heliyon and Social Sciences and Humanities Open reflects the interdisciplinary nature of this study, combining service management, information technology, and education policy. Theoretically, this trend strengthens the position of the Service Quality and E-Service Quality models as important frameworks for defining performance indicators for digital-based education services. Practically, this data supports the urgency of campus service reform toward a responsive, inclusive, and standardized digital system. In other words, answering this research question not only explores the contribution of digital service models but also formulates strategies to strengthen institutional capabilities in facing the era of digital transformation in the higher education sector.



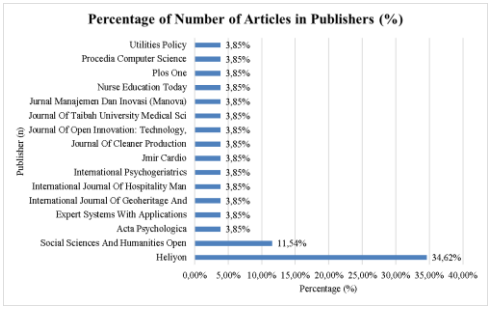
(a) Article Predictions using Linear Forecast



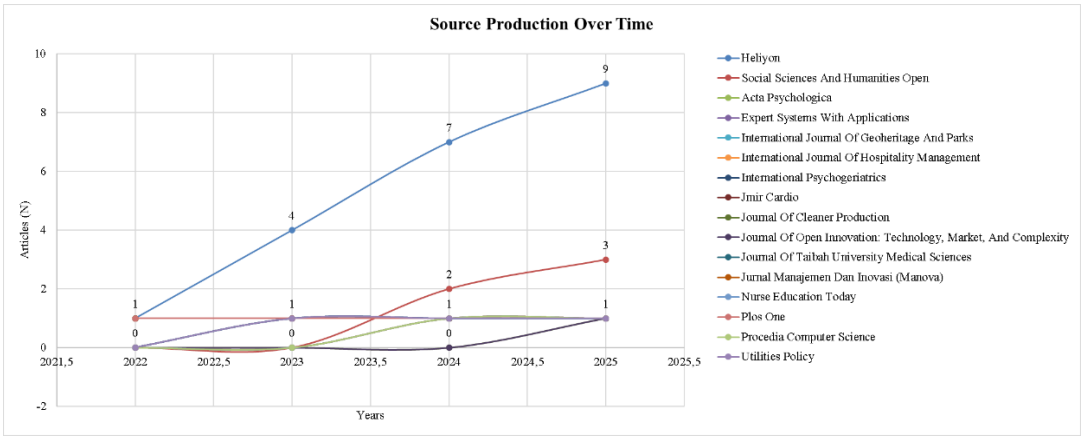
(b) Most Relevant Authors



(c) Author Productivity through Lotka's Law



(d) Percentage of Number of Articles in Publishers (%)



(e) Source Production Over Time

Figure 2. Article Predictions, Key Authors, Productivity, and Publication Trends (Source: Data processing, 2025)

Major Proposition: The Service Quality and E-Service Quality models are strategic foundations for improving the effectiveness of academic and administrative services through adaptive and sustainable digitalization.

Minor Proposition:

a. The surge in publications between 2022–2025 reflects academic urgency regarding the quality of digital services in higher education.
b. The effectiveness of digital services is largely determined by technological readiness, HR competency, and managerial support as key enablers.
c. Barriers such as lack of training, limited funding, and resistance to change are crucial challenges in digital service transformation.

RQ2. What are the methodological and practical challenges faced in applying the AHP, Fuzzy Logic, and IPA methods in measuring and evaluating the perception of the quality of educational services, and how does data uncertainty affect the validity of strategic decisions?

A search of research trends related to service quality shows that this topic is a major focus in the scientific literature, with the highest frequency of occurrence at 24 times. The primary focus is on the measurement and evaluation of service quality applied in various sectors, including digital banking, logistics, tourism, education, and healthcare. The significance of this term is reflected in the Callon Centrality value of 0.1 and Callon Density of 32.6, as well as the cluster frequency of 35.0. This indicates that the issue of service quality has a strong relationship with other topics and also serves as a pivot for various analytical approaches.

The first group in the mapping shows the dominance of the term “Service Quality,” which is examined from both face-to-face and digital service

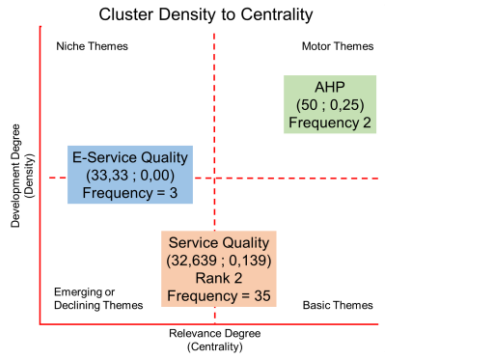
perspectives. It includes terms such as “Higher Education” (appearing six times) and “satisfaction” (three times), indicating the researchers’ focus on user perceptions and their relationship to institutional service quality.

Meanwhile, the digital services category, or "E-Service Quality," emerged as a stand-alone entity with a word density of 33.3, despite its low network centrality. This indicates that this topic has developed relatively independently in the literature, but is not yet closely connected to other domains (Figure 3).

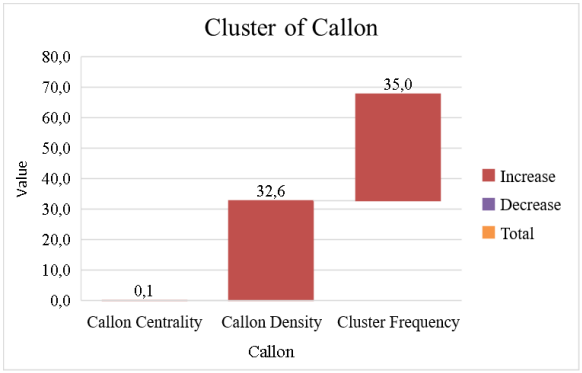
More specific and methodological topics, such as "AHP" (Analytic Hierarchy Process), form their own cluster. Although it only appears twice, its Callon Centrality value of 0.3 and density of 50.0 demonstrate the importance of this approach in systematically structuring and weighting service quality elements.

In several recent publications, the combination of AHP and SERVQUAL methods appears prominently. For example, the study by Bhattacharya et al., with DOI 10.1016/j.ijgeop.2023.04.001 applied AHP-SERVQUAL integration to assess tourism service quality in India, with the highest AHP score (0.92) compared to other dimensions (Bhattacharya et al., 2023). Meanwhile, research by Adiningtyas et al., in the Procedia Computer Science journal shows the strength of e-service quality (0.89) in measuring user sentiment towards mobile banking services (Adiningtyas & Auliani, 2024).

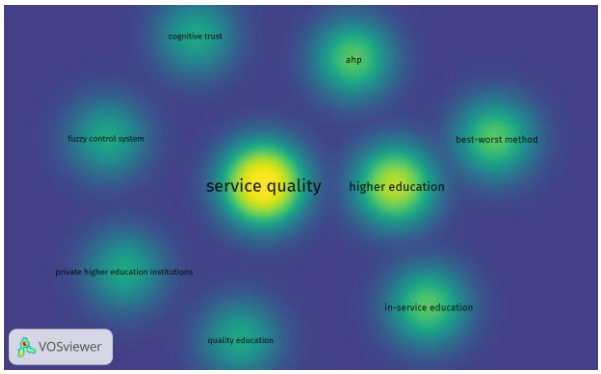
The topic of customer satisfaction, although only recorded three times, still plays a crucial role as a bridge between user perception and service success. In several studies, satisfaction serves as a mediating variable linking service quality and customer loyalty or repurchase intentions, as seen in the research by Hui et al. (Hui et al., 2025) nor Ayvaz-Çavdaroğlu et al (Ayvaz-Çavdaroğlu et al., 2024).



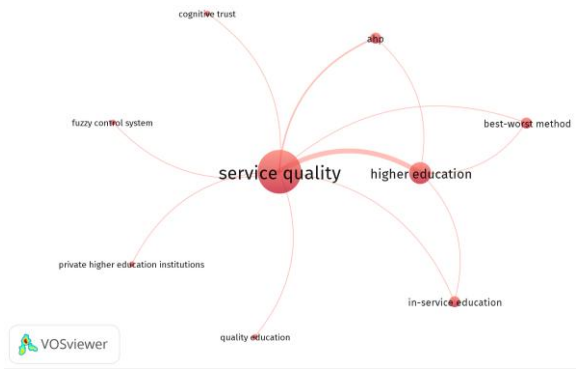
(a) Cluster Density to Centrality



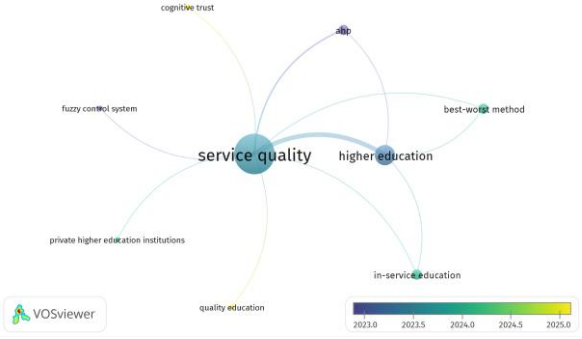
(b) Cluster of Callon



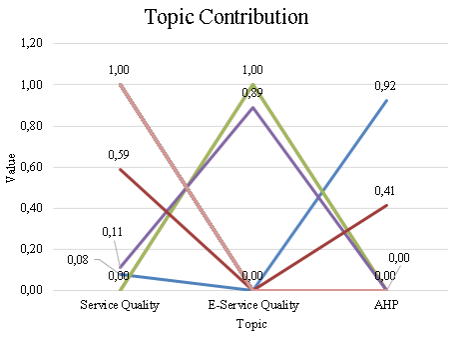
(c) Density Visualization



(d) Network Visualization



(e) Overlay Visualization



(f) Topic Contribution

Figure 3. Visualization of clusters, density, centrality, network, overlay, topic contribution and Callon structure (Source: Data processing, 2025)

Density visualization, where areas with yellow intensity indicate high frequency of occurrence of terms—indicating that "service quality" is the most dominant term. Terms such as "higher education," "fuzzy control system," "AHP," and "best-worst method" appear to spread around the center, but with lower density, indicating interconnectedness but not as strong as the core theme. Network visualization, which depicts relationships between terms based on the strength of their association. "Service quality" is the central node with many connection lines to other terms such as "higher education," "in-service education," and "cognitive trust." The thickness of the lines indicates the strength of the relationship, and this shows that research related to service quality integrates a multi-method approach and includes aspects of educational institutions. Overlay visualization that presents the temporal trend of publications. Blue indicates older terms (2015-2024), while yellow indicates newer terms (2023–2024). The terms "service quality" and "higher education" are in the middle-yellow zone, indicating that they are still highly relevant and continue to be cutting-edge topics. In contrast, "fuzzy control systems" and "cognitive trust" emerged earlier but are still connected to the main theme. Literature mapping shows that service quality is not only a dominant topic but also a center of methodological and interdisciplinary innovation in the context of higher education, involving approaches such as AHP, fuzzy logic, and policy evaluation.

This literature mapping reveals three major axes in the development of service quality research: Exploration and Evaluation of Traditional Service Quality – dominant in the public, education, and health sectors. Transformation Towards Digital Services (E-Service Quality) – developing in the context of e-commerce, fintech, and other online platforms. Integration of Quantitative Approaches such as AHP – used to prioritize service quality attributes structurally.

This study demonstrates that the literature consistently points to the urgency of developing service assessment instruments that are more adaptive to the digital context and personalized to user needs. The emphasis on quantitative methodologies such as AHP, fuzzy logic, and sentiment analysis increasingly marks a shift toward a data-driven approach to strategic decision-making in improving service quality.

The clustering reveals three main areas of focus in the literature. First, Service Quality is the dominant focus with 24 occurrences, supported by the topics "Higher Education," "Satisfaction," and the use of "Fuzzy" methods. This underscores the significant attention paid to service quality evaluation in higher education. Second, the E-Service Quality cluster (3 occurrences) indicates a shift towards service digitalization, such as online administration systems. Third, the AHP cluster (2 occurrences) demonstrates the application of multi-criteria decision-making methods in service assessment (Table 4).

A single cluster (n=1) focuses on Service Quality (Dimension1 = -0.27; Dimension2 = 0.05), encompassing key terms such as Customer Satisfaction (Dimension2 = 2.83), E-Service Quality (Dimension1 = 2.32), and Attitudes (Dimension1 = 3.26). Dominant quantitative methods include AHP (D1 = -0.29) and Fuzzy Logic (D1 = -0.22), as well as the IPA and Best-Worst Method approaches. The application contexts range from Higher Education (D1 = -0.53), Educational Services, to Policy and Delivery, demonstrating a focus on systematic and satisfaction-based evaluation of educational services (Table 5).

Table 4. Occurrence and Cluster Label

Occurrences	Words	Cluster	Cluster_Label
24	Service Quality	1	Service Quality
6	Higher Education	1	Service Quality
3	Satisfaction	1	Service Quality
2	Fuzzy	1	Service Quality
3	E-Service Quality	2	E-Service Quality
2	AHP	3	AHP

Source: Data processing, 2025

Table 5. Term Dimension1 Dimension2 Cluster

Term	Dimension 1	Dimension 2	Cluster
Service Quality	-0.27	0.05	1
Higher Education	-0.53	-0.8	1
E.Service.Quality	2.32	-0.44	1
Satisfaction	-0.17	0.04	1
AHP	-0.29	0.06	1
Fuzzy	-0.22	0	1
Attitudes	3.26	-0.66	1

Best.Worst.Method	-0.31	-0.19	1
Cognitive Trust	-0.29	0.36	1
Consumer Satisfaction	3.26	-0.66	1
Cross-Border E-Commerce	-0.18	0.19	1
Customer Satisfaction	-0.71	2.83	1
Education Delivery	-0.29	0.36	1
Education Policy	-0.1	0.1	1
Educational Services	-0.1	0.1	1
Fuzzy Control System	-0.29	0.36	1
Importance.Performance.Analysis	-0.3	-0.1	1
In.Service.Education	-1.7	-4.01	1
Private.Higher.Education.Institutions	-0.1	0.1	1
Public Secondary Schools	-0.29	0.36	1
Quality Education	-0.29	0.36	1
Servqual.Model	-0.29	0.36	1

Source: Data processing, 2025

Service Quality appears 24 times, with the dominant year distribution being 2024 (Q1 = 2023, Median = 2024, Q3 = 2024), indicating a very strong and recent research trend. This indicates that this topic is at the center of attention in the current literature, reflecting the urgency in evaluating service quality, particularly in digital or educational contexts. Meanwhile, Higher Education appears six times, also with a median of 2024, indicating that service quality issues are now increasingly focused on in the context of higher education. The synergy between these two terms confirms that service quality in higher education is a strategic concern in the current scientific literature.

In recent literature, service quality appears 24 times and higher education 6 times, indicating a high level of attention to the quality of educational services (Figure 4). However, data uncertainty and the heterogeneity of educational institutions pose challenges to measurement validity. Therefore, institutional characteristics indicators are needed as mediators or moderators in evaluation models, including:

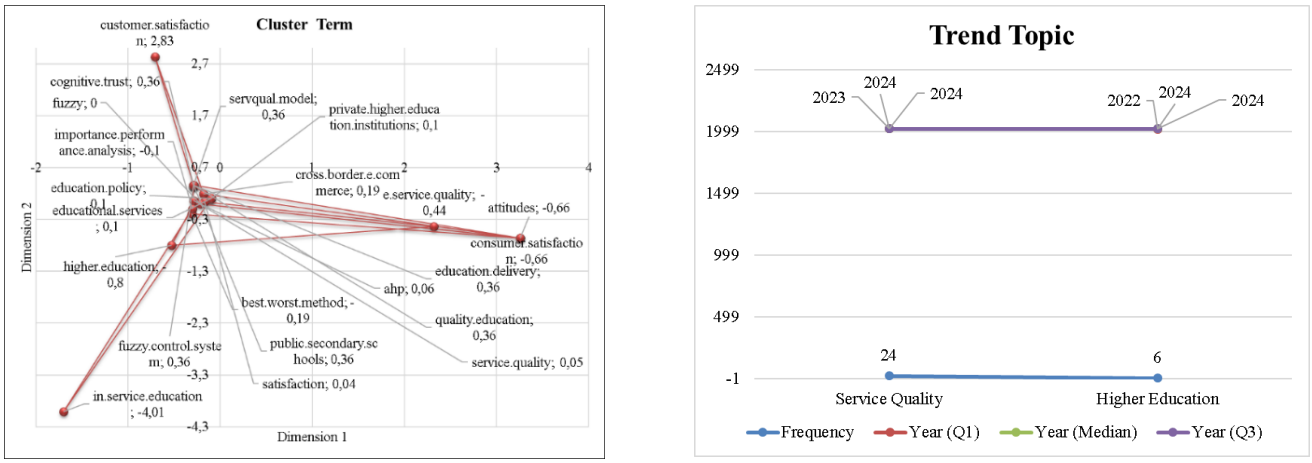
a. Ownership status: private/state.
b. Funding model.
c. Flexibility of managerial policies.
d. Academic autonomy.
e. Relationships with external stakeholders.

The integration of these indicators is important to produce contextual, accurate evaluations, and are able to guide strategic decision-making that is on target, so that an empirical basis is provided in designing more contextual, adaptive, and sustainable educational service policies, both in public and private institutions, in order to increase student satisfaction and institutional competitiveness in the increasingly digital and dynamic higher education ecosystem.

Major Proposition: Evaluation of the quality of educational services faces methodological challenges, due to data complexity and institutional dynamics.

Minor Proposition :

a. Uncertainty in reducing validity and reliability in AHP, Fuzzy and IPA methods has the potential to reduce strategic decision strategies in educational services.
b. AHP, Fuzzy and IPA precision strategies as perceptions of educational service quality.



(a) Cluster Term (b) Trending Topics

Figure 4. Cluster Term and Trend Topic (Source: Data processing, 2025)

RQ2. To what extent do differences in factors supporting and inhibiting service quality occur between private and public higher education institutions, and how do institutional characteristics mediate/moderate their influence on student satisfaction and cognitive trust?

Differences between public and private institutions are evident in their preparedness and strategies for addressing the aforementioned factors. Public institutions tend to be more structured in terms of technology systems and quality management, but often face bureaucratic constraints that hinder innovation and student empowerment. Meanwhile, private institutions, particularly market-oriented ones, tend to be more flexible in adopting technology and responding directly to student needs, but often face limitations in infrastructure and stable human resources. Institutional characteristics such as autonomy, organizational structure, quality culture, and decision-making patterns play a crucial role as mediators or moderators. Adaptive institutions can strengthen the influence of supporting factors on student satisfaction and cognitive trust, while simultaneously mitigating the negative effects of inhibiting factors. Conversely, rigid and centralized institutions can weaken the positive impact of innovation and increase resistance to change. Differences in supporting and inhibiting factors in service quality between public and private institutions are influenced by institutional characteristics, which act as mediators or moderators of the impact of each factor on student satisfaction and cognitive trust (Table 6).

This literature review addresses the need to understand the differences in factors that support and hinder service quality between private and public higher education institutions by examining the role of institutional characteristics as mediating or moderating variables. Using indicators such as ownership status, funding model, managerial policy flexibility, academic autonomy, and relationships with external stakeholders, this study explores how these characteristics shape students' perceptions of service quality. The impact is measured through two main endogenous constructs:

a) Student Satisfaction—which includes administrative services, lecturer-student interactions, access to academic information, campus facilities, and speed and responsiveness of service.
b) Cognitive Trust—which includes trust in the integrity of the institution, perceptions of service reliability, beliefs in quality commitment, expectations of service, and clarity of information.

Table 6. Supporting Factors and Inhibiting Factors

Category	Supporting Factors	Source	Inhibiting Factors	Source
Technology & Digitalization	Adoption of technology in public services (egovernment, AI, digital platforms)	(Aditya et al., 2023; Ayvaz-Çavdaroğlu et al., 2024; Hui et al., 2025; Meng et al., 2024)	Digital inequality and asynchronous technology systems	(Bhattacharya et al., 2023; Hasib & Lukmandono, 2022; Kalibatienė et al., 2023)
HR Interaction & Services	Responsiveness and empathy of service officers	(Meng et al., 2024; Ong et al., 2023; Wong & Chan, 2023)	Lack of training and excessive workload	(Almarhabi et al., 2024; Meng et al., 2024; Oyebode et al., 2023)
Information & Transparency	Accurate and real-time information to customers	(Asawawibul et al., 2025; Han et al., 2025)	User reviews contain noise and subjective bias.	(Adiningtyas & Auliani, 2024; Liang & Liu, 2024)
Environmental Quality & Infrastructure	Attractive and well-maintained destination environment	(Bhattacharya et al., 2023; Wider et al., 2024b)	Inadequate supporting infrastructure (accessibility, WiFi, complaint system)	(Asawawibul et al., 2025; Hui et al., 2025; Kalibatienė et al., 2023)
Management & Organizational Commitment	Commitment to quality management and service sustainability	(Mamun-ur-Rashid, 2023; Rahman & Nasrin, 2024b)	Lack of stakeholder involvement	(Han et al., 2025; Rauf et al., 2024)
Customer Perception & Expectations	Customers feel empowered and empowered (self-efficacy, perceived control)	(Bohórquez et al., 2024; Han et al., 2025)	The gap between expectations and reality creates disappointment.	(Ong et al., 2022, 2023; Rauf et al., 2024)
Data & Evaluation Support Systems	Use of AI & data analytics to analyze customer reviews	(Adiningtyas & Auliani, 2024; Aditya et al., 2023)	Lack of utilization of objective assessment systems and gaps between channels	(Kalibatienė et al., 2023; Liang & Liu, 2024)

Source: Data processing, 2025

The differences between private and public universities necessitate understanding what supports and hinders service quality, and how this impacts student satisfaction and trust in the institution. Factors that support service quality include the availability of information technology, qualified faculty, comprehensive learning facilities, management support for service improvement, and a curriculum that aligns with the needs of the workplace. Meanwhile, barriers include a lack of staff training, limited operational funds, resistance to digital change, unclear service procedures, and unequal access to services across departments.

The characteristics of an institution—such as ownership status (whether private or public), funding methods, policy flexibility, academic management freedom, and relationships with external parties—can influence the influence of these supporting and inhibiting factors. All of this will impact how students assess campus services, from administrative services and relationships with lecturers to ease of access to academic information and campus facilities to the speed and responsiveness of service. Furthermore, student trust in an institution is also shaped by how honestly the institution is assessed, how reliable its services are, how committed it is to quality, how well its services meet student expectations, and the clarity of the information provided. Through this understanding, better ways can be designed to improve educational services, both at private and public universities.

This framework (Figure 5) is reinforced by the results of a bibliometric analysis, which shows that Service Quality appears 24 times, becoming the most dominant term. Higher Education appears six times, and Digital Systems four times. Methods such as AHP and Fuzzy Logic each appear twice, but have Callon Centrality values of 0.3 and Density of 50.0, indicating strong methodological weight. Meanwhile, Customer Satisfaction and Cognitive Trust each appear three times, strengthening the endogenous dimension in service evaluation.(Hutabarat et al., 2013; Hutabarat & Sulistyadi, 2024). This framework includes 5 exogenous indicators (enablers), 5 barrier indicators, 5 institutional characteristics indicators, and 5 indicators each for student satisfaction and cognitive trust, making it a reference for precision research based on construct structure.

Discussion

Based on the literature review and bibliometric analysis, the Service Quality and E-Service Quality models have proven to be strategic frameworks for enhancing the effectiveness of academic and administrative services in higher education, improving student satisfaction, operational efficiency, and trust in campus digital systems (Adiningtyas & Auliani, 2024; Aditya et al., 2023). The significant increase in publications from 5 articles in 2022 to 26 articles in 2025, with a predicted stabilization at 7–8 articles per year until 2030, reflects growing academic attention to the digitalization of educational services (Asawawibul et al., 2025; Hui et al., 2025; Kalibatienė et al., 2023).

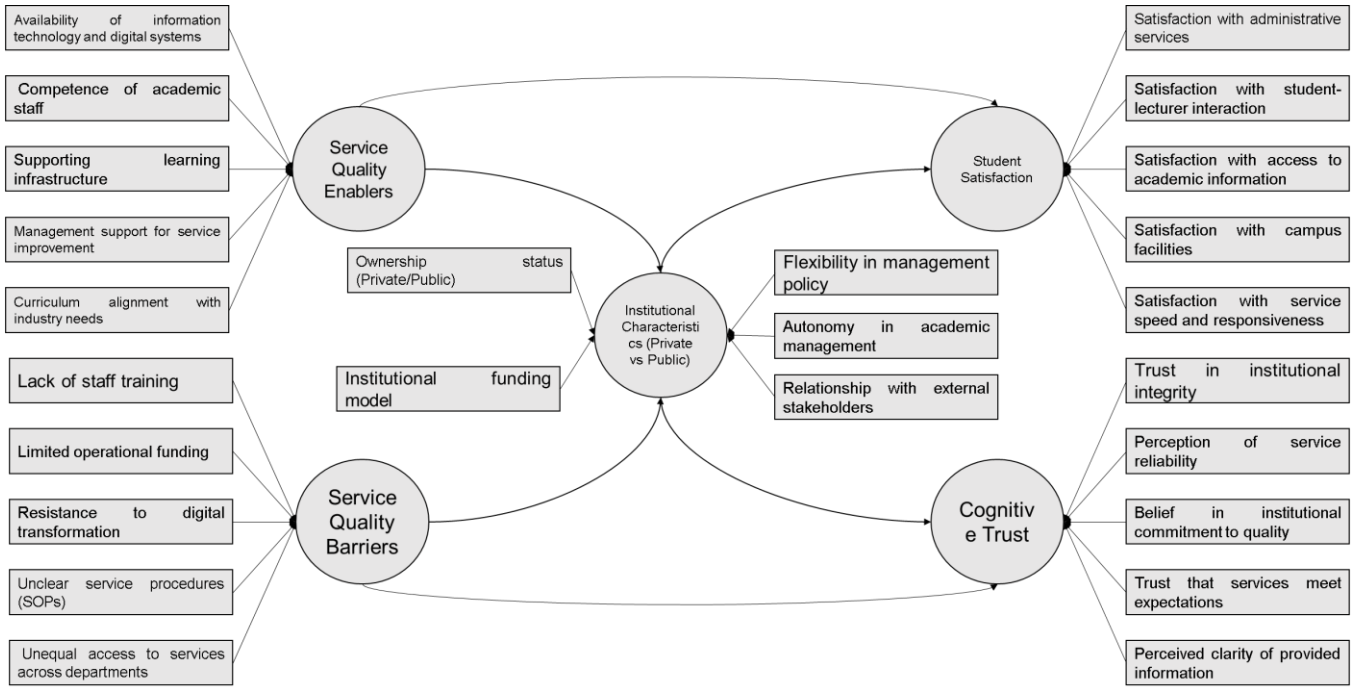


Figure 5. Framework of Service Quality Impact in Higher Education Institutions (FSQIHEI) (Source: Researcher Processing

Key enabler factors include digital infrastructure readiness, academic staff competence, managerial support, learning facilities, and curriculum alignment with industry needs, while major barriers involve insufficient staff training, limited funding, resistance to digital transformation, unclear service procedures, and unequal access across departments. Differences between public and private institutions further highlight the mediating/moderating role of institutional characteristics, where flexibility, academic autonomy, and external stakeholder relationships can strengthen supporting factors and mitigate inhibiting ones (Aditya et al., 2023; Ayvaz-Çavdaroğlu et al., 2024; Hui et al., 2025; Meng et al., 2024). The use of quantitative methods such as AHP, Fuzzy Logic, and IPA demonstrates methodological challenges due to data uncertainty and institutional complexity but also emphasizes the need for adaptive, contextual, and sustainable service evaluation instruments. Overall, this study provides empirical and practical justification for reforming higher education services toward responsive, inclusive, and standardized digital systems.

The FSQIHEI framework explains how supporting and inhibiting factors of service quality affect student satisfaction and cognitive trust, with institutional characteristics (private vs. public) acting as mediators/ moderators. The model systematically maps five key indicators for each variable, covering technology, human resources, management policies, and the psychological dimensions of students.

The findings show that institutional characteristics influence the relationship between service factors and student outcomes. Private universities are more adaptive in digitalization and responding to student needs, although they are constrained by limited resources. Characteristics such as autonomy, quality culture, and policy flexibility act to strengthen or weaken the influence of external factors on student perceptions (Assab, 2011; Kristiyanti & Sugiharto, 2007; Martilla & James, 1977; Parasuraman et al., 1985).

The model measures satisfaction as a short-term indicator and cognitive trust as a long-term indicator, providing an empirical basis for improving higher education service policies. With five structured indicators per variable, the model is ready for quantitative testing using SEM-PLS, enabling validation based on field data (Figure 6).

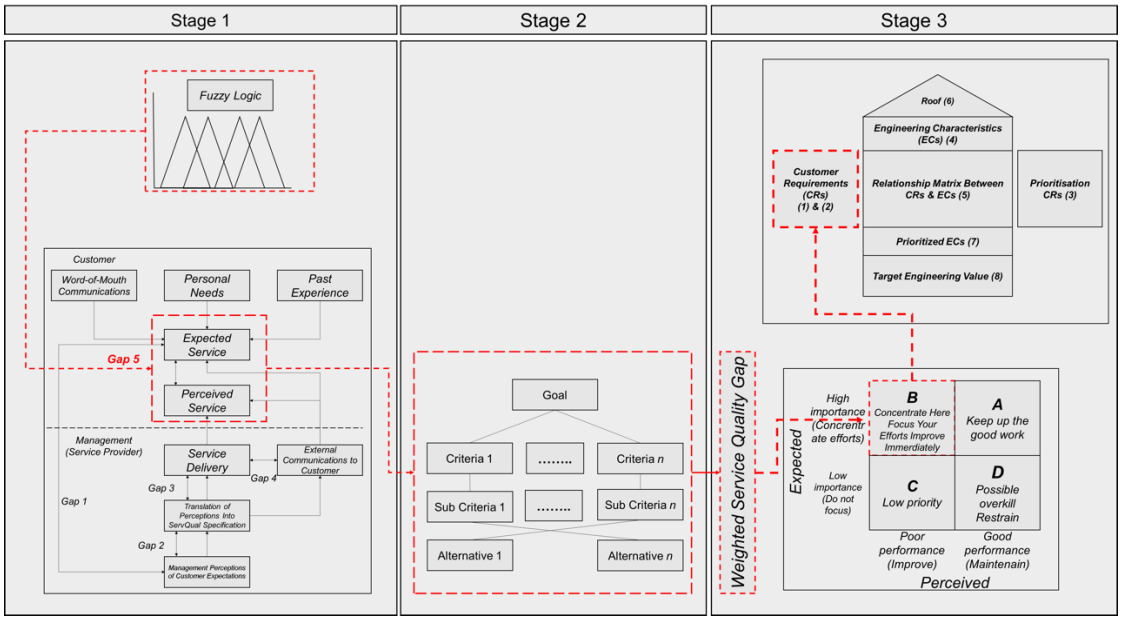
Conclusion

Main Contributions of the Study

This study contributes to the Service Quality model in improving academic and administrative digital services in higher education.

This study provides a mapping of the current literature (2023–2025) related to service quality, with a primary focus on the term “Service Quality” as a thematic axis in the literature.

This study fills the literature gap regarding the differences in service strategies between public and private universities by adding the dimension of institutional characteristics as a key variable that has previously been underexplored empirically and conceptually.



Note: - - - - - - - - = Focus Future Research Directions

Figure 6. Future Research Directions (Source: adopted from Assab, 2011; Kristiyanti & Sugiharto, 2007; Martilla & James, 1977; Parasuraman et al., 1985)

Key Findings

This study found an increase in articles from 5 (2022) to 26 (2025), predicted to remain stable at 7–8 articles/year until 2030. Heliyon is the most productive (34.62%), the majority of authors have only one article, the topics are multidisciplinary and open to study.

Integration of Multicriteria Methodology: Demonstrates the significant role of quantitative methods such as AHP, Fuzzy Logic, and Best-Worst Method in evaluating service quality, especially in the higher education and digital sectors. Contributes to the literature by highlighting the need for institutional characteristics indicators in assessing service quality in the education sector, as a form of strengthening the one-dimensional approach currently used.

This study develops the Framework of Service Quality Impact in Higher Education Institutions (FSQIHEI) which integrates supporting factors (enablers), inhibiting factors (barriers), and institutional characteristics as mediators or moderators in influencing student customer satisfaction and cognitive trust.

Practical Implications

The Service Quality and E-Service Quality models serve as important frameworks for assessing the performance of digital education services. They support the formulation of a digital campus strategy that is efficient, responsive, and standardized, and enhances student satisfaction.

The need for digitization and user personalization. The use of AHP and Fuzzy Logistics approaches helps universities design more systematic and data-driven service systems. Variables such as ownership status, funding model, managerial flexibility, and academic autonomy should be included in service quality evaluations.

The use of digital technology, human resource training, and data analytics-based evaluation systems such as AI are crucial steps in increasing responsiveness and student trust. The FSQIHEI model also serves as a reference for developing data-driven quality policies and institutional characteristics, both in the public and private sectors.

Research Limitations

The lack of author dominance, the theme is still wide open, requires local research and a strategy to strengthen digital institutions.

AHP and E-Service Quality only appear two or three times, indicating that this quantitative study is still developing and needs to be expanded. The dominant focus remains on education and digital services, with other sectors such as transportation, energy, or manufacturing underexplored. It does not include temporal co-word analysis or topic evolution analysis.

This research is still conceptual and has not been supported by direct empirical testing at higher education institutions. Furthermore, external factors such as national policies, local culture, and financing systems have not been fully integrated into the model. Another limitation lies in the scope of the literature, which still focuses on general contexts without in-depth comparisons between regions or countries. Further recommendations include empirical validation of the FSQIHEI model through quantitative approaches (SEM/PLS) and a deeper exploration of the cognitive trust dimension in the context of digital transformation in education.

Recommendations and Future Research Agenda

The Future Research Directions framework is built from a bibliometric analysis that shows the dominance of service quality topics, then developed through the integration of Fuzzy Logic to capture perceptual ambiguity, Gap 5 to measure service gaps, AHP for the hierarchy of quality attributes, and IPA for strategic priorities, resulting in a multidimensional model that is responsive to the real needs and institutional context of higher education.

General Conclusion

This study enriches the literature by integrating a Service Quality model based on institutional characteristics, highlighting the importance of differentiating service strategies between public and private universities. Bibliometric findings and literature mapping for 2023–2025 reinforce the urgency of developing responsive, measurable, and personalized digital services, and point to future research directions based on a multidimensional and data-driven approach to sustainably improve student satisfaction and trust.

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Conflict of Interest

No conflict of interest.

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