



Unpacking data-driven governance: Digital quality assurance utilization as the missing link to institutional effectiveness in higher education

Indah Prabawati¹
Wiwik Sri Utami²
Harmanto³
Suci Megawati⁴
Azlan Bin Abas⁵



(✉ Corresponding Author)

^{1,2}Department of Public Administration, Faculty of Social Science and Political Science, Universitas Negeri Surabaya, Surabaya, Indonesia.
¹Email: indahprabawati@unesa.ac.id
⁴Email: sucimegawati@unesa.ac.id
²Department of Geography Education, Faculty of Social Science and Political Science, Universitas Negeri Surabaya, Surabaya, Indonesia.
²Email: wiwikutami@unesa.ac.id
³Department of Pancasila and Citizenship Education, Faculty of Social Science and Political Science, Universitas Negeri Surabaya, Surabaya, Indonesia.
³Email: harmanto@unesa.ac.id
⁵Department of Environmental Management, University Kebangsaan Malaysia, Malaysia.
⁵Email: azlanabas@ukm.edu.my

Abstract

This study investigates Digital Quality Assurance Utilization (DQAU) as a mechanism linking data-driven governance capabilities to quality assurance effectiveness in higher education. Drawing on the Resource-Based View, Dynamic Capabilities Theory, and Institutional Theory, the study examines how Data Governance Capacity, Digital Infrastructure Readiness, and University Policy Capacity influence Quality Assurance Effectiveness through digital QA utilization. A quantitative cross-sectional design was employed with 500 respondents comprising institutional leaders, quality assurance managers, and governance administrators from Indonesian higher education institutions. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM), bootstrapping, and Importance–Performance Map Analysis (IPMA). The results show that Data Governance Capacity and University Policy Capacity significantly enhance DQAU, whereas Digital Infrastructure Readiness has no significant effect. DQAU emerges as the strongest predictor of Quality Assurance Effectiveness and significantly mediates the effects of governance capabilities on quality outcomes. These findings indicate that effective institutional quality management depends more on the strategic utilization and governance integration of digital QA systems than on technological availability alone. The study contributes to higher education governance literature by empirically validating an integrated framework positioning DQAU as a strategic mechanism linking governance capabilities with quality assurance effectiveness.

Keywords: Data-driven governance, Digital quality assurance, Higher education governance, Institutional effectiveness, PLS-SEM, SDGs 4-quality education.

Citation | Prabawati, I., Utami, W. S., Harmanto, Megawati, S., & Abas, A. B. (2026). Unpacking data-driven governance: Digital quality assurance utilization as the missing link to institutional effectiveness in higher education. *Journal of Education and E-Learning Research*, 13(4), 13–30. 10.20448/jeelr.v13i4.9548
History:
Received: 10 July 2026
Revised: 19 August 2026
Accepted: 14 September 2026
Published: 21 October 2026
Licensed: This work is licensed under a [Creative Commons Attribution 4.0 License](https://creativecommons.org/licenses/by/4.0/)
Publisher: Asian Online Journal Publishing Group

Funding: This study was funded by the International Collaboration Assignment Research Scheme Grant – Faculty of Social and Political Sciences (FISIPOL), funded through Non-State Budget (Non-APBN) funds of Universitas Negeri Surabaya in 2026.
Institutional Review Board Statement: The Ethical Committee of the Academic Council, Universitas Negeri Surabaya, Indonesia, granted approval for this study, under protocol number [1106/UN14.2.2.VII.14/LT/2026].
Informed Consent Statement: Informed verbal consent was obtained from all participants prior to their participation in the study. All data were anonymized to ensure participants' confidentiality.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Disclosure of AI Use: The authors used Trinka AI for English language editing and grammar refinement and OpenAI's ChatGPT (GPT-5.5) to assist in identifying writing inconsistencies and improving the clarity of the manuscript. All AI-generated suggestions were carefully reviewed, verified, and revised by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the final manuscript.

Contents

1. Introduction	14
2. Literature Review and Hypothesis Development.....	15
3. Methodology	17
4. Result.....	19
5. Discussion and Implications	24
6. Conclusion	27
References.....	27

Contribution of this paper to the literature

This study contributes to the literature by reconceptualizing Digital Quality Assurance Utilization as a governance mechanism linking governance capabilities to quality assurance effectiveness. The paper’s primary contribution is demonstrating that effective utilization, rather than technology availability alone, translates data governance and policy capacity into improved quality outcomes in higher education.

1. Introduction

The rapid development of artificial intelligence, cloud computing, and big data analytics has accelerated the transition to data-driven governance in higher education (David, Abdurachman, Bandur, & Kosasih, 2023; López-Chila, Llerena-Izquierdo, Sumba-Nacipucha, & Cueva-Estrada, 2024; Xia & Li, 2022). Every day, universities produce vast amounts of academic and administrative data, but many are still unable to convert these assets into evidence-based decision-making given fragmented information systems, weak data governance, limited analytical capabilities, and organizational resistance (Fattah, 2024; Salerno & Maçada, 2026). This has resulted in an ever-present gap between the wealth of data at one’s disposal and its use in practice for governance. This gap raises questions about the real effects of data-driven governance on enhancing institutional effectiveness in higher education.

Institutional effectiveness has become a strategic priority for higher education institutions due to its importance for accreditation performance, international competitiveness, and public accountability (Buitrago, Barbosa Camargo, & Cala Vitery, 2021; Santos, Barrichello, & Morano, 2023). In addition, public accountability requires transparency and prudent management of resources, which are critical for sustaining the confidence of stakeholders (Makanga et al., 2025). Increasingly, the ability to incorporate institutional data into ongoing quality improvement and strategic decision-making is becoming critical to realizing these outcomes. However, the absence of standard data governance and the fragmentation of digital ecosystems mean that universities have not yet been able to exploit the full value of institutional data (Paddock, Franco, Breidt, & Betancourt, 2025; Tasani & Yusof, 2026).

Recent studies have confirmed that data-driven decision-making, digital transformation and quality assurance lead to organizational improvement in higher education (Asfaw, Alemneh, Ferede, Santure, & Jimma, 2025; Kalim & Bibi, 2023). Simultaneously, emerging methods focus on integrating multiple data sources and iterative decision-making processes to enhance responsiveness and adaptability in complex educational settings (Evenstein, Hershkovitz, Cohen, & Nachmias, 2026; Y. Zhang, Zhang, Wu, & Li, 2025). Parallel to this, digital transformation has been recognized as a strategic lever for innovation and competitiveness. Studies have highlighted its capacity to enhance institutional resilience and operational efficiency, albeit with fragmented strategies and inconsistent empirical findings (Talafidaryani & Asarian, 2024). The data-driven governance literature is focused on data capability and decision support, the digital transformation literature is focused on technology adoption, and the quality assurance literature is focused on compliance and accreditation mechanisms (Aldhobaib, 2024). Consequently, there has been little attention to how governance capabilities are operationalised through institutional quality assurance processes to enhance organisational effectiveness.

Although significant advances have been made in previous research in understanding data-driven governance, digital transformation and quality assurance in higher education, there are still some important limitations. Firstly, these research streams have emerged largely in parallel, with governance capability, digital transformation and quality assurance viewed as distinct domains rather than interconnected dimensions of institutional governance. Second, the existing research has focused primarily on the direct effects of governance capabilities on organizational performance, with little knowledge of the organizational mechanisms through which institutional data are transformed into strategic decisions and measurable effectiveness. The process by which data-driven governance produces institutional value is thus not well explained. Moreover, digital quality assurance (QA) has been largely imagined as a process or compliance function that meets accreditation requirements rather than a strategic governance capability that integrates institutional data, encourages evidence-based decision-making, and facilitates continuous organizational learning. This narrow view underestimates the broader governance role of digitally enabled QA systems in converting fragmented data into actionable managerial intelligence. The absence of an integrative theoretical and practical framework on governance capacity, digital QA use and institutional effectiveness is a substantial gap. To address this gap, the present study re-conceptualizes the use of digital quality assurance, not just as an operational support function or a mediating variable, but as a strategic governance mechanism through which data-driven governance capabilities can be translated into effective quality management and improved institutional effectiveness in higher education.

Building on the identified gap, this study formulates several key research questions. First, how does digital quality assurance utilization mediate the relationship between data governance capacity, digital infrastructure readiness, and policy capacity within universities? Second, to what extent does the utilization of digital quality assurance systems influence quality assurance effectiveness in higher education institutions? Third, why do many institutions fail to translate data governance capabilities into measurable institutional effectiveness outcomes?

This paper aims to examine the role of digital quality assurance utilization as a critical intermediary linking data-driven governance components to institutional effectiveness in higher education. Specifically, it seeks to develop and empirically test an integrative framework that connects governance capacity, technological readiness, and policy

alignment with quality assurance outcomes. This study makes three important contributions. First, it advances data-driven governance theory by identifying digital quality assurance utilization as the organizational mechanism through which governance capabilities are converted into institutional effectiveness. Second, it develops and empirically validates an integrative governance framework linking data governance capacity, digital infrastructure readiness, policy capacity, digital QA utilization, QA effectiveness, and institutional effectiveness. Third, it demonstrates that quality assurance should be understood not merely as a compliance function but as a strategic governance capability that enables evidence-based institutional management.

2. Literature Review and Hypothesis Development

2.1. Data-Driven Governance in Higher Education

The rapid digitalization of higher education has accelerated the adoption of data-driven governance as a strategic approach to institutional management. Rather than relying solely on administrative experience, universities increasingly utilize institutional data to support strategic planning, policy formulation, performance evaluation, and resource allocation (Linlang, Linzhen, Qinghong, & Zhongqi, 2023). This shift reflects a broader transition toward evidence-based governance, in which digital technologies, institutional intelligence, and data analytics enhance transparency, accountability, and organizational responsiveness (Cheng, 2025). Furthermore, decision-support systems and business intelligence platforms enable universities to transform institutional data into actionable insights that improve strategic planning and operational efficiency (Zhang, 2025).

Despite these advances, empirical evidence suggests that implementing data-driven governance remains challenging. While digital technologies provide substantial opportunities for improving governance, their effectiveness depends on the institutional capacity to integrate, manage, and utilize data across organizational units. Previous studies consistently identify fragmented information systems, weak interoperability, limited analytical capabilities, and organizational resistance as major barriers to effective implementation (Engwall, 2018; Lepori, Bornmann, & de Moya Anegón, 2023). These findings indicate that technological investments alone are insufficient; effective data-driven governance requires robust governance capacity that aligns institutional policies, organizational capabilities, and digital infrastructures to support evidence-based decision-making and institutional effectiveness (Ajayi & Hussin, 2018; Shin, Li, Nam, & Byun, 2022).

2.2. Digital Quality Assurance Utilization in Higher Education

Quality assurance (QA) in higher education has evolved from a compliance-oriented function toward a strategic governance practice that supports continuous quality improvement and institutional performance (Kayyali, 2025; Lytras & Şerban, 2025). Rather than serving solely as a mechanism for accreditation and regulatory compliance, contemporary QA is increasingly integrated into institutional planning, performance management, and evidence-based decision-making (Hauptman Komotar, 2020; Tran, Van, Nguyen, Nguyen, & Nguyen, 2025). This shift reflects a broader emphasis on developing a quality culture in which transparency, stakeholder engagement, and continuous organizational learning are supported by reliable institutional data.

Digital technologies have further strengthened this transformation by enabling institutions to collect, integrate, and analyze quality-related information through dashboards, academic information systems, digital accreditation platforms, and analytics-based monitoring tools (Haiping & Kadhila, 2024; Pons, Llach, & Casadesús, 2024; Zuhairi, Raymundo, & Mir, 2020). However, previous studies consistently suggest that the effectiveness of these technologies depends less on their availability than on how they are utilized within institutional governance processes. In many universities, digital QA systems remain primarily administrative tools for fulfilling accreditation requirements, limiting their contribution to strategic decision-making and continuous quality improvement due to weak organizational integration, limited stakeholder engagement, and resistance to change (Buinytska, Hrytseliak, Smirnova, & Tiutiunnyk, 2025; Singh, Nair, & Watson, 2023). These findings indicate that digital QA utilization should be viewed not merely as technology adoption but as a governance capability that enables institutional data to be translated into continuous monitoring, strategic learning, and evidence-based quality improvement.

2.3. Resource-Based View (RBV) and Dynamic Capability Theory

The Resource-Based View (RBV) posits that sustainable organizational performance depends on the effective deployment of valuable, rare, inimitable, and organizationally embedded resources (Barney, 1991). Within higher education, these strategic resources include data governance capacity, digital infrastructure, and institutional policy capability, which collectively enable universities to strengthen evidence-based governance and institutional performance (Helfat et al., 2023). However, RBV alone provides only a partial explanation, as the possession of strategic resources does not automatically lead to superior organizational outcomes. Empirical evidence indicates that many universities possess substantial digital resources yet struggle to realize their full value because of limited organizational capabilities to integrate and utilize them effectively (Maijanen, 2020).

Dynamic Capability Theory extends this perspective by emphasizing an organization's ability to integrate, reconfigure, and apply strategic resources in response to changing environments (Teece, Pisano, & Shuen, 1997). Rather than focusing on resource ownership, the theory explains how organizational capabilities transform available resources into effective managerial actions and sustained performance (Mutmainah, Suharjo, Kirbrandoko, & Nurmalina, 2020). Integrating RBV and Dynamic Capability Theory therefore provides a stronger theoretical foundation for explaining not only what strategic resources support institutional effectiveness, but also how these resources are converted into organizational outcomes.

Accordingly, this study conceptualizes Digital Quality Assurance Utilization (DQAU) as a dynamic organizational capability through which universities operationalize data governance capacity, digital infrastructure, and policy capability into continuous quality improvement and institutional effectiveness. From this perspective, DQAU functions as the governance mechanism that enables institutional resources to be translated into evidence-based decision-making, continuous monitoring, and strategic organizational learning, thereby strengthening institutional effectiveness.

2.4. Data Governance Capacity and Digital QA Utilization

Data governance capacity reflects an institution's ability to manage data in a structured manner through data quality control, clear data ownership, system interoperability, and consistent implementation of governance standards (Beerkens, 2022; Burton, 2021). This capacity is an important element in supporting evidence-based decision-making and digital system optimization in higher education (de Oliveira, de Castro Neto, Costa, Simões, & Sousa, 2025). Good data quality management ensures the accuracy, consistency, and reliability of information so that it can be used as a basis for effective quality monitoring (Caballero, Rincón, Toscano, Pérez, & Gómez, 2025; Cahyaningsih, Shaleh, & Fitriyanti, 2024). In addition, clarity on data ownership and governance standards helps to improve accountability, security, and coordination between units in institutional data management (Chimpiri, 2025; Nai, Rifai, & Sadiq, 2025).

Institutions with strong data governance capacity tend to be better able to integrate various data sources and utilize digital quality assurance systems strategically to support academic evaluation, performance monitoring, and accreditation processes (Giest, McBride, Nikiforova, & Sikder, 2025; Salerno & Maçada, 2026). In the perspective of the Resource-Based View (RBV), data governance capacity is seen as a strategic resource that can create institutional excellence if managed effectively (Yang, 2020). Meanwhile, Dynamic Capability Theory emphasizes that the ability of institutions to integrate and reconfigure digital resources determines the effectiveness of utilizing digital-based QA systems (Chounta, Ortega-Arranz, Daskalaki, Dimitriadis, & Avouris, 2024; Medeiros, Araújo, Silva, & Silva, 2025).

Thus, data governance capacity not only functions as an administrative infrastructure, but also as a strategic capability that allows institutions to optimize the utilization of digital QA systems to support the continuous process of evaluation, quality control, and data-driven decision-making. Therefore, the following hypothesis is formulated.

Hypothesis 1: Data governance capacity positively influences digital quality assurance utilization.

2.5. Digital Infrastructure Readiness and Digital QA Utilization

The readiness of digital infrastructure reflects the ability of universities to provide adequate technological support for data management and the implementation of digital-based systems in an integrated manner (Areba, Nyakundi, & Nyakan, 2026; Dijju, Shah, & Raghunandan, 2025). The infrastructure includes integrated information systems, cloud computing, analytics platforms, and cybersecurity readiness, which play a role in supporting operational processes and institutional quality control. An interconnected information system allows data exchange between units to take place faster and more coordinated so that the quality assurance process can be carried out more effectively and based on accurate information (Elliot, 2026). In addition, the use of cloud systems and analytics platforms helps institutions improve data accessibility, speed up information processing, and support real-time quality monitoring (Jeong, Moon, Jeong, & Moon, 2024; Tsimpanis, Plessas, Balaouras, & Avouris, 2025).

The use of digital quality assurance requires infrastructure support that is able to ensure system integration, data availability, and continuous monitoring capabilities. Adequate digital infrastructure enables institutions to conduct academic evaluations, performance measurements, and quality control in a more responsive and systematic manner (Tsimpanis et al., 2023). In addition, cybersecurity readiness is an important factor in maintaining the integrity and reliability of the digital QA system so that institutional information remains protected (Haiping & Kadhila, 2024; Jayanti & Sarja, 2019). Therefore, universities with a higher level of digital infrastructure readiness tend to have better ability to optimize the use of digital quality assurance systems. Thus, the hypotheses proposed are as follows:

Hypothesis 2: Digital infrastructure readiness positively influences digital quality assurance utilization.

2.6. Policy Capacity and Digital QA Utilization

Policy capacity reflects the ability of institutions to formulate, direct, and implement policies that support the sustainable use of digital systems (Wu, Ramesh, & Howlett, 2015; Yan & Saguin, 2021). In the context of higher education, policy capacity includes strategic alignment, leadership support, institutional regulation, and governance commitment to digital transformation and quality assurance (Shawyun, Al-Khatnai, & Wattanasap, 2025). Policies integrated with strategic planning allow digital QA to function not only as an administrative instrument, but also as a data-driven decision-making tool.

Leadership support and internal regulations also determine the legitimacy of data use, operational standards, and coordination between units in the implementation of digital QA (Gullifer & Russo, 2022). In addition, governance commitment plays an important role in ensuring the sustainability of digital QA integration through standardization, transparency, and organizational accountability (Patnaik, Pattnaik, & Singh, 2020). Institutions with strong policy capacity tend to be better able to integrate QA systems into academic evaluation, performance monitoring, and institutional development strategically (Nik Harun, Md Syed, & Abdullah, 2025). Thus, institutional policies are an important factor in strengthening the effectiveness of the use of digital QA in universities. Therefore, the following hypothesis is formulated.

Hypothesis 3: Policy capacity positively influences digital quality assurance utilization.

2.7. Digital QA Utilization and QA Effectiveness

The use of digital quality assurance (QA) allows universities to carry out quality assurance processes in a more measurable, adaptive, and evidence-based manner. The digital QA system supports data-driven monitoring through dashboards, analytics platforms, and automated reporting that helps institutions monitor quality indicators in real-time (Schellekens et al., 2023). In addition, the application of predictive analytics allows institutions to identify potential academic and operational problems earlier so that policy responses can be carried out more quickly and on target (Awujoola, Enem, Ogwueleka, Abioye, & Adelegan, 2024; Vaghela et al., 2025).

The use of digital QA also strengthens evidence-based evaluation through the integration of academic data, learning evaluation, and institutional performance reporting that supports strategic decision-making (Jesus-Silva, Carvalho, & Cardoso, 2023). In the context of continuous improvement, the digital QA system facilitates a continuous evaluation cycle through feedback loops and periodic monitoring of quality achievements. Optimal implementation

of digital QA contributes to improved accreditation performance, institutional responsiveness, and overall quality enhancement (Gaftandzhieva, Doneva, & Bliznakov, 2020). Thus, the use of digital QA is an important factor in increasing the effectiveness of quality assurance in universities. Therefore, the following hypothesis is formulated.

Hypothesis 4: Digital quality assurance utilization positively influences quality assurance effectiveness.

2.8. Mediating Role of Digital QA Utilization

While governance resources provide the foundation for digital transformation, previous studies offer limited explanation regarding the organizational mechanism through which these resources generate quality assurance outcomes. Drawing on Dynamic Capability Theory, this study proposes that Digital Quality Assurance Utilization represents the organizational capability that operationalizes governance resources into evidence-based quality management and institutional effectiveness. Governance resources such as data governance capacity, digital infrastructure readiness, and policy capacity are fundamental elements in supporting digital transformation in higher education. However, the ownership of these resources does not necessarily directly produce the effectiveness of quality assurance if it is not accompanied by a utilization mechanism that is able to convert resources into operational practices of strategic value. A number of studies show that governance capacity and technological readiness often do not have a significant institutional impact when digital systems have not been optimally utilized in the process of evaluation, monitoring, and academic decision-making (Almashekhi, Mohamad, & Khafidz, 2026; Camisón & Puig-Denia, 2016).

In this framework, digital quality assurance (QA) utilization is seen as a mediation mechanism that bridges governance resources with institutional outcomes. The use of digital QA allows for cross-unit data integration, strengthening evidence-based evaluations, increasing transparency, and developing continuous quality improvement in a more adaptive and systematic manner (Riveros-Gavilanes et al., 2026). In addition, the implementation of digital QA also strengthens the institution's ability to make technological adjustments and strategic responses to the dynamics of the higher education environment (Sadat, 2025). Thus, the effectiveness of quality assurance is not only determined by the availability of governance capacity and digital infrastructure, but also by the ability of institutions to optimize the use of digital QA systems as strategic organizational capabilities.

Hypothesis 5: Digital quality assurance utilization mediates the relationship between data governance capacity and quality assurance effectiveness.

Hypothesis 6: Digital quality assurance utilization mediates the relationship between digital infrastructure readiness and quality assurance effectiveness.

Hypothesis 7: Digital quality assurance utilization mediates the relationship between policy capacity and quality assurance effectiveness.

3. Methodology

3.1. Research Design

The study used a quantitative method with a cross-sectional design to test the proposed relationship between the study variables in one period of observation. The analysis was conducted on higher education institutions in Indonesia, and the respondents were in strategic positions related to institutional governance and quality assurance such as university executives, quality assurance units, IT managers, and academic administrators responsible for digital quality management practices. Indonesia is an interesting empirical setting, as the country currently hosts over 4,400 higher education institutions, making it one of the largest higher education systems in the world. However, the competitiveness of the world's academia is still not evenly distributed. Only a handful of Indonesian universities have been able to consistently make it to the top international rankings. This situation highlights the constant challenge of improving institutions' quality, accountability, and competitiveness through data-driven governance mechanisms. Thus, the present study aims to analyze the digital quality assurance utilization as a mediating mechanism between governance-related capabilities and institutional effectiveness in higher education. To achieve this objective, the study developed seven hypotheses, which were embedded in the conceptual framework presented in Figure 1.

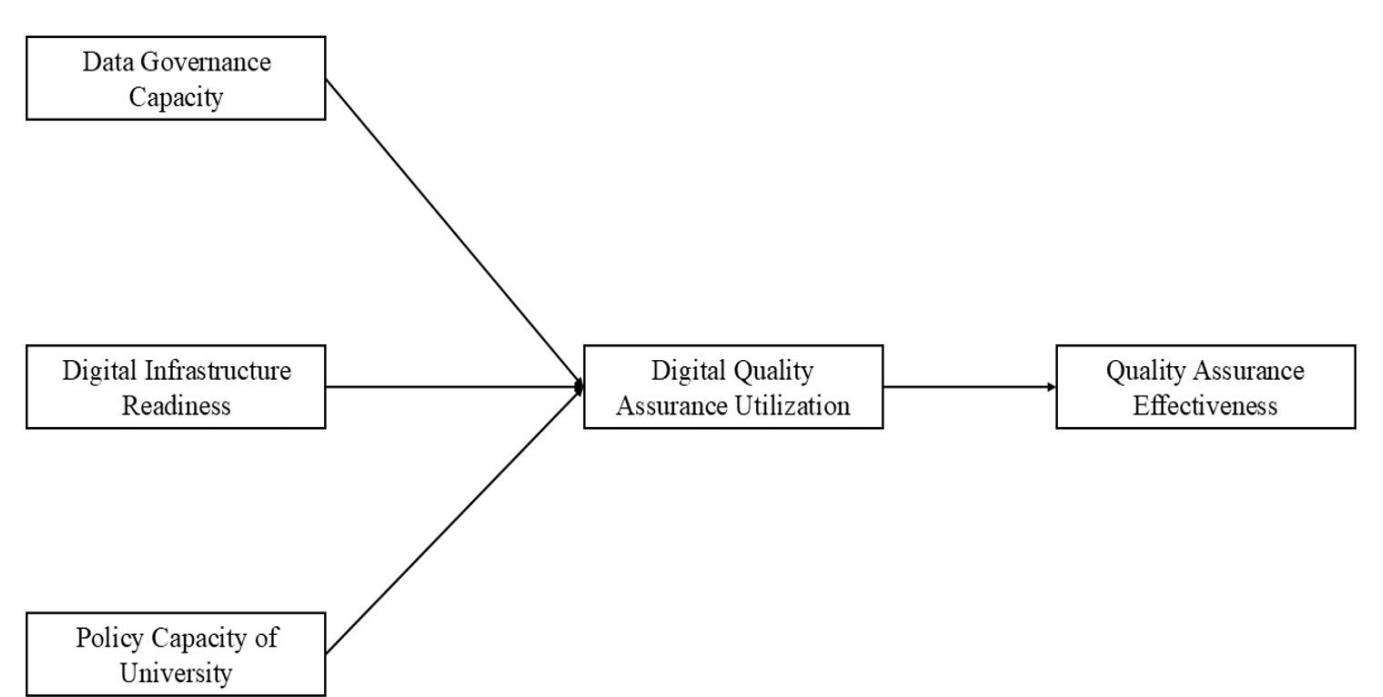


Figure 1. Research model.

3.2. Measurement of Variables

The questionnaire used in this study was developed by adopting measurement items from previous empirical studies on data governance, digital infrastructure, institutional policy capacity, and quality assurance practices in higher education. The instrument was refined by conducting a Focus Group Discussion (FGD) with university quality assurance coordinators, higher education policy experts, digital transformation experts, accreditation evaluators, and academics in the field of education management and information systems to improve the contextual suitability and content accuracy. Then, the expert review process was followed by a pilot study on 30 respondents from various higher education institutions in Indonesia. The pilot assessment showed good psychometric properties. The corrected item-total correlation values ranged from 0.438 to 0.801, suggesting satisfactory construct validity. Cronbach's alpha coefficients were between 0.873 and 0.951, which confirmed a high reliability across all constructs. Responses were measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

The proposed model consisted of five latent constructs with a total of 65 measurement items. Data Governance Capacity was operationalized through 15 indicators reflecting data quality, interoperability, security mechanisms, governance standards, and accountability practices (Beerrens, 2022; Hillman, 2023; Nai et al., 2025; Tsavatewa, 2023). Digital Infrastructure Readiness comprised 14 indicators associated with ICT availability, system integration, digital literacy, and institutional technological support (Blayone, 2018; Chounta et al., 2024; Flowers & Tanner, 2024; Jige, 2025; Martín & Ramos, 2022). Policy Capacity of University included 12 indicators related to evidence-based policymaking, leadership commitment, and strategic governance (Dip, de Arguibel, & Aliprandini, 2025; Gedifew & Muluneh, 2021; Lawrence, Fierlbeck, McGrath, & Curran, 2020; Yan & Saguin, 2021). Digital Quality Assurance Utilization was measured using 12 indicators addressing digital monitoring, analytics usage, evaluation systems, and continuous improvement activities (Asad, Mahar, Dato, Sherwani, & Hassan, 2023; Chakraborty, 2024; Haddade, Nur, Rasyid, & Abd Raviq, 2024; Iatraki & Mikropoulos, 2023; Schellekens et al., 2023). Meanwhile, Quality Assurance Effectiveness consisted of 12 indicators capturing accreditation achievement, institutional responsiveness, stakeholder satisfaction, and overall quality enhancement outcomes (O. Serrano, Miranda Gonzalez, & Mourato, 2026; O. M. E. Serrano, Miranda González, & Mourato, 2025; Sharvashidze, Grdzeldze, Sikharulidze, & Gabrichidze, 2023; Ulkhaq, Handayani, & Rahmat, 2026).

Because the study relied on a single-source questionnaire, several procedural remedies were implemented during questionnaire design to minimize the potential for common method bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The questionnaire assured respondents of anonymity and confidentiality to reduce social desirability bias and evaluation apprehension. Participants were informed that there were no right or wrong answers and were encouraged to provide responses that accurately reflected their institutional practices. In addition, all measurement items were adapted from previously validated scales, refined through expert review and focus group discussions, and pilot-tested to improve clarity and reduce item ambiguity. These procedural measures were implemented prior to data collection, while statistical assessment of common method bias was subsequently conducted using the full collinearity approach and is reported in the Results section.

3.3. Sample and Data Collection Procedures

In this study, a purposive sampling method was used to select respondents who had considerable knowledge and experience regarding digital governance and the implementation of quality assurance in higher education institutions. The relevance of this approach is due to the uneven level of digital transformation in Indonesian universities. Indonesia is ranked as the largest higher education system in the world with more than 4,400 higher education institutions (Ministry of Higher Education Science and Technology of the Republic of Indonesia, 2025). As a result, the respondents were purposefully selected based on the inclusion criteria. The participants should be from the universities that have implemented a digital quality assurance system for at least two years; hold strategic positions related to institutional governance, quality assurance, information technology, or academic planning; be involved directly in the data-driven decision-making process; and come from institutions with at least "B" or "Unggul" accreditation status.

The minimum sample size was based on the recommendation of Hair, Black, Babin, and Anderson (2019) of at least five observations per measurement indicator. The study utilised 65 indicators, which had a minimum sample size of 325 respondents. The G*Power analysis also confirmed this requirement, with an effect size of 0.15, significance level of 0.05, statistical power of 0.95, and four predictors, with a minimum recommended sample of 129 respondents (Faul, Erdfelder, Buchner, & Lang, 2009).

Data collection was carried out through a hybrid mechanism during January-April 2026. The online questionnaires were delivered using Google Forms, distributed via institutional email databases and professional social networking channels, targeting university officials with responsibility for quality assurance and governance functions. To enhance the quality of response and institutional representation, offline data collection was also conducted through enumerator visits to universities in the top 10 QS World University Rankings Indonesia. All the data collection stages were implemented according to established research ethics, including voluntary participation, confidentiality protection and informed consent procedures.

The respondents came from a wide range of Indonesian higher education institutions, including leading public universities, private universities, religious higher education institutions, and specialized institutes. The participating institutions were universities from the QS World University Rankings Indonesia and nationally accredited universities from across major regions of Indonesia. Examples are Universitas Airlangga, Universitas Gadjah Mada, Institut Teknologi Sepuluh Nopember, Universitas Brawijaya, Universitas Hasanuddin and so on. Individual institutions are not named to preserve the confidentiality of their identity as agreed to in the informed consent agreement.

At first, the study got 631 questionnaire responses from participants from a wide range of higher education institutions in Indonesia. All responses were checked for completeness, consistency and compliance with the inclusion criteria before statistical analysis. Among the 131 excluded questionnaires, there were considerable missing or incomplete responses and/or failure to meet the pre-set eligibility criteria. Thus, 500 valid responses were kept for the final analysis, leading to a usable response rate of 79.2% (Table 1). No missing values were statistically imputed

from the final data. Most of the respondents were from private universities (72.4%), consistent with the actual composition of higher education institutions in Indonesia, where the number of private institutions is much more than that of public universities. Most of the participants were in senior academic or administrative positions, particularly directors of quality assurance units, chairs of academic programs, and senior institutional officers, which suggests that the responses were provided by persons with considerable authority and knowledge of digital governance processes. Regarding academic qualifications, more than half of the respondents held PhD degrees, indicating a relatively high level of expertise among the participants. Moreover, most of the institutions had already been using digital QA systems for more than 4 years, which means that they had sufficient organizational experience with digital quality management practices. Respondents were spread across the main regions of Indonesia geographically, but institutions in Java remained dominant, reflecting the concentration of higher education infrastructure in the country.

Table 1. Respondent characteristics.

Characteristics	Category	Frequency	Percentage (%)
Gender	Male	287	57.4
	Female	213	42.6
Age	< 30 years	48	9.6
	30–39 years	176	35.2
	40–49 years	189	37.8
	≥ 50 years	87	17.4
Highest Education	Master’s Degree	241	48.2
	Doctoral Degree	259	51.8
Academic Position	Lecturer	138	27.6
	Senior Lecturer	176	35.2
	Associate Professor	121	24.2
	Professor	65	13.0
Institution Type	Private Universities (PTS)	362	72.4
	Public Universities (PTN)	138	27.6
Accreditation Status	Excellent/Unggul	268	53.6
	Very Good/B	187	37.4
	Good/C	45	9.0
Institution Location	Java	341	68.2
	Sumatra	61	12.2
	Kalimantan	33	6.6
	Sulawesi	38	7.6
	Bali–Nusa Tenggara	18	3.6
	Papua–Maluku	9	1.8
Position in Institution	Rector/Vice Rector	54	10.8
	Head of Quality Assurance Unit	149	29.8
	Dean/Vice Dean	96	19.2
	Head of Study Program	131	26.2
	IT/Digital Transformation Manager	70	14.0
Experience in QA/Digital Governance	2–5 years	157	31.4
	6–10 years	214	42.8
	>10 years	129	25.8
Digital QA Implementation Duration	2–3 years	121	24.2
	4–5 years	208	41.6
	>5 years	171	34.2

3.4. Data Analysis Technique

The statistical data analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS (version 4). The analytical method was used because the research model has multiple latent variables, higher-order relationships, and mediation effect(s) that need to be estimated simultaneously in the proposed predictive research model (Joseph F Hair, Risher, Sarstedt, & Ringle, 2019). Furthermore, emphasis was also given to theory building and expansion of digital governance mechanisms for institutional quality assurance; hence, the PLS-SEM applied statistical technique was appropriate for a large indicator structure as well as complex structural relationships in an applied social science research setting (Dzin & Lay, 2021).

Data analysis consisted of four successive stages. Stage one was associated with the evaluation of the measurement model (outer model), which consisted of indicator loading(s), composite reliability (CR), Cronbach’s alpha, average variance extracted (AVE), and discriminant validity. In the second stage, the structural model (inner model) was assessed by examining multicollinearity, the coefficient of determination (R2), predictive relevance (Q2), and structural path coefficients (Guenther, Guenther, Ringle, Zaefarian, & Cartwright, 2023). For stage three, a bootstrapping analysis was performed to examine the hypothesized direct and mediating relationships. Stage four involved importance-performance map analysis (IPMA) to identify the constructs contributing most significantly to improving institutional quality assurance effectiveness (Hauff, Richter, Sarstedt, & Ringle, 2024).

4. Result

4.1. Common Method Bias

To address the potential for common method bias (CMB), the data were collected through a single-source questionnaire in the same period of observation, and thus the potential for CMB was carefully assessed prior to testing the hypotheses. The variance inflation factor (VIF) values of all latent constructs involved in the proposed model (Table 2) were checked following the full collinearity assessment procedure recommended by Kock (2015).

Table 2. Full collinearity assessment for common method bias.

Construct	Full Collinearity VIF	Threshold	Interpretation
Data Governance Capacity (DGC)	2.184	< 3.3	No collinearity issue
Digital Infrastructure Readiness (DIR)	2.417	< 3.3	No collinearity issue
Policy Capacity of University (PCU)	2.063	< 3.3	No collinearity issue
Digital Quality Assurance Utilization (DQAU)	2.588	< 3.3	No collinearity issue
Quality Assurance Effectiveness (QAE)	2.271	< 3.3	No collinearity issue

4.2. Measurement Model Assessment

Before moving forward to the analysis of the structural model, the measurement model assessment was carried out to verify that all proposed constructs satisfied the criteria of convergent validity, discriminant validity, reliability and multicollinearity (Memon et al., 2021). In PLS-SEM, this step is performed to verify that the indicators measure the latent variables well and the measurement instrument has acceptable levels of psychometric properties.

The measurement model assessment shown in Table 3 shows that the proposed constructs have an acceptable level of validity and reliability. Some indicators with relatively lower loading estimates were improved and all remaining measurement items had outer loading estimates greater than the recommended value of 0.70 (Guenther et al., 2023), indicating that each indicator adequately represented its intended latent construct. Moreover, the Average Variance Extracted (AVE) values were between 0.521 and 0.586, indicating that the constructs accounted for more than half of the variance of their indicators and therefore met the requirement for convergent validity.

The reliability assessment also indicated good internal consistency within all of the constructs. Cronbach’s alpha coefficients were between 0.917 and 0.936, and composite reliability values were between 0.926 and 0.943, indicating that the measurement scales reliably captured the dimensions underlying study variables. The results indicate that the instrument was stable and reliable enough for empirical analysis.

Furthermore, the collinearity diagnostic indicated that all outer VIF values were well below the critical value of 5.00, suggesting that multicollinearity between indicators was not a problem in the measurement model (Kock, 2015).

Table 3. Validity, reliability and outer collinearity results.

Variables	Indicator	Outer Loading	AVE	CA	CR	Outer VIF
Data Governance Capacity (DGC)	DGC1	0.712	0.528	0.931	0.939	2.093
	DGC2	0.736				2.842
	DGC3	0.721				2.253
	DGC4	0.701				2.088
	DGC5	0.714				1.706
	DGC6	0.708				1.753
	DGC7	0.719				1.692
	DGC8	0.726				2.039
	DGC9	0.781				2.430
	DGC10	0.812				2.789
	DGC11	0.774				3.146
	DGC12	0.742				2.097
	DGC13	0.768				3.173
	DGC14	0.751				2.287
	DGC15	0.759				2.882
Digital Infrastructure Readiness (DIR)	DIR1	0.703	0.521	0.924	0.931	1.391
	DIR2	0.741				1.949
	DIR3	0.756				2.063
	DIR4	0.714				1.697
	DIR5	0.702				1.624
	DIR6	0.718				1.938
	DIR7	0.774				2.248
	DIR8	0.811				2.556
	DIR9	0.782				2.335
	DIR10	0.761				2.028
	DIR11	0.775				2.017
	DIR12	0.748				1.766
	DIR13	0.742				1.697
	DIR14	0.786				2.352
Digital Quality Assurance Utilization (DQAU)	DQAU1	0.708	0.539	0.917	0.926	1.540
	DQAU2	0.732				1.903
	DQAU3	0.791				2.151
	DQAU4	0.798				2.721
	DQAU5	0.714				1.715
	DQAU6	0.826				2.756
	DQAU7	0.761				2.225
	DQAU8	0.779				2.154
	DQAU9	0.811				2.488
	DQAU10	0.744				2.034
	DQAU11	0.701				1.456
	DQAU12	0.793				2.175
Policy Capacity of University (PCU)	PCU1	0.812	0.563	0.926	0.934	2.508
	PCU2	0.754				1.990
	PCU3	0.761				2.053
	PCU4	0.748				2.410

Variables	Indicator	Outer Loading	AVE	CA	CR	Outer VIF
	PCU5	0.806	0.586	0.936	0.943	2.895
	PCU6	0.719				2.293
	PCU7	0.801				2.645
	PCU8	0.738				1.865
	PCU9	0.817				2.425
	PCU10	0.742				2.223
	PCU11	0.721				1.935
	PCU12	0.793				2.610
	QAE1	0.754				2.100
	QAE2	0.773				1.906
	QAE3	0.801				2.133
	QAE4	0.756				2.286
Quality Assurance Effectiveness (QAE)	QAE5	0.768	0.586	0.936	0.943	2.423
	QAE6	0.821				2.662
	QAE7	0.731				2.409
	QAE8	0.786				2.179
	QAE9	0.781				2.251
	QAE10	0.799				2.245
	QAE11	0.826				2.273
	QAE12	0.764				2.072

Discriminant validity was assessed using the Heterotrait–Monotrait Ratio (HTMT), considered a more robust and sensitive criterion in PLS-SEM than traditional methods (e.g., Fornell–Larcker criterion and cross-loadings). HTMT was selected because the constructs studied in this research are conceptually related in the wider field of digital governance and quality assurance, and therefore require stricter validation to ensure construct distinctiveness.

As shown in Table 4, all the HTMT values were below the recommended threshold of 0.90, ranging from 0.736 to 0.891. These results suggest that each construct has good discriminant validity and measures empirically distinct dimensions of the proposed framework. The findings, therefore, confirm that data governance capacity, digital infrastructure readiness, policy capacity, digital QA utilization and quality assurance effectiveness are distinct but theoretically related constructs in the higher education governance landscape.

Table 4. Discriminant validity assessment (HTMT criterion).

Constructs	DGC	DIR	DQAU	PCU	QAE
Data Governance Capacity (DGC)	—				
Digital Infrastructure Readiness (DIR)	0.842	—			
Digital Quality Assurance Utilization (DQAU)	0.781	0.816	—		
Policy Capacity of University (PCU)	0.736	0.851	0.872	—	
Quality Assurance Effectiveness (QAE)	0.748	0.824	0.883	0.891	—

4.3. Structural Model Evaluation

Having fulfilled the requirements of validity and reliability for the measurement model, the test on the structural model was performed (Figure 2). The purpose of this phase was to assess the predictive power and explanatory power of the proposed framework for explaining the relationships among the constructs of governance, digital quality assurance utilization, and institutional effectiveness. The data were analyzed using the bootstrapping procedure with 5,000 resampling iterations and the two-tailed testing approach to obtain robust estimations of the significance of the paths and the stability of the model (Streukens & Leroi-Werelds, 2016).

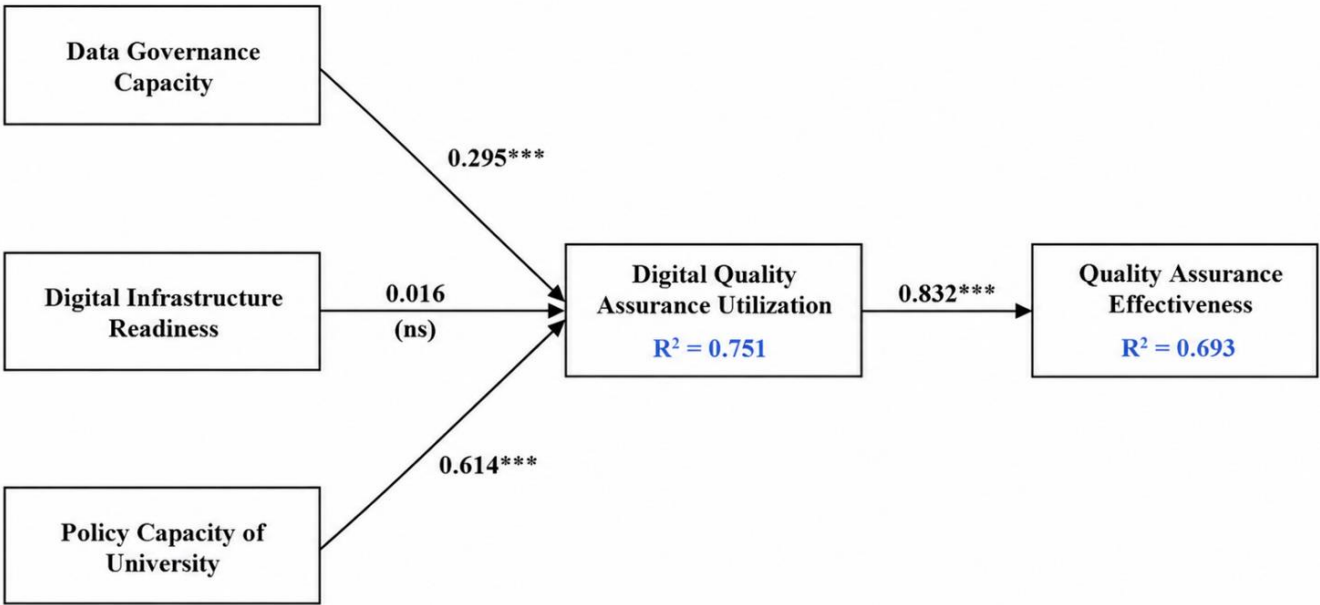


Figure 2. Structural Model.

Note: Standardized path coefficients (β). ***p < 0.001; ns = Not significant.
R² = Coefficient of Determination.

The collinearity test results as shown in Table 5 revealed that the inner VIF values were less than the recommended value of 5.00 (Kock, 2015) for all the predictor constructs, thus indicating that the predictor constructs did not suffer from collinearity problems. Although the Digital Infrastructure Readiness construct had a relatively high collinearity estimate in the first place, the amended model was still within the acceptable boundary. Hence, the structural associations could be interpreted reliably.

Table 5. Inner collinearity.

Structural Path	Inner VIF	Interpretation
Data Governance Capacity → Digital QA Utilization	3.336	No multicollinearity issue
Digital Infrastructure Readiness → Digital QA Utilization	4.782	Acceptable collinearity
Policy Capacity of University → Digital QA Utilization	3.662	No multicollinearity issue
Digital QA Utilization → Quality Assurance Effectiveness	1.000	No multicollinearity issue

The structural model also showed good explanatory power. Table 6 shows that the coefficient of determination (R²) is 75.1% and 69.3% for the variance explained by the proposed antecedent variables for Digital Quality Assurance Utilization and Quality Assurance Effectiveness, respectively. These values show that the model explains a large proportion of the variance of both endogenous constructs and therefore has a high explanatory power.

Furthermore, the findings suggest that Data Governance Capacity, Digital Infrastructure Readiness and University Policy Capacity together play a significant role in explaining the adoption and utilization of digital quality assurance systems and their impact on institutional quality performance. Therefore, the findings provide strong empirical evidence that governance-related capabilities are key determinants of successful implementation of digital QA and, thus, of the effectiveness of quality assurance practices in higher education institutions.

Table 6. Coefficient of determination (R²).

Endogenous Variables	R ²	Adjusted R ²	Interpretation
Digital Quality Assurance Utilization	0.751	0.749	Substantial
Quality Assurance Effectiveness	0.693	0.692	Moderate–Substantial

The results of the predictive relevance analysis are reported in Table 7. The Q² values were significantly larger than zero, which indicates satisfactory predictive capability of the structural model for all endogenous constructs. These results confirm the model’s ability to make significant predictions of the dependent variables involved in the research framework.

Furthermore, the model fit evaluation reported in Table 8 indicates that the overall fit of the proposed model is acceptable, especially with respect to the Standardized Root Mean Square Residual (SRMR), which suggests a reasonable match between the observed data and the hypothesized structural model. While the Normed Fit Index (NFI) values were moderate, this result is not atypical in PLS-SEM studies with relatively complex structural models with a large number of indicators and higher-order or multidimensional constructs. Therefore, the overall model fit can still be considered sufficient for hypothesis testing and structural interpretation.

Table 7. Predictive relevance (Q²).

Endogenous Construct	Q ²	Predictive Relevance
Digital Quality Assurance Utilization	0.487	Large predictive relevance
Quality Assurance Effectiveness	0.451	Large predictive relevance

Table 8. Model Fit Assessment.

Fit Index	Saturated Model	Estimated Model	Recommended Threshold
SRMR	0.078	0.081	< 0.08–0.10
d_ ULS	13.145	14.882	Lower is better
d_ G	11.090	11.203	Lower is better
Chi-Square	19389.473	19534.364	—
NFI	0.446	0.442	Acceptable in complex PLS models

The predictive adequacy of the model was also supported by the PLSpredict procedure shown in Table 9. Most indicators showed lower prediction errors for the PLS-SEM estimation as compared to the linear benchmark model, indicating satisfactory medium predictive performance. The overall results show that the proposed framework has an adequate level of explanatory and predictive robustness to understand how the use of digital quality assurance is a strategic intermediary between the resources of data-driven governance and institutional effectiveness in higher education institutions.

Table 9. PLSpredict assessment.

Construct	Q ² predict Range	Dominant Prediction Result	Predictive Power
Digital QA Utilization	0.178 – 0.465	Majority of PLS-SEM errors lower than LM	Medium predictive power
Quality Assurance Effectiveness	0.243 – 0.438	Majority of PLS-SEM errors lower than LM	Medium predictive power

4.4. Direct Hypothesis Testing

The direct effect evaluation is shown in Table 10, which supported three of the four proposed hypotheses statistically. Data Governance Capacity had a significant and positive impact on Digital Quality Assurance Utilization ($\beta = 0.295$; $p < 0.001$). This indicates that the more the institutional capacity to manage data quality, interoperability and accountability, the more intensive utilization of digital QA systems. The effect size also constitutes an important practical contribution to the practices of governance in higher education. On the other hand,

Digital Infrastructure Readiness ($\beta = 0.016$; $p = 0.773$) did not significantly influence Digital Quality Assurance Utilization; therefore, H2 was rejected. This finding suggests that technology readiness alone is not sufficient for effective digital QA implementation. In the context of Indonesian higher education, the availability of infrastructure appears to be less decisive than institutional commitment and governance orientation. On the contrary, Policy Capacity of the University was found to be the strongest predictor of Digital Quality Assurance Utilization ($\beta = 0.614$; $p < 0.001$), which supported H3. The findings demonstrate the strategic importance of evidence-based policymaking, leadership buy-in and governance direction in accelerating the uptake of digital QA. Finally, the results showed that Digital Quality Assurance Utilization had a very strong positive effect on Quality Assurance Effectiveness ($\beta = 0.832$; $p < 0.001$), supporting H4. The large effect size implies that digital QA is a salient operational mechanism through which governance capabilities are translated into institutional quality improvement outcomes.

Table 10. Direct hypothesis testing results.

Hypothesis	Relationship	β (O)	STDEV	t-value	p-value	95% BCa CI	f ²	Decision
H1	Data Governance Capacity → Digital Quality Assurance Utilization	0.295	0.035	8.392	<0.001	[0.224, 0.362]	0.105	Supported
H2	Digital Infrastructure Readiness → Digital Quality Assurance Utilization	0.016	0.055	0.289	0.773	[-0.092, 0.123]	0.000	Not Supported
H3	Policy Capacity of University → Digital Quality Assurance Utilization	0.614	0.045	13.530	<0.001	[0.521, 0.699]	0.412	Supported
H4	Digital Quality Assurance Utilization → Quality Assurance Effectiveness	0.832	0.018	45.996	<0.001	[0.792, 0.864]	2.254	Supported

4.5. Mediation Analysis

Table 11 presents mediation analysis that offers a more insightful understanding of the central proposition of the study, indicating that Digital Quality Assurance (QA) Utilization is the main operational channel through which governance capabilities are transformed into enhanced institutional quality performance. The results show that Data Governance Capacity has a positive and significant indirect effect on Quality Assurance Effectiveness through Digital QA Utilization ($\beta = 0.246$; $p < 0.001$). Therefore, H5 is supported. This result implies that the effectiveness of data governance is achieved not only by having governance capabilities, but by their integration into digital quality assurance activities and evidence-based assessment practices.

The mediating role of Digital Infrastructure Readiness on Quality Assurance Effectiveness through Digital QA Utilization was found to be statistically insignificant ($\beta = 0.013$; $p = 0.774$), and consequently H6 was rejected. Evidence suggests that the mere presence of adequate technological infrastructure is not sufficient to improve institutional quality outcomes. However, technological resources generate value only when they are successfully integrated into digital quality assurance processes. Thus, the results suggest that the lack of organizational adoption and governance integration of infrastructure readiness adds little to quality improvement in higher education institutions.

Moreover, University Policy Capacity had a significant and meaningful indirect effect on Quality Assurance Effectiveness through Digital QA Utilization ($\beta = 0.511$; $p < 0.001$), providing empirical support for H7. The relative magnitude of this indirect effect underscores the importance of institutional policies, leadership commitment and governance coherence for effective implementation of digital quality assurance systems. The significant mediation effects for H5 and H7 are better characterized as indirect-only mediation because the structural model only specifies indirect relationships between governance antecedents and Quality Assurance Effectiveness. Overall, the findings support the proposition that Digital QA Utilization is the key mediator linking governance capabilities to improved institutional quality performance in higher education.

Table 11. Mediation analysis results.

Hypothesis	Indirect Relationship	Indirect Effect (β)	STDEV	t-value	p-value	Mediation Type	Decision
H5	Data Governance Capacity → Digital QA Utilization → Quality Assurance Effectiveness	0.246	0.030	8.211	<0.001	Indirect-Only Mediation	Supported
H6	Digital Infrastructure Readiness → Digital QA Utilization → Quality Assurance Effectiveness	0.013	0.046	0.288	0.774	No Mediation	Not Supported
H7	Policy Capacity of University → Digital QA Utilization → Quality Assurance Effectiveness	0.511	0.040	12.783	<0.001	Indirect-Only Mediation	Supported

4.6. Importance–Performance Map Analysis (IPMA)

Besides the structural model assessment, Importance – Performance Map Analysis (IPMA) was further applied to identify the constructs that significantly affect the Quality Assurance Effectiveness and the extent to which management should pay attention to them depending on their current performance levels. Unlike conventional path analysis that only considers statistical significance, IPMA offers a more pragmatic interpretation by combining the total effects of each construct with their performance scores (Hauff et al., 2024). This approach is especially applicable to governance in higher education, where institutional leaders need strategic direction on the governance dimensions to emphasize for improving quality assurance outcomes in the context of digital transformation.

As seen in Figure 3 and Table 12, the highest importance value is Digital Quality Assurance Utilization (0.832), which indicates that this construct is the most potent predictor of institutional quality assurance effectiveness.

However, its performance score (69.822) was lower than several antecedent variables, which showed that there are still large opportunities for universities to optimize the operational use of digital QA systems. This finding suggests that institutional effectiveness is not only a function of the availability of governance resources, but also of the extent to which digital quality mechanisms are actively embedded into evaluation, monitoring and continuous improvement activities.

(0.511) Policy Capacity of the University also showed significant strategic importance along with a relatively stable performance level (70.200). The finding indicates that leadership commitment, evidence-based policymaking, and institutional governance direction continue to be critical foundations for strengthening digital QA practices. In terms of Data Governance Capacity, a moderate contribution was observed for institutional effectiveness, highlighting the continued importance of data integration, accountability, and governance standards to support digital quality management processes.

On the other hand, Digital Infrastructure Readiness was ranked the lowest importance value despite having the highest performance score (72.184). The trend suggests that many universities may have a relatively adequate technological infrastructure, thus limiting its further contribution to quality assurance outcomes. The IPMA findings together reinforce the main claim of this study that the effectiveness of data-driven governance in higher education is less a question of technological availability and more a question of how well digital quality assurance systems are used in governance practices of higher education institutions.

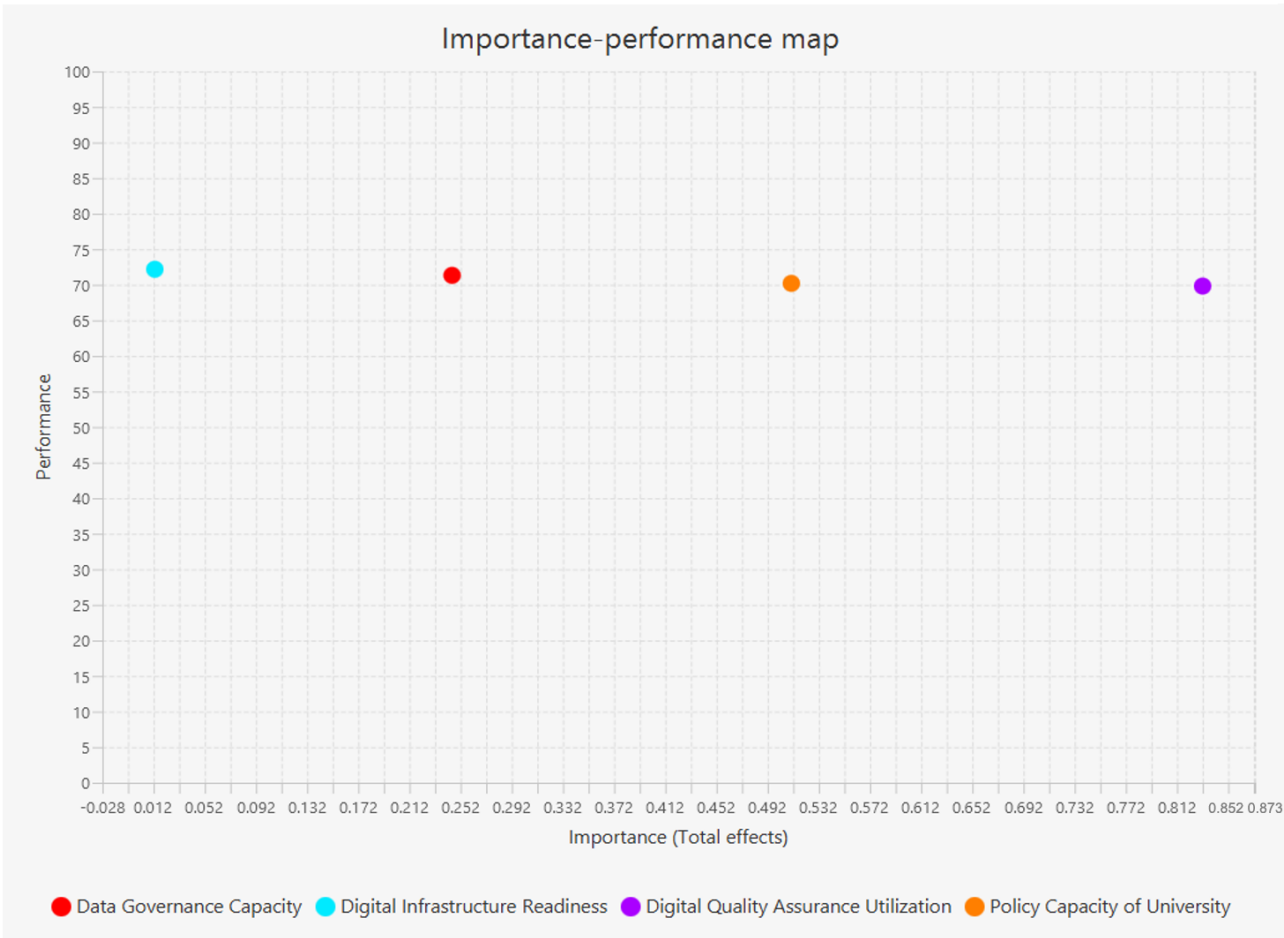


Figure 3. IPMA matrix output.

Table 12. Importance–performance map analysis (IPMA) results.

Construct	Importance (Total Effect)	Performance Index	Strategic Priority
Data Governance Capacity	0.246	71.329	Moderate Priority
Digital Infrastructure Readiness	0.013	72.184	Low Priority
Digital Quality Assurance Utilization	0.832	69.822	Highest Priority
Policy Capacity of University	0.511	70.200	High Priority

5. Discussion and Implications

5.1. Discussion

This study aims to examine the extent to which the employment of digital quality assurance functions as a bridge between the dimensions of data-driven governance and institutional effectiveness in Indonesian higher education. Specifically, the relationships between data governance capacity, digital infrastructure readiness, policy capacity, digital QA utilization, and quality assurance effectiveness were examined in the study. To accomplish these goals, the study employed a quantitative cross-sectional study design with 500 respondents from universities across Indonesia. The respondents were mostly institutional leaders, quality assurance managers, and governance-related administrators. The developed framework was tested with PLS-SEM using SmartPLS 4 and enabled a comprehensive analysis of the measurement model, structural relationships, mediation effects and strategic priorities via IPMA. The wider findings imply that the success of higher education quality assurance systems is not only dependent upon the presence of digital infrastructure, but more significantly upon the integration and use of digital quality assurance practices within institutional governance processes.

The results show that data governance capability is an important organizational foundation for increasing the use of digital quality assurance in higher education institutions. Successful digital QA implementation depends not

only on the availability of technology but also on the institution's ability to manage data through standard governance mechanisms, interoperability, accountability and reliable information systems. This finding is in line with previous studies showing that strong data governance helps institutions to better integrate information resources and to optimize digital QA systems for monitoring, accreditation and evidence-based decision-making processes (Beerkens, 2022; Giest et al., 2025; Salerno & Maçada, 2026).

Better governance structures usually also come with better processes around data ownership, validation and integration across units, so digital QA systems can be used as credible tools for monitoring and evaluation instead of just administrative tools. Where governance capacity is weak, institutions tend to have fragmented data systems, inconsistent reporting, and organizational silos that diminish the practical value of digital QA practices. On the other hand, mature governance capacity helps institutions turn scattered institutional data into integrated governance intelligence for evidence-based quality management. The finding supports the study's argument that governance capability is not enough unless it is operationalized through active utilization of digital quality assurance.

In contrast to the findings in H1, the results of the H2 test show that Digital Infrastructure Readiness does not significantly contribute to Digital Quality Assurance Utilization. The findings indicate that the presence of a sufficient technological infrastructure does not necessarily result in the optimization of the use of digital QA systems in institutional practices. Availability of hardware, networks and digital platforms, in other words, seems to be a basic prerequisite, rather than a major determinant for the actual use of data-driven QA systems. This finding points to a technology paradox in the context of higher education in which investments in digital infrastructure do not necessarily lead to increased use of digital quality assurance systems or changes in organizational practices.

These findings run counter to earlier theoretical discussions that emphasize integrated information systems, cloud computing, analytics platforms, and cybersecurity readiness as the primary determinants that enable the optimization of digital quality assurance through data integration, real-time monitoring, and improved accessibility to institutional information (Areba et al., 2026; Jeong et al., 2024; Tsimpanis et al., 2025). However, for this study, the readiness of the infrastructure was not enough to induce the use of digital QA in real terms. The phenomenon shows that the use of digital QA in higher education management depends more on the governance capacity and policy orientation than only on technical readiness. This variable loses its differentiation in terms of the level of utilization of digital QA systems when digital infrastructure has become the minimum standard in many universities. One possible reason is that digital infrastructure has become a baseline organizational pre-requisite for many universities, thus limiting its capacity to differentiate institutions in terms of digital QA use. Therefore, infrastructure is more likely to function as a condition that allows change to occur rather than as a direct cause of organizational change.

The results also suggest a tendency toward mimetic isomorphism, where institutions adopt digital infrastructure mainly to satisfy the modernization legitimacy requirements rather than being driven by genuine quality assurance operational needs. Thus, many digital systems are formally available but not yet fully integrated in the routine of quality evaluation and academic decision-making. These findings do not support a technology-centric explanation of organizational change, but instead suggest that technological infrastructure alone may not be sufficient to explain the effective use of digital quality assurance systems. In this study, governance quality and institutional policy capacity seem to play a more important role than infrastructure readiness alone. In this study, the capacity of data governance and institutional policy capacity proved to be more decisive than infrastructure readiness alone.

If the readiness of digital infrastructure in H2 has been found incapable of significantly encouraging the utilization of digital QA, then the results of H3 actually indicate the reverse direction. The highest Digital Quality Assurance Utilization was explained by the most dominant factor: The Policy Capacity of the University. The findings suggest that the success of digital QA transformation in higher education is more linked to the institution's capacity to create policy direction, organizational coordination and regulatory legitimacy than to the mere availability of technology. In other words, the use of digital QA is, in essence, a policy-driven process and flows top-down through institutional governance mechanisms. These findings are consistent with prior theoretical arguments which suggest that policy capacity is the strategic capacity of an institution to align regulations, leadership support and governance commitments to ensure the sustainability of digital QA implementation (Gullifer & Russo, 2022; Nik Harun et al., 2025; Patnaik et al., 2020; Wu et al., 2015). In this sense, policy is not only an administratively functional tool, but also a tool for organizational change.

The magnitude of the effect of these variables shows that universities with high policy capacity are more likely to have a clearer digitalization roadmap, better regulation coordination between units and more effective capabilities of mobilizing resources. This creates a situation in which there are coercive and normative pressures on all academic units to embed digital QA systems in their day-to-day quality evaluation activities. Data use becomes part of the culture of the organization, not simply an administrative task. The findings also indicate that policy factors have a much stronger effect than data governance capacity and digital infrastructure readiness. This means that in a bureaucratic higher education environment, the policy direction and commitment of institutional leadership are more decisive than the technical aspects alone. Even quite advanced technology can become strategically worthless without clear regulations, operational standards, and implementation mechanisms to support it. Thus, policy capacity can be seen as one of the drivers that links the digital transformation agenda with the data-driven QA practices that are actually used operationally in universities.

The results of the test of H4 are in line with the previous findings and show that the intensity of the use of Digital Quality Assurance is the most decisive factor in increasing the effectiveness of quality assurance in higher education. This very strong impact shows us that the quality of the institution is not only determined by the existence of digital policies or digital infrastructure, but above all by the extent to which digital QA systems are actually used in the everyday activities of academic evaluation, monitoring and decision-making. In other words, the transition to new data-driven governance makes a real impact when data and digital systems are integrated into institutional managerial practices in a way that is operational and sustainable.

The findings provide empirical support for the proposition that the use of digital quality assurance is an important organizational mechanism that links governance capacity to institutional effectiveness. When the Digital Quality Assurance system is actively used, the PPEPP process can be run more adaptively, in real time, and evidence-

based. Quality monitoring has evolved from an administrative, periodic activity to a continuous control mechanism through an analytical dashboard, early warning system, and data integration across academic units. This situation allows universities to respond more quickly and more objectively to potential quality problems before they grow into larger institutional problems.

These findings are in line with the development of a previous hypothesis that highlights the role of digital QA in enabling the systematic conduct of quality monitoring by institutions using analytics platforms, automated reporting and feedback loops to improve evidence-based evaluation and sustainable institutional quality improvement (Jesus-Silva et al., 2023; Schellekens et al., 2023; Vaghela et al., 2025). The regular use of digital systems also enhances the responsiveness of organizations to changes in quality standards and the increasingly dynamic accreditation demands. The effectiveness of quality assurance is enhanced when the technical capacity is aligned with the complexity of the tasks of academic evaluation and university governance. The Digital Quality Assurance system has not become an additional administrative device, but rather has become the heart of the quality architecture of modern institutions. The findings suggest that higher education institutions are more likely to improve effectiveness in quality assurance when digital QA systems are substantively embedded in routine governance processes, rather than being implemented as merely technological or administrative initiatives.

We performed a mediation analysis to examine the mediation of DQAU in the data-driven governance framework, beyond testing the direct relationships. H5 showed that Data Governance Capacity had a significant indirect effect on Quality Assurance Effectiveness through DQAU, which was classified as indirect-only mediation. These findings indicate that good data governance alone does not ensure quality effectiveness if not translated into active use of digital QA systems. Data standardization and system interoperability and data stewardship mechanisms provide essentially only administrative foundations. The strategic value only comes when the data is used in quality audits, academic monitoring and digital-based institutional evaluations. Thus, DQAU appears to serve as a key mechanism through which data governance capacity is translated into better quality assurance practices and institutional outcomes.

But H6 shows that there is no significant mediating effect of Digital Infrastructure Readiness on the effectiveness of quality assurance. The absence of a meaningful mediation effect indicates that digital infrastructure alone may not be sufficient to lead to improvements in the effectiveness of quality assurance without the concomitant effective organizational utilization. The findings suggest the phenomenon of a productivity paradox in the digitalization of higher education. The investment in technology does not always translate directly into an improvement in institutional performance. In the absence of substantive use of the system by organizational actors, digital infrastructure is merely a supporting facility. At the operational implementation level, the path to quality effectiveness is blocked by the lack of infrastructure readiness to facilitate the use of DQAU.

Meanwhile, H7 demonstrated the strongest mediation pattern in this study model. Policy Capacity of University has an indirect effect with a very large magnitude on Quality Assurance Effectiveness through DQAU with an indirect-only mediation type. The results suggest that policy capacity affects the effectiveness of quality assurance mainly through enabling coherent and integrated use of digital quality assurance systems across institutional processes. Strategic policies, leadership support, digitalization roadmaps and regulatory legitimacy create organizational pressure that compels faculties and academic units to use the DQA system in the evaluation and quality control process. However, these results also demonstrate that policies do not necessarily increase quality effectiveness if they stay at the level of administrative documents without being enacted through the use of real digital systems.

The mediation analysis provides empirical support for the view of DQAU as an important mediating capability in translating governance resources into quality assurance outcomes. However, the cross-sectional design does not allow for causal inference, but the findings suggest that data-driven governance is more likely to improve institutional effectiveness when governance resources and policy capacity are operationalized through the continuous use of digital quality assurance systems in institutional decision-making.

5.2. Theoretical Implications

This study adds to the body of literature on data-driven governance in higher education by providing an integrated view of the relationship between organizational capabilities, digital systems and institutional effectiveness. First, the results contribute to the Resource-Based View (RBV) and Dynamic Capability Theory, indicating that strategic resources are not enough to create institutional value if they are not efficiently implemented through organizational capabilities. The results indicate that Data Governance Capacity and Policy Capacity are more strongly associated with Digital Quality Assurance Utilization (DQAU) than Digital Infrastructure Readiness, suggesting that governance-related resources may be more influential than technological assets alone in facilitating data-driven quality management.

Second, the study makes a contribution to the data-driven governance literature by empirically validating the perception of DQAU as an important organizational capability that links governance capabilities to quality assurance effectiveness. The findings suggest that the value of digital quality assurance is not in an administrative function geared towards compliance, but in facilitating continuous monitoring, evidence-based evaluation and organisational learning. This perspective extends the Institutional Theory literature by proposing that digital systems are more likely to contribute to institutional effectiveness if they are substantively embedded in routine governance processes rather than adopted for largely symbolic or legitimacy reasons.

Third, the findings imply that technological readiness may not be adequate to explain differences in the effectiveness of institutional quality assurance. While digital infrastructure fared relatively well in the IPMA analysis, its direct effect on DQAU was not statistically significant. This result extends the knowledge on Task–Technology Fit Theory by indicating that the organizational value of technology is contingent on the fit with governance capacity and institutional policy support. Therefore, this study suggests an integrative governance perspective where governance capacity, policy capacity, and DQAU collectively contribute to institutional quality assurance in higher education.

5.3. Practical and Policy Implications

The practical implications of this study imply that institutional effectiveness in higher education is not only about technological modernization but also the integration of governance capacity, policy direction and effective utilization of digital quality assurance (DQA) systems. The results offer various goals derived from the structural model and Importance–Performance Map Analysis (IPMA) that could support university leaders and policymakers to enhance data-driven governance practices.

First, colleges should focus on improving the substantive use of DQAU in everyday governance procedures, rather than being solely concerned with technology acquisition. Some institutions have developed digital systems, but these systems are not always properly integrated into quality assurance operations and institutional decision-making. Therefore, colleges can profit from boosting user participation, including DQA into performance management systems and enhancing continuous monitoring via digital dashboards, analytics and feedback mechanisms.

Second, the institutional policy capacity should be upgraded to enable sustainable digital governance implementation. Clear digital governance roadmaps, alignment of institutional legislation and strengthened leadership commitment may allow consistent adoption of evidence-based quality management techniques. At the same time, investments in human capacities like data literacy and digital auditing and analytical capabilities for quality assurance people are likely to improve the effective use of digital technologies.

Third, institutions need to build data governance capacity by enhancing data stewardship, standardizing data ownership and integrating academic, administrative and quality assurance information systems. A credible and interoperable data ecosystem provides a better basis for institutional monitoring, accreditation and strategic decision-making.

The findings also suggest that simply increasing the digital infrastructure may not be sufficient to improve institutional quality assurance. Instead of spending more on hardware, colleges could realize larger gains by better integrating systems, rethinking governance processes and promoting regular use of current digital platforms. This move from technology purchase to technology utilization may provide more organizational value in the long run.

The results show that the evaluation frameworks used by higher education regulators and certification bodies may place greater emphasis on the use of digital technology, rather than their mere availability. Hence, future certification frameworks may benefit from including indicators that capture the use of digital quality assurance, evidence-based decision making, ongoing monitoring, and digital audit trails, in addition to traditional assessments of technological readiness.

6. Conclusion

The study suggests that institutional success in higher education is less a function of the availability of digital technology per se, and more a function of the practical embedding of digital quality assurance methods in governance processes. The results indicate that Data Governance Capacity and Policy Capacity of University positively and considerably improve Digital Quality Assurance Utilization (DQAU), while Digital Infrastructure Readiness does not make a major impact. Most crucially, DQAU was the best predictor of Quality Assurance Effectiveness and the main mediating mechanism that linked governance ability with institutional results. These findings demonstrate that in higher education, digital transformation is policy-enabled and governance-driven rather than technology-driven. Hence, the study considers DQAU as the “missing link” translating institutional governance preparation into evidence-based quality management and sustainable organizational success.

The study also adds to the greater debate on data-driven governance by opposing technological determinism and confirming the productivity paradox in higher education. Technological infrastructure alone does not necessarily lead to institutional change until it is embedded in organizational routines, policy procedures and practices of data-based decision-making. Therefore, governance maturity and policy congruence are more critical than infrastructure expansion for genuine digital transformation.

Despite these contributions, there are several limits that should be noted. First, the cross-sectional approach restricts the possibility of capturing the longitudinal changes of digital governance practices over time. Second, the study targeted Indonesian higher education institutions and this may limit the generalizability to other regulatory and cultural settings. Thirdly, the model was limited to organizational-level variables and did not include behavioral aspects such as user resistance, digital culture, or leadership style. Future research should employ a longitudinal or mixed-methods approach, broaden comparisons across other countries, and combine behavioral and organizational culture characteristics to further elucidate how digital governance ecosystems develop in higher education.

References

- Ajayi, B. A., & Hussin, H. (2018). Conceptualizing information technology governance model for higher education: An absorptive capacity approach. *Bulletin of Electrical Engineering and Informatics*, 7(1), 117-124. <https://doi.org/10.11591/eei.v7i1.898>
- Aldhobaib, M. A. (2024). Quality assurance struggle in higher education institutions: Moving towards an effective quality assurance management system. *Higher Education*, 88(4), 1547-1566. <https://doi.org/10.1007/s10734-024-01182-5>
- Almashekhi, A. S. S., Mohamad, A. D., & Khafidz, H. A. (2026). Digital transformation initiatives and beneficiaries' satisfaction in public services: The mediating roles of service accessibility and ease of use. *International Review of Management and Marketing*, 16(3), 386-394. <https://doi.org/10.32479/irmm.23399>
- Areba, G. N., Nyakundi, E., & Nyakan, B. (2026). The digital divide in higher education: Challenges and opportunities for leaders. In G. N. Areba, B. N. Gisore, E. W. Njurai, F. M. Awuor, & R. Makiya Cyprian (Eds.), *Transformative leadership and enhancing equity in technological advancements in higher education* (pp. 81-110). Hershey, PA: IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3373-2322-0.ch004>
- Asad, M. M., Mahar, P., Datoo, A. K., Sherwani, F., & Hassan, R. (2023). Impact of quality assurance on TVET programs for the digital employment market of IR 4.0 in Pakistan: A quantitative investigation. *Education + Training*, 65(6-7), 891-908. <https://doi.org/10.1108/ET-08-2022-0295>
- Asfaw, Z., Alemneh, D., Ferede, B., Santure, A., & Jimma, W. (2025). Implementing data-driven decision-making to improve the quality of education in Ethiopian higher learning institutions. *International Journal of African Higher Education*, 11(3), 49-75. <https://doi.org/10.6017/ijahe.v11i3.17669>

- Awujoola, J. O., Enem, T. A., Ogwueleka, F. N., Abioye, O., & Adelegan, R. O. (2024). Machine learning-enabled predictive analytics for quality assurance in Industry 4.0 and smart manufacturing: A case study on red and white wine quality classification. In A. K. Tyagi, S. Tiwari, & S. S. Ahmad (Eds.), *Industry 4.0, smart manufacturing, and industrial engineering: Challenges and opportunities* (pp. 65–97). Boca Raton, FL: CRC Press.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. <https://doi.org/10.1177/014920639101700108>
- Beerens, M. (2022). An evolution of performance data in higher education governance: A path towards a ‘big data’ era? *Quality in Higher Education*, 28(1), 29–49. <https://doi.org/10.1080/13538322.2021.1951451>
- Blayone, T. (2018). Reexamining digital-learning readiness in higher education: Positioning digital competencies as key factors and a profile application as a readiness tool. *International Journal on E-Learning: Corporate, Government, Healthcare, and Higher Education*, 17(4), 425–451.
- Buinytska, O., Hrytseliak, B., Smirnova, V., & Tiutiunyyk, A. (2025). Analysis of digital tools for educational quality assessment at the university. *Cybersecurity Providing in Information and Telecommunication Systems 2025*(3991), 248–258.
- Buitrago, R. R. E., Barbosa Camargo, M. I., & Cala Vitery, F. (2021). Emerging economies’ institutional quality and international competitiveness: A PLS-SEM approach. *Mathematics*, 9(9), 928. <https://doi.org/10.3390/math9090928>
- Burton, S. (2021). Data governance: The path to a data-driven culture. *Applied Marketing Analytics*, 6(4), 298–308. <https://doi.org/10.69554/bzxb2352>
- Caballero, R. S., Rincón, C. L., Toscano, R. A., Pérez, V. A., & Gómez, M. G. (2025). Challenge-based learning and design thinking in higher education: Institutional strategies for linking experiential learning, innovation, and academic performance. *Innovations in Education and Teaching International*, 62(2), 557–574. <https://doi.org/10.1080/14703297.2024.2326191>
- Cahyaningsih, E., Shaleh, S., & Fitriyanti, A. (2024). Utilization of computer-based testing technology to optimize cognitive-based assessment literacy in the learning of Islamic elementary school students. *Journal of Integrated Elementary Education*, 4(2), 151–172. <https://doi.org/10.21580/jieed.v4i2.21943>
- Camisón, C., & Puig-Denia, A. (2016). Are quality management practices enough to improve process innovation? *International Journal of Production Research*, 54(10), 2875–2894. <https://doi.org/10.1080/00207543.2015.1113326>
- Chakraborty, S. (2024). Digital quality’s role in US online higher education. *Quality Assurance in Education*, 32(1), 1–16. <https://doi.org/10.1108/QAE-05-2023-0083>
- Cheng, E. C. K. (2025). Strategic use of data in higher education institutions for quality enhancement. In M. Kayyali (Ed.), *Navigating quality assurance and accreditation in global higher education* (pp. 535–562). Hershey, PA: IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-6915-9.ch023>
- Chimpiri, T. R. (2025). *A six-pillar governance readiness framework and tool for ERP migration data quality*. Paper presented at the 2025 IEEE 11th Information Technology International Seminar (ITIS). IEEE.
- Chounta, I.-A., Ortega-Arranz, A., Daskalaki, S., Dimitriadis, Y., & Avouris, N. (2024). Toward a data-informed framework for the assessment of digital readiness of higher education institutions. *International Journal of Educational Technology in Higher Education*, 21(1), 59. <https://doi.org/10.1186/s41239-024-00491-0>
- David, D., Abdurachman, E., Bandur, A., & Kosasih, W. (2023). Improving competitive advantages of higher education institutions through IT governance, IT excellence, and IT innovation: A case study in School of informatics management & computing in Indonesia. *CommIT (Communication and Information Technology) Journal*, 17(1), 103–119. <https://doi.org/10.21512/commit.v17i1.8505>
- de Oliveira, T. H. M., de Castro Neto, M., Costa, E. G., Simões, M. Q., & Sousa, C. (2025). *Rewiring governance: Building a data-centric ecosystem for higher education strategic (and digital) transformation*. In K. Arai (Ed.). Paper presented at the Proceedings of the Future Technologies Conference 2025, Cham, Switzerland: Springer Nature Switzerland.
- Dijju, S., Shah, V., & Raghunandan, A. (2025). *Challenges to digital readiness in K–12 education: Insights from Indian schools*. In S. Mishra, A. Kothiyal, S. Iyer, S. Sahasrabudhe, A. Lingnau, & R. Kuo (Eds.). Paper presented at the Proceedings of the International Conference on Technology 4 Education 2024 (Lecture Notes in Educational Technology, Singapore: Springer Nature Singapore.
- Dip, J. A., de Arguibel, F. C., & Aliprandini, P. A. (2025). Evaluating performance to improve management in Argentine public universities with desirable and undesirable indicators. *Public Money & Management*, 1–15. <https://doi.org/10.1080/09540962.2025.2601073>
- Dzin, N. H. M., & Lay, Y. F. (2021). Validity and reliability of adapted self-efficacy scales in Malaysian context using PLS-SEM approach. *Education Sciences*, 11(11), 676. <https://doi.org/10.3390/educsci11110676>
- Elliot, M. (2026). Quality assurance, accreditation, and digital competencies: Reimagining standards for the digital age. In C. Marques & V. Santos (Eds.), *Reinventing higher education through digital transformation and smart campuses* (pp. 381–406). Hershey, PA: IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3373-6831-3.ch011>
- Engwall, L. (2018). Montesquieu in the university: The governance of world-class institutions of higher education and research. *European Review*, 26(2), 285–298. <https://doi.org/10.1017/S1062798717000679>
- Evenstein, S. S., Hershkovitz, A., Cohen, A., & Nachmias, R. (2026). Trusting the data: An updated framework for teachers’ data-driven decision-making (DDDM) in higher education. *Education and Information Technologies*, 31(3), 953–981. <https://doi.org/10.1007/s10639-025-13819-8>
- Fattah, I. A. (2024). The mediating effect of data literacy competence in the relationship between data governance and data-driven culture. *Industrial Management & Data Systems*, 124(5), 1823–1845. <https://doi.org/10.1108/IMDS-11-2023-0812>
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, 41(4), 1149–1160. <https://doi.org/10.3758/BRM.41.4.1149>
- Flowers, B., & Tanner, M. (2024). *Exploring the digital readiness of underprivileged secondary schools in South Africa*. Paper presented at the International Conference on Implications of Information and Digital Technologies for Development, Cham, Switzerland: Springer Nature Switzerland.
- Gaftandzhieva, S., Doneva, R., & Bliznakov, M. (2020). Internal and external QA in HE: LA tools and self-evaluation report preparation. *International Journal of Emerging Technologies in Learning*, 15(16), 191–199. <https://doi.org/10.3991/ijet.v15i16.14401>
- Gedifew, M. T., & Muluneh, G. S. (2021). Building a change adaptive university: A system of composite indicators to measure and facilitate pervasive changes. *Higher Education Quarterly*, 75(2), 227–246. <https://doi.org/10.1111/hequ.12279>
- Giest, S., McBride, K., Nikiforova, A., & Sikder, S. K. (2025). Digital & data-driven transformations in governance: A landscape review. *Data & Policy*, 7, e21. <https://doi.org/10.1017/dap.2024.47>
- Guenther, P., Guenther, M., Ringle, C. M., Zaefarian, G., & Cartwright, S. (2023). Improving PLS-SEM use for business marketing research. *Industrial Marketing Management*, 111, 127–142. <https://doi.org/10.1016/j.indmarman.2023.03.010>
- Gullifer, J. M., & Russo, J. (2022). Academic governance and online pedagogy. In S. P. McKenzie, L. Arulkadacham, J. Chung, & Z. Aziz (Eds.), *The future of online education: Advancements in learning and instruction* (pp. 69–91). New York, NY: Nova Science Publishers.
- Haddade, H., Nur, A., Rasyid, M. N. A., & Abd Raviq, R. (2024). Quality assurance strategies of higher education in digital era: An anthropology of education study in Islamic higher education institution. *Quality Assurance in Education*, 32(1), 46–63. <https://doi.org/10.1108/QAE-05-2023-0084>
- Haipinge, E., & Kadhila, N. (2024). Models of quality assurance: Towards a quality assurance framework of digital learning in higher education in Africa. In P. Neema-Abooki (Ed.), *The sustainability of higher education in sub-Saharan Africa: Quality assurance perspectives* (pp. 15–41). Cham, Switzerland: Palgrave Macmillan. https://doi.org/10.1007/978-3-031-46242-9_2
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Andover, Hampshire, United Kingdom: Cengage Learning EMEA.
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Hauff, S., Richter, N. F., Sarstedt, M., & Ringle, C. M., (2024). Importance and performance in PLS-SEM and NCA: Introducing the combined importance-performance map analysis (cIPMA). *Journal of Retailing and Consumer Services*, 78, 103723. <https://doi.org/10.1016/j.jretconser.2024.103723>

- Hauptman Komotar, M. (2020). Discourses on quality and quality assurance in higher education from the perspective of global university rankings. *Quality Assurance in Education*, 28(1), 78-88. <https://doi.org/10.1108/QAE-05-2019-0055>
- Helfat, C. E., Kaul, A., Ketchen, J. D. J., Barney, J. B., Chatain, O., & Singh, H. (2023). Renewing the resource-based view: New contexts, new concepts, and new methods. *Strategic Management Journal*, 44(6), 1357-1390. <https://doi.org/10.1002/smj.3500>
- Hillman, V. (2023). Bringing in the technological, ethical, educational and social-structural for a new education data governance. *Learning, Media and Technology*, 48(1), 122-137. <https://doi.org/10.1080/17439884.2022.2052313>
- Iatraki, G., & Mikropoulos, T. A. (2023). *Introducing a new technology quality indicator for intervention design in special education*. Paper presented at the International Conference on Immersive Learning, Cham: Springer Nature Switzerland.
- Jayanti, N. K. D. A., & Sarja, N. L. A. K. Y. (2019). *IT as a tools: Quality assurance system in higher education*. Paper presented at the 2019 1st International Conference on Cybernetics and Intelligent System, ICORIS 2019, 279-282.
- Jeong, D. W., Moon, H., Jeong, S. M., & Moon, C. J. (2024). Digital capital accumulation in schools, teachers, and students and academic achievement: Cross-country evidence from the PISA 2018. *International Journal of Educational Development*, 107, 103024. <https://doi.org/10.1016/j.ijedudev.2024.103024>
- Jesus-Silva, N., Carvalho, L., & Cardoso, A. (2023). *Information technologies in quality management in higher education*. Paper presented at the Proceedings - JICV 2023: 13th International Conference on Virtual Campus.
- Jige, S. B. (2025). Role of digital technologies in the education. In M. Anshari, M. N. Almunawar, & P. Ordóñez de Pablos (Eds.), *Multi-industry digitalization and technological governance in the AI era* (pp. 51-72). Hershey, PA: IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3373-1681-9.ch003>
- Kalim, U., & Bibi, S. (2023). Understanding data-driven decision making approach in Chinese higher education through the lens of Bakers model. *International Journal of Chinese Education*, 12(1), 2212585X231162120. <https://doi.org/10.1177/2212585X231162120>
- Kayyali, M. (2025). *Navigating quality assurance and accreditation in global higher education*. Hershey, PA: IGI Global. <https://doi.org/10.4018/979-8-3693-6915-9>
- Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration*, 11(4), 1-10. <https://doi.org/10.4018/ijec.2015100101>
- Lawrence, L. M., Fierlbeck, K., McGrath, P. J., & Curran, J. A. (2020). An expert-generated tool for assessing policy capacity. *Canadian Public Administration*, 63(2), 293-317. <https://doi.org/10.1111/capa.12364>
- Lepori, B., Bornmann, L., & de Moya Anegón, F. (2023). Measuring university size: A comparison of academic personnel versus scientific talent pool data. *Quantitative Science Studies*, 4(4), 800-819. https://doi.org/10.1162/qss_a_00273
- Linlang, L., Linzhen, L., Qinghong, W., & Zhongqi, X. (2023). College basic development status data management system based on data governance framework. *Journal of Donghua University (English Edition)*, 40(4), 446-453.
- López-Chila, R., Llerena-Izquierdo, J., Sumba-Nacipucha, N., & Cueva-Estrada, J. (2024). Artificial intelligence in higher education: An analysis of existing bibliometrics. *Education Sciences*, 14(1), 47. <https://doi.org/10.3390/educsci14010047>
- Lytras, M. D., & Şerban, A. C. (2025). *Academic accreditation and evaluation in higher education: Practices, experiences, and quality assurance*. Hershey, PA: IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-5608-1>
- Maijanen, P. (2020). Approaches from strategic management: Resource-based view, knowledge-based view, and dynamic capability view. In M. Rimscha (Ed.), *Management and economics of communication* (pp. 47-68). Berlin, Germany: De Gruyter Mouton. <https://doi.org/10.1515/9783110589542-003>
- Makanga, C. N., Orobia, L. K., Kaawaase, T. K., Nabeta, I. N., Mindra, R. K., & Munene, J. C. (2025). Oversight mechanisms and public accountability in an emerging economy. *Cogent Business & Management*, 12(1), 2507216. <https://doi.org/10.1080/23311975.2025.2507216>
- Martín, A. V. D., & Ramos, J. M. L. (2022). DEIFDC framework: Evaluation of digital education deployment in India in the midst of the COVID-19 pandemic. *Social Sciences & Humanities Open*, 6(1), 100281. <https://doi.org/10.1016/j.ssaho.2022.100281>
- Medeiros, T., Araújo, A., Silva, J., & Silva, A. (2025). Data governance in education: Addressing challenges and unlocking opportunities for effective data management. In J. Filipe, M. Smialek, A. Brodsky, & S. Hammoudi (Eds.). In (Vol. 1, pp. 367-374). Proceedings of the 27th International Conference on Enterprise Information Systems: ICEIS, Setúbal, Portugal: SciTePress.
- Memon, M. A., Ramayah, T., Cheah, J.-H., Ting, H., Chuah, F., & Cham, T. H. (2021). PLS-SEM statistical programs: A review. *Journal of Applied Structural Equation Modeling*, 5(1), 1-14.
- Ministry of Higher Education Science and Technology of the Republic of Indonesia. (2025). *Indonesian higher education database*. Indonesia: Ministry of Higher Education Science and Technology of the Republic of Indonesia.
- Mutmainah, I., Suharjo, B., Kirbrandoko, & Nurmalina, R. (2020). The influence of dynamic capability and performance on the competitiveness of private higher education. *International Journal of Innovation, Creativity and Change*, 12(9), 456-470.
- Nai, S., Rifai, A., & Sadiq, A. (2025). Data governance in education: Enhancing predictions and decision-making for performance monitoring. In B. E. Elbaghazaoui, M. Amnai, & N. Gherabi (Eds.), *Data governance, DevSecOps, and advancements in modern software* (pp. 99-112). Hershey, PA: IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3373-0365-9.ch005>
- Nik Harun, N. A., Md Syed, M. A., & Abdullah, F. (2025). Revolutionising costume design education: A case study on the impact of Microsoft Copilot. *Quality Assurance in Education*, 33(2), 321-335. <https://doi.org/10.1108/QAE-06-2024-0119>
- Paddock, S. M., Franco, C., Breidt, F. J., & Betancourt, B. (2025). Statistical data integration for health policy evidence-building. *Annual Review of Statistics and Its Application*, 12, 107-131. <https://doi.org/10.1146/annurev-statistics-112723-034507>
- Patnaik, P., Pattnaik, S., & Singh, P. (2020). A simulation model for quality assurance of e-governance projects. In S. S. Rautaray, G. Eichler, C. Erfurth, & G. Fahrnberger (Eds.), *Innovations for community services* (Communications in Computer and Information Science, Vol. 1139, pp. 309-325). Cham, Switzerland: Springer. https://doi.org/10.1007/978-3-030-37484-6_18
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879-903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Pons, M., Llach, J., & Casadesús, M. (2024). *Assuring quality in higher education: Defining dimensions in e-assessment*. In P. Sampaio, P. Domingues, A. Carvalho, M. Casadesús, A. Costa, F. Marimon, S. Pereira, A. R. Pires, & P. Saraiva (Eds.). Paper presented at the Proceedings book of the 6th International Conference on Quality Engineering and Management, 2024. Braga, Portugal: International Conference on Quality Engineering and Management.
- Riveros-Gavilanes, J., Riveros-Gavilanes, J., Amaya-Mejía, R., Guevara-Castro, Y., Cabrera-Gonzales, L. M., & Roa-Yaguara, B. L. (2026). The triad of digital governance: Performance, participation, and digital implementation. *International Review of Public Administration*, 31(1), 23-46. <https://doi.org/10.1080/12294659.2025.2546190>
- Sadat, A. (2025). Digital governance and civic inclusion to enhance public participation in political decision-making processes. *Frontiers in Political Science*, 7, 1671373. <https://doi.org/10.3389/fpos.2025.1671373>
- Salerno, F. F., & Maçada, A. C. G. (2026). The effect of data governance on data-driven culture: The mediating effect of data quality. *The TQM Journal*, 38(7), 1647-1662. <https://doi.org/10.1108/TQM-08-2024-0304>
- Santos, E. G. D., Barrichello, A., & Morano, R. S. (2023). How important are institutions for innovation and global competitiveness? *International Journal of Business Innovation and Research*, 30(4), 476-496. <https://doi.org/10.1504/IJBIR.2023.130075>
- Schellekens, L. H., van der Schaaf, M. F., van der Vleuten, C. P. M., Prins, F. J., Wools, S., & Bok, H. G. J. (2023). Developing a digital application for quality assurance of assessment programmes in higher education. *Quality Assurance in Education*, 31(2), 346-366. <https://doi.org/10.1108/QAE-03-2022-0066>
- Serrano, O., Miranda Gonzalez, F., & Mourato, J. (2026). Impact of quality assurance on higher education institution performance: Differences between public and private institutions. *Societies*, 16(3), 76. <https://doi.org/10.3390/soc16030076>
- Serrano, O. M. E., Miranda González, F. J., & Mourato, J. A. B. (2025). Determinants of the effectiveness of quality assurance systems and institutional performance in higher education. *Cogent Education*, 12(1), 2581411. <https://doi.org/10.1080/2331186X.2025.2581411>
- Sharvashidze, G., Grdzeldze, I., Sikharulidze, D., & Gabrichidze, T. (2023). Data-driven analysis for evidence-based decision making at universities: Benchmarking, software tools and weighted indicators in quality assurance-analytical framework of Tbilisi State University. *Quality in Higher Education*, 29(1), 42-59. <https://doi.org/10.1080/13538322.2022.2122107>

- Shawyun, T., Al-Khatnai, M., & Wattanasap, S. (2025). King Saud University's integrated quality assurance: A longitudinal mixed-methods study of framework evolution, outcomes, and sustainability in higher education management. *Journal of Institutional Research South East Asia*, 23(3), 261-288.
- Shin, J. C., Li, X., Nam, I., & Byun, B.-K. (2022). Institutional autonomy and capacity of higher education governance in South Asia: A comparative perspective. *Higher Education Policy*, 35(2), 414-438. <https://doi.org/10.1057/s41307-020-00220-y>
- Singh, U. G., Nair, C. S., & Watson, R. (2023). *Academic quality and integrity in the new higher education digital environment: A global perspective*. Cambridge, MA: Chandos Publishing. <https://doi.org/10.1016/C2021-0-03390-3>
- Streukens, S., & Leroi-Werelds, S. (2016). Bootstrapping and PLS-SEM: A step-by-step guide to get more out of your bootstrap results. *European Management Journal*, 34(6), 618-632. <https://doi.org/10.1016/j.emj.2016.06.003>
- Talafidaryani, M., & Asarian, M. (2024). Digital transformation research: A bird's eye image of core knowledge and global trends. *Data and Information Management*, 8(2), 100061. <https://doi.org/10.1016/J.DIM.2023.100061>
- Tasani, M. H., & Yusof, M. K. (2026). A systematic literature review on data integration: Issues, data types, architecture. *Journal of Computer Science*, 22(2), 487-503. <https://doi.org/10.3844/JCSSP.2026.487.503>
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533.
- Tran, C. A., Van, D. H., Nguyen, T. T. P., Nguyen, T. T. T., & Nguyen, T. M. (2025). Research in higher education quality assurance worldwide (2003-2023): A bibliometric analysis from the Scopus database. *Cogent Education*, 12(1), 2479405. <https://doi.org/10.1080/2331186X.2025.2479405>
- Tsavatewa, C. C. (2023). Perceptions of data governance: Identifying critical success factors in a university system's implementation effort. Doctoral Dissertation, Middle Georgia State University.
- Tsimpanis, K., Avouris, N., Chounta, I.-A., Daskalaki, S., Dimitriadis, Y., Gari, C. M., . . . Balaouras, P. (2023). *Implementing a data-driven framework for measuring digital readiness across European universities*. In J.-F. Desnos & M. López Nores (Eds.). Paper presented at the Proceedings of European University Information Systems Congress 2023 (EPiC Series in Computing). EasyChair.
- Tsimpanis, K., Plessas, A., Balaouras, P., & Avouris, N. (2025). UDReady: A data-driven platform measuring digital readiness of higher education institutions. *EPiC Series in Computing*, 105, 254-264. <https://doi.org/10.29007/vczq>
- Ulkhaq, M. M., Handayani, N. U., & Rahmat, T. O. (2026). Do quality assurance mechanisms work through quality culture or directly? Evidence on higher education performance from Indonesia. *Journal of Applied Research in Higher Education*, 1-19. <https://doi.org/10.1108/JARHE-09-2025-0808>
- Vaghela, D. A., Chaudhari, A. Z., Balar, P. C., Kumar, A., Solanki, H., & Chavda, V. P. (2025). Data science for quality management. In V. P. Chavda & U. Desai (Eds.), *Data science in pharmaceutical development* (pp. 217-258). Hoboken, NJ: John Wiley & Sons.
- Wu, X., Ramesh, M., & Howlett, M. (2015). Policy capacity: A conceptual framework for understanding policy competences and capabilities. *Policy and Society*, 34(3-4), 165-171. <https://doi.org/10.1016/j.polsoc.2015.09.001>
- Xia, X., & Li, X. (2022). Artificial intelligence for higher education development and teaching skills. *Wireless Communications and Mobile Computing*, 2022(1), 7614337.
- Yan, Y., & Saguin, K. (2021). Policy capacity matters for capacity development: Comparing teacher in-service training and career advancement in basic education systems of India and China. *International Review of Administrative Sciences*, 87(2), 294-310. <https://doi.org/10.1177/0020852320983867>
- Yang, X. (2020). Research on integration method of AI teaching resources based on learning behaviour data analysis. *International Journal of Continuing Engineering Education and Life Long Learning*, 30(4), 492-508. <https://doi.org/10.1504/IJCEELL.2020.110930>
- Zhang, C. (2025). Research on the application of talent cultivation in higher education based on data mining. *International Journal of Web-Based Learning and Teaching Technologies*, 20(1), 1-16. <https://doi.org/10.4018/IJWLTT.389875>
- Zhang, Y., Zhang, M., Wu, L., & Li, J. (2025). Digital transition framework for higher education in AI-assisted engineering teaching: Challenge, strategy, and initiatives in China. *Science & Education*, 34(2), 933-954. <https://doi.org/10.1007/s11191-024-00575-3>
- Zuhairi, A., Raymundo, M. R. D. R., & Mir, K. (2020). Implementing quality assurance system for open and distance learning in three Asian open universities: Philippines, Indonesia and Pakistan. *Asian Association of Open Universities Journal*, 15(3), 297-320. <https://doi.org/10.1108/AAOUJ-05-2020-0034>