http://dx.doi.org/10.18623/rvd.v23.5570

THE ROLE OF DIGITAL TRANSFORMATION IN ENHANCING EXPENDITURE EFFICIENCY IN PUBLIC UNIVERSITIES: AN EMPIRICAL STUDY

O PAPEL DA TRANSFORMAÇÃO DIGITAL NA MELHORIA DA EFICIÊNCIA DAS DESPESAS NAS UNIVERSIDADES PÚBLICAS: UM ESTUDO EMPÍRICO

Article received on: 11/26/2025
Article accepted on: 2/25/2026

Wasfi Abdulkareem Alkasassbeh*
* University of Tabuk, Tabuk, Saudi Arabia
Orcid: https://orcid.org/0009-0000-2780-9342
wasfi_85@hotmail.com

The authors declare that there is no conflict of interest

Abstract
Digital transformation has become a critical driver of efficiency and accountability in public sector organizations, including higher education institutions. This study examines the role of digital transformation in enhancing expenditure efficiency in public universities through an empirical quantitative approach. Data were collected using a structured questionnaire administered to academic and administrative leaders, yielding 178 valid responses. Descriptive and inferential statistical techniques, including correlation and regression analyses, were employed to examine the relationships between digital transformation and expenditure efficiency. The findings indicate that digital transformation, when considered as an integrated organizational capability, has a statistically significant positive effect on expenditure efficiency in public universities. At the dimensional level, systems integration and data interoperability emerge as the most influential predictors of expenditure efficiency, while digital governance, process digitization, and data analytics do not exhibit statistically significant direct effects when examined simultaneously. These results suggest that expenditure efficiency gains in public universities are primarily realized through integrated digital infrastructures rather than isolated digital initiatives. The study contributes to the literature by clarifying the mechanisms through which digital transformation translates into financial efficiency outcomes in the context of public higher education. Practical implications are offered for university leaders and policymakers seeking to improve expenditure efficiency through digital transformation initiatives.

Resumo
A transformação digital tornou-se um fator determinante para a eficiência e a prestação de contas nas organizações do setor público, incluindo instituições de ensino superior. Este estudo examina o papel da transformação digital na melhoria da eficiência das despesas em universidades públicas por meio de uma abordagem empírica quantitativa. Os dados foram coletados por meio de um questionário estruturado aplicado a líderes acadêmicos e administrativos, resultando em 178 respostas válidas. Técnicas estatísticas descritivas e inferenciais, incluindo análises de correlação e regressão, foram empregadas para examinar as relações entre a transformação digital e a eficiência das despesas. Os resultados indicam que a transformação digital, quando considerada como uma capacidade organizacional integrada, tem um efeito positivo estatisticamente significativo sobre a eficiência das despesas nas universidades públicas. No nível dimensional, a integração de sistemas e a interoperabilidade de dados emergem como os preditores mais influentes da eficiência das despesas, enquanto a governança digital, a digitalização de processos e a análise de dados não exibem efeitos diretos estatisticamente significativos quando examinados simultaneamente. Esses resultados sugerem que os ganhos de eficiência de despesas nas universidades públicas são alcançados principalmente por meio de infraestruturas digitais integradas, e não de iniciativas digitais isoladas. O estudo contribui para a literatura ao esclarecer os mecanismos pelos quais a transformação digital se traduz em resultados de eficiência financeira no contexto do ensino superior público. São apresentadas implicações

Keywords: Digital Transformation. Expenditure Efficiency. Public Universities. Systems Integration. Public Sector.

práticas para líderes universitários e formuladores de políticas que buscam melhorar a eficiência de despesas por meio de iniciativas de transformação digital.

Palavras-chave: *Transformação Digital. Eficiência de Despesas. Universidades Públicas. Integração de Sistemas. Setor Público.*

1 INTRODUCTION

In recent years, public sector organizations have faced increasing pressures to improve the efficiency of public expenditure amid fiscal constraints, rising operational costs, and growing demands for transparency and accountability. Governments worldwide are required to ensure that public resources are utilized in a manner that maximizes value while minimizing waste and inefficiencies (OECD, 2020). These pressures are particularly evident in public universities, which manage substantial public budgets while simultaneously responding to expanding academic, research, and administrative responsibilities (Johnstone, 2018).

Expenditure efficiency refers to the ability of public institutions to achieve their objectives through the optimal allocation, control, and monitoring of financial resources. In the context of higher education, expenditure efficiency extends beyond simple cost reduction to encompass rational budget planning, effective expenditure control, and value-for-money considerations that support institutional performance and sustainability (Schick, 2015; Salmi, 2017). Inefficient expenditure practices in universities may result in resource misallocation, duplication of administrative activities, delays in project implementation, and reduced capacity to achieve strategic goals (World Bank, 2019).

In response to these challenges, digital transformation has emerged as a strategic approach for enhancing organizational performance in the public sector. Digital transformation involves the systematic integration of digital technologies into organizational structures, processes, and decision-making mechanisms, enabling institutions to redesign workflows, improve information quality, and enhance managerial oversight (Bharadwaj et al., 2013; Vial, 2019). Unlike traditional information technology

adoption, digital transformation emphasizes strategic alignment, governance, and organizational change as key drivers of value creation.

Within public sector organizations, digital transformation has been associated with improvements in financial transparency, expenditure monitoring, and evidence-based decision-making. Integrated digital systems, enterprise platforms, and data analytics tools provide decision-makers with timely and accurate financial information, supporting more effective budget planning and control (Dunleavy et al., 2006; Mergel et al., 2019). As a result, digital transformation is increasingly viewed as a potential enabler of expenditure efficiency rather than merely a technological upgrade.

In the context of public universities, digital transformation plays a critical role in enhancing coordination among academic and administrative units, strengthening financial governance, and improving the management of public funds. Universities increasingly rely on enterprise resource planning systems, digital procurement platforms, and business intelligence solutions to support financial operations and institutional decision-making (De Haes et al., 2020). However, despite growing investments in digital initiatives, the extent to which digital transformation translates into measurable improvements in expenditure efficiency remains unclear.

Several studies suggest that digital transformation does not automatically lead to efficiency gains unless it is supported by effective governance structures, leadership commitment, and organizational readiness (Kane et al., 2015; Vial, 2019). In many public universities, digital initiatives are implemented in fragmented ways or without clear alignment to financial management objectives, limiting their potential impact on expenditure efficiency. Moreover, empirical research focusing specifically on the relationship between digital transformation and expenditure efficiency in public universities remains limited and context-dependent.

In the context of public universities, digital transformation extends beyond technological adoption to encompass managerial and governance-related processes that shape institutional performance and accountability. Public universities operate under increasing pressure to demonstrate efficient use of public resources while maintaining academic and societal missions. From an educational management perspective, digital transformation represents a managerial capability that supports evidence-based decision-making, coordination across organizational units, and transparency in financial practices.

Accordingly, examining how digital transformation contributes to expenditure efficiency in public universities provides important insights into the managerial drivers of institutional efficiency and the governance of higher education organizations.

Accordingly, this study seeks to examine the role of digital transformation in enhancing expenditure efficiency in public universities through an applied empirical investigation. By analyzing key dimensions of digital transformation—including digital governance, process digitization, systems integration, and data-driven decision support—and their relationship with expenditure efficiency outcomes, this study aims to contribute to the literature on digital transformation in higher education and provide practical insights for university leaders and policymakers seeking to improve the efficient use of public resources.

2 RESEARCH PROBLEM

Public universities operate under increasing financial pressures while being expected to maintain high standards of academic performance, administrative efficiency, and public accountability. Despite growing investments in digital technologies and transformation initiatives, many public universities continue to experience challenges related to inefficient expenditure, fragmented financial processes, and limited integration between administrative and financial systems. These challenges raise concerns about whether digital transformation initiatives are effectively contributing to improving expenditure efficiency within university settings.

The literature indicates that digital transformation has the potential to enhance expenditure efficiency through improved governance, process digitization, systems integration, and data-driven decision-making. However, empirical evidence suggests that such efficiency gains are not automatic and often depend on organizational readiness, leadership commitment, and alignment between digital initiatives and financial management objectives. In public universities, digital transformation initiatives are sometimes implemented in isolation from expenditure efficiency goals, which may limit their practical impact.

Moreover, existing studies have predominantly examined digital transformation and expenditure efficiency as separate constructs, with limited empirical research focusing

on their interrelationship within public universities. Research that does address this relationship often adopts a broad public sector perspective, providing insufficient insight into the specific financial and administrative context of public higher education institutions. Consequently, there remains a clear gap in empirical understanding of how digital transformation practices influence expenditure efficiency outcomes in public universities.

2.1 Research problem question

In light of the above, the central research problem of this study can be articulated as follows:

To what extent does digital transformation contribute to enhancing expenditure efficiency in public universities, and how do key dimensions of digital transformation influence expenditure efficiency outcomes?

3 RESEARCH OBJECTIVES

The primary objective of this study is to examine the role of digital transformation in enhancing expenditure efficiency in public universities. In order to achieve this overarching objective, the study seeks to accomplish the following specific objectives:

1. To assess the level of digital transformation practices in public universities, with particular emphasis on digital governance, process digitization, systems integration, and data-driven decision support.
2. To evaluate the level of expenditure efficiency in public universities in terms of budget planning and control, transparency and expenditure monitoring, rationalization of administrative and operational expenditures, and value-for-money orientation.
3. To examine the relationship between digital transformation and expenditure efficiency in public universities.
4. To analyze the extent to which the key dimensions of digital transformation influence expenditure efficiency outcomes in public universities.
5. To provide practical recommendations for university leaders and policymakers on

how digital transformation initiatives can be leveraged to enhance expenditure efficiency and improve the effective use of public resources.

4 RESEARCH QUESTIONS

Based on the research problem and objectives, this study seeks to answer the following research questions:

1. What is the level of digital transformation in public universities in terms of digital governance, process digitization, systems integration, and data-driven decision support?
2. What is the level of expenditure efficiency in public universities with respect to budget planning and control, transparency and expenditure monitoring, rationalization of administrative and operational expenditures, and value-for-money orientation?
3. Is there a relationship between digital transformation and expenditure efficiency in public universities?
4. To what extent do the key dimensions of digital transformation influence expenditure efficiency outcomes in public universities?
5. How can public universities leverage digital transformation practices to enhance expenditure efficiency and improve the effective use of public resources?

5 RESEARCH HYPOTHESES

Based on the research problem, objectives, and research questions, the following hypotheses are formulated to empirically examine the relationship between digital transformation and expenditure efficiency in public universities:

5.1 Main hyothesis

5.1.1 H1

Digital transformation has a statistically significant positive effect on expenditure efficiency in public universities.

5.2 Sub-hypotheses

5.2.1 H1a

Digital governance and strategic alignment have a statistically significant positive effect on expenditure efficiency in public universities.

5.2.2 H1b

Process digitization and automation have a statistically significant positive effect on expenditure efficiency in public universities.

5.2.3 H1c

Systems integration and data interoperability have a statistically significant positive effect on expenditure efficiency in public universities.

5.2.4 H1d

Data analytics and decision-support capabilities have a statistically significant positive effect on expenditure efficiency in public universities.

6 THEORETICAL FRAMEWORK AND LITERATURE REVIEW

This section establishes the theoretical foundation of the study and reviews the relevant literature related to digital transformation and expenditure efficiency in public universities. It aims to clarify the key concepts, synthesize prior research findings, and provide a coherent theoretical basis for examining the relationship between digital transformation and expenditure efficiency.

6.1 Digital transformation in public universities

Digital transformation has been widely discussed in the literature as a comprehensive organizational change process that goes beyond the mere adoption of digital technologies. Scholars emphasize that digital transformation represents a strategic capability that integrates digital technologies with organizational structures, governance mechanisms, and managerial processes to enhance performance and value creation (Bharadwaj et al., 2013; Vial, 2019). From this perspective, digital transformation involves rethinking how organizations operate, make decisions, and deliver value in digitally enabled environments.

In the public sector, digital transformation has been associated with efforts to modernize administrative processes, improve transparency, and enhance accountability in the use of public resources (Dunleavy et al., 2006). Public organizations increasingly rely on integrated digital systems and automated workflows to reduce administrative burdens and improve coordination across functional units. However, researchers argue that the effectiveness of digital transformation depends largely on the presence of clear governance frameworks and strategic alignment between digital initiatives and organizational objectives (Kane et al., 2015).

Within public universities, digital transformation plays a critical role in supporting complex academic and administrative operations. Universities manage diverse activities, including teaching, research, procurement, and financial management, which require high levels of coordination and information integration. Studies suggest that the adoption of enterprise systems, digital procurement platforms, and analytics tools can enhance administrative efficiency and improve financial oversight in higher education institutions

(De Haes et al., 2020). Nevertheless, without strong leadership commitment and institutional readiness, digital transformation initiatives may remain fragmented and fail to deliver their intended benefits (Sebastian et al., 2017).

Based on the literature, digital transformation in public universities can be conceptualized through multiple interrelated dimensions, including digital governance and strategic alignment, process digitization and automation, systems integration and data interoperability, and data analytics and decision-support capabilities. These dimensions collectively reflect the extent to which digital technologies are embedded within organizational practices and managerial decision-making.

6.2 Expenditure efficiency in the public sector and public universities

Expenditure efficiency is a central concept in public financial management literature and is commonly defined as the ability of public organizations to achieve intended outcomes through the optimal allocation and utilization of financial resources while minimizing waste and inefficiencies (Schick, 2015). International organizations emphasize that expenditure efficiency is not solely about cost reduction but also about maximizing value-for-money and ensuring that public expenditures contribute effectively to policy and institutional objectives (OECD, 2020).

In the context of public universities, expenditure efficiency is particularly important due to increasing financial constraints and growing expectations regarding institutional performance. Scholars argue that efficient universities are characterized by disciplined budget planning, effective expenditure monitoring, and transparent financial reporting systems that support accountability and informed decision-making (Salmi, 2017; Johnstone, 2018). Inefficiencies in university expenditure may arise from rigid administrative procedures, fragmented financial systems, and weak links between planning and budgeting processes (World Bank, 2019).

Previous research highlights that improving expenditure efficiency in universities requires not only financial controls but also organizational and managerial reforms that enhance coordination and reduce duplication of activities. Transparency, timely reporting, and performance-based budgeting are frequently cited as key mechanisms for

strengthening expenditure efficiency in higher education institutions (OECD, 2020). Accordingly, expenditure efficiency in this study is treated as a multidimensional construct encompassing budget planning and control, transparency and expenditure monitoring, rationalization of administrative and operational expenditures, and value-for-money orientation.

6.3 Digital transformation and expenditure efficiency: review of previous studies

A growing body of literature suggests a positive relationship between digital transformation and expenditure efficiency in public sector organizations. Studies indicate that process digitization and automation contribute to reducing administrative costs, minimizing errors, and accelerating transaction processing, which collectively enhance efficiency (Dunleavy et al., 2006; Sebastian et al., 2017). Similarly, systems integration has been shown to improve data accuracy and reduce duplication, enabling better monitoring and control of expenditures.

Other studies emphasize the role of digital data and analytics in supporting evidence-based budgeting and financial decision-making. Access to real-time financial information and analytical tools allows managers to identify inefficiencies, monitor budget variances, and evaluate expenditure outcomes more effectively (Mergel et al., 2019). These capabilities are particularly relevant in complex organizations such as public universities, where financial decisions involve multiple stakeholders and competing priorities.

However, the literature also cautions that digital transformation does not automatically result in improved expenditure efficiency. Researchers highlight that governance quality, leadership support, and organizational readiness are critical factors that shape the outcomes of digital transformation initiatives (Kane et al., 2015; Vial, 2019). In the higher education context, empirical studies examining the direct impact of digital transformation on expenditure efficiency remain limited, and existing findings are often context-specific. This indicates a clear need for applied empirical research focusing on public universities.

6.4 Conceptual framework of the study

Drawing on the reviewed literature, this study proposes a conceptual framework in which digital transformation functions as an independent variable influencing expenditure efficiency in public universities. Digital transformation is represented through four dimensions: digital governance and strategic alignment, process digitization and automation, systems integration and data interoperability, and data analytics and decision-support capabilities. Expenditure efficiency is conceptualized as a multidimensional outcome reflected in budget control, transparency, rationalization of expenditure, and value-for-money orientation. This framework provides the theoretical basis for the hypotheses formulated in the study and guides the subsequent research methodology and data analysis.

7 RESEARCH METHODOLOGY

7.1 Research design

This study adopts a **quantitative, cross-sectional, and applied research design** to examine the effect of digital transformation on expenditure efficiency in public universities. A quantitative approach is appropriate because it enables the measurement of respondents' perceptions using standardized scales and supports statistical testing of the proposed hypotheses. The study employs a **survey strategy** through a structured questionnaire administered to targeted participants, allowing for systematic data collection and comparative analysis across the study variables. The design is cross-sectional as data are collected at a single point in time to capture the current status of digital transformation practices and expenditure efficiency outcomes within the study context.

7.2 Study context and population

The study is conducted within the context of a **Saudi public university**, focusing on its administrative and academic environment related to digital transformation and financial management practices. Public universities in Saudi Arabia operate within a

regulated public sector framework and manage substantial government-funded budgets, which makes them an appropriate context for examining expenditure efficiency and the role of digital transformation.

The study population consists of **academic and administrative leaders** who are directly or indirectly involved in digital initiatives and financial decision-making processes. This includes senior administrators, deans, department heads, unit managers, and specialists working in areas such as finance, procurement, planning, and information systems. These groups are considered the most knowledgeable about digital transformation practices and expenditure efficiency within the university, and their perceptions provide valuable insights into the study variables.

7.3 Sample and sampling technique

7.3.1 Sample description

The sample includes academic and administrative leaders such as deans, vice-deans, department heads, unit managers, and senior specialists working in finance, procurement, planning, and information systems. These participants are considered suitable for the study because of their roles in overseeing digital systems and managing or influencing expenditure decisions.

7.3.2 Sampling technique

A purposive (judgmental) sampling technique is employed in this study to ensure that respondents possess relevant knowledge and practical exposure to digital transformation initiatives and expenditure-related processes within the university. This approach is widely adopted in organizational and management research when the research objectives require informed judgments from key stakeholders rather than responses from the general employee population. By targeting academic and administrative leaders involved in digital systems and financial decision-making, the study ensures the collection

of data that is both relevant and meaningful for examining the relationship between digital transformation and expenditure efficiency (Saunders, Lewis, & Thornhill, 2019).

7.3.3 Sample size considerations

A total of 200 questionnaires were distributed to the targeted academic and administrative participants. Following data screening and validation procedures, 178 questionnaires were deemed valid and suitable for statistical analysis and hypothesis testing.

To ensure adequate statistical power and reliability of the findings, methodological guidelines suggest that for multiple regression analysis, the minimum required sample size should exceed the threshold of (50 + 8m), where m represents the number of independent variables (Green, 1991). Given that the present study includes four independent dimensions of digital transformation, the minimum sample size requirement is clearly satisfied.

Accordingly, the final sample size of 178 valid responses is considered more than sufficient for conducting descriptive analysis, reliability testing, correlation analysis, and multiple regression analysis. This sample size also aligns with established recommendations for empirical research in management and social science studies, which indicate that samples exceeding 150 observations provide robust and stable statistical estimates (Hair et al., 2019).

7.3.4 Data screening and preparation

Prior to hypothesis testing, the dataset was screened to ensure completeness, accuracy, and consistency. The final dataset comprised **178 valid responses** and **37 variables**. The screening process confirmed that there were **no missing values** and **no duplicate records**. In addition, all Likert-scale items measuring the **digital transformation (DT)** and **expenditure efficiency (SE)** constructs fell within the valid response range (**1–5**), indicating consistent coding and readiness for **descriptive, reliability, correlation, and regression analyses**.

7.4 Data collection instrument

7.4.1 Questionnaire development

Data for this study were collected using a **structured questionnaire** designed to measure the main study variables: digital transformation as the independent variable and expenditure efficiency as the dependent variable. The questionnaire was developed based on an extensive review of the relevant literature to ensure conceptual alignment and methodological rigor.

Digital transformation was operationalized as a multidimensional construct reflecting key organizational capabilities, including digital governance and strategic alignment, process digitization and automation, systems integration and data interoperability, and data-driven decision support. This conceptualization is consistent with established frameworks that view digital transformation as an organizational capability rather than a purely technological initiative (Bharadwaj et al., 2013; Vial, 2019).

Expenditure efficiency was conceptualized as the effective allocation, control, and monitoring of financial resources to maximize value and minimize waste within public university settings. The questionnaire items related to expenditure efficiency focused on budget planning and control, transparency and expenditure monitoring, rationalization of administrative and operational expenditures, and value-for-money orientation, in line with public financial management literature (Schick, 2015; OECD, 2020).

All questionnaire items were formulated as clear and concise statements suitable for respondents occupying academic and administrative leadership roles. The wording of the items was designed to reflect observable practices and perceptions related to digital transformation and expenditure efficiency within the university context.

7.4.2 Measurement scale and coding

All questionnaire items were measured using a **five-point Likert scale** ranging from **1 (Strongly Disagree)** to **5 (Strongly Agree)**. Higher values indicate higher levels of the measured practice or outcome. The responses were coded consistently, and

composite scores were computed by averaging the items of each dimension and the overall construct prior to inferential analysis.

7.4.3 Operational definitions of the study variables

To ensure clarity and methodological rigor, the main constructs examined in this study were operationalized into measurable dimensions reflecting their practical application within public university settings. Operational definitions were developed to translate abstract concepts into observable and quantifiable indicators suitable for empirical measurement through the questionnaire. This approach enhances the validity of the instrument and ensures consistency between the theoretical framework, measurement items, and statistical analysis.

Digital transformation was operationalized as a multidimensional construct representing the extent to which digital technologies are strategically governed, integrated into organizational processes, and utilized to support data-driven decision-making. Expenditure efficiency was operationalized as a multidimensional outcome reflecting how effectively financial resources are planned, monitored, and utilized to maximize value and minimize waste.

Table 1 Presents the operational definitions of the study variables and their corresponding dimensions as used for measurement and analysis.

Table 1

Operational Definitions of Study Variables

Construct	**Dimension**	**Operational Definition**
Digital Transformation	Digital Governance	The extent to which digital initiatives are aligned with institutional strategy and governed by clear accountability and oversight mechanisms.
Digital Transformation	Process Digitization	The degree of automation and digital execution of administrative and financial processes.
Digital Transformation	Systems Integration	The level of integration and interoperability among core institutional systems, enabling seamless data exchange and reduced duplication.
Digital Transformation	Data Analytics	The extent to which digital data and analytical tools support evidence-based decision-making and financial monitoring.
Expenditure Efficiency	Budget Control	The effectiveness of planning, monitoring, and controlling financial resources in line with approved budgets.
Expenditure	Transparency	The level of traceability, accessibility, and accuracy of

Efficiency		expenditure monitoring and reporting.
Expenditure Efficiency	Rationalization of Expenditure	The extent to which administrative and operational expenditures are optimized and unnecessary expenditure is reduced.
Expenditure Efficiency	Value-for-Money	The degree to which expenditure decisions maximize outcomes and benefits relative to costs incurred.

7.4.4 Instrument structure and dimensions

The questionnaire was structured into **three main sections** to ensure logical flow and clarity for respondents, while facilitating accurate measurement of the study variables. The questionnaire consisted of a total of **36 items**, distributed across the study dimensions as follows.

7.4.5 Section A: demographic and professional information

This section included **4 items** designed to collect background information about the respondents, such as job position, years of experience, level of involvement in digital initiatives, and degree of participation in financial and expenditure-related decision-making. These variables were used to describe the study sample and provide contextual understanding of respondents' perspectives.

7.4.6 Section B: digital transformation (DT)

This section measured digital transformation as the independent variable through **16 items**, distributed equally across four key dimensions derived from the theoretical framework and prior literature:

- **Digital Governance and Strategic Alignment (4 items)**, focusing on leadership support, clarity of digital strategy, and accountability mechanisms.
- **Process Digitization and Automation (4 items)**, capturing the extent of digital execution and automation of administrative and financial processes.
- **Systems Integration and Data Interoperability (4 items)**, assessing the level of integration among institutional systems and the availability of unified and accurate data.

- **Data Analytics and Decision Support (4 items)**, examining the use of digital data, dashboards, and analytical tools to support managerial and financial decision-making.

7.4.7 Section C: expenditure efficiency (SE)

This section measured expenditure efficiency as the dependent variable through **16 items**, distributed equally across four dimensions:

- **Budget Planning and Control Efficiency (4 items)**, reflecting disciplined budgeting practices and effective monitoring of financial performance.
- **Transparency and Expenditure Monitoring (4 items)**, focusing on traceability, auditability, and timeliness of financial reporting.
- **Rationalization of Administrative and Operational Expenditure (4 items)**, assessing efforts to reduce waste and prioritize expenditures.
- **Value-for-Money Orientation (4 items)**, evaluating the extent to which expenditure decisions are based on outcome achievement and cost–benefit considerations.

The structure of the questionnaire ensures full alignment between the conceptual framework, operational definitions, and statistical analysis, thereby supporting the reliability and validity of the study findings.

7.5 Validity and reliability

7.5.1 Content validity

To ensure the **content validity** of the research instrument, the questionnaire items were developed based on an extensive review of the relevant literature on digital transformation and expenditure efficiency in the public sector and higher education. The items were formulated to reflect the conceptual definitions and dimensions identified in the theoretical framework, thereby ensuring alignment between the study constructs and their empirical measurement.

In addition, the questionnaire was reviewed by a panel of academic experts and practitioners with experience in digital transformation, financial management, and research methodology. Their feedback was used to assess the clarity, relevance, and appropriateness of the questionnaire items. Minor revisions were made to improve wording and ensure that the items accurately captured the intended constructs. This expert review process enhanced the representativeness and relevance of the instrument, thereby supporting its content validity.

7.5.2 Construct validity

Construct validity was established to ensure that the questionnaire items accurately measured the underlying constructs of digital transformation and expenditure efficiency as conceptualized in the study. To achieve this, the measurement items were derived directly from established theoretical frameworks and prior empirical studies, ensuring conceptual consistency between the theoretical definitions and their operationalization.

The dimensional structure of the questionnaire reflects the multidimensional nature of both constructs. Digital transformation was measured through four distinct but related dimensions, while expenditure efficiency was operationalized through four outcome-oriented dimensions. This structure supports the theoretical assumption that each construct represents a higher-order concept composed of interrelated dimensions, thereby enhancing construct validity.

Furthermore, construct validity was supported by the clear alignment between the study's conceptual framework, operational definitions, and the questionnaire items. This alignment ensured that each item contributed meaningfully to its intended dimension and minimized the risk of construct overlap or measurement ambiguity. The established construct validity provided a sound basis for subsequent reliability testing and statistical analysis.

7.5.3 Reliability analysis (cronbach's alpha)

The reliability of the research instrument was assessed using **Cronbach's Alpha coefficient**, which is widely employed to evaluate the internal consistency of multi-item

measurement scales in social science research. Reliability analysis was conducted for each dimension of digital transformation and expenditure efficiency, as well as for the overall constructs.

Cronbach's Alpha values were examined to determine the extent to which the items within each dimension consistently measured the same underlying concept. According to established methodological guidelines, alpha values of **0.70 or higher** are considered acceptable indicators of internal consistency, while higher values reflect stronger reliability (Hair et al., 2019). The results of the reliability analysis indicated that all constructs and dimensions achieved acceptable levels of internal consistency, supporting the reliability of the measurement instrument.

The satisfactory reliability results confirm that the questionnaire items are suitable for subsequent statistical analyses, including correlation analysis and multiple regression, and provide confidence in the stability and consistency of the collected data.

7.6 Data collection procedures

The data collection process was carried out in a systematic and organized manner to ensure the accuracy, completeness, and integrity of the collected data. After finalizing the questionnaire and confirming its content validity, the instrument was prepared for distribution to the target respondents.

The questionnaire was administered to academic and administrative leaders at the selected public university who are involved in digital transformation initiatives and financial decision-making processes. Prior to distribution, the purpose of the study was clearly explained to potential participants, and they were informed that their participation was voluntary and that their responses would be used solely for scientific research purposes.

To facilitate participation and improve response rates, the questionnaire was distributed using appropriate channels suitable for the study context. Respondents were given sufficient time to complete the questionnaire, and follow-up reminders were used where necessary to encourage timely responses. Upon completion of the data collection phase, the returned questionnaires were reviewed to ensure completeness and consistency.

All collected responses were screened and coded prior to data analysis. Incomplete or invalid questionnaires were excluded, and only usable responses were retained for statistical analysis. This systematic data collection and screening process ensured the quality and reliability of the dataset used for testing the study hypotheses.

7.7 Data analysis techniques

The collected data were analyzed using appropriate **statistical analysis techniques** consistent with the research objectives, hypotheses, and measurement scale. Prior to analysis, the data were coded and entered into a statistical software package for processing and analysis.

Descriptive statistics were employed to summarize the characteristics of the study sample and to describe respondents' perceptions of digital transformation and expenditure efficiency. Measures such as frequencies, percentages, means, and standard deviations were used to provide an overall understanding of the data distribution and central tendencies.

To assess the reliability of the measurement instrument, **Cronbach's Alpha coefficients** were calculated for each construct and dimension. **Correlation analysis** was then conducted to examine the direction and strength of the relationships between digital transformation and expenditure efficiency variables.

To test the study hypotheses, **multiple regression analysis** was employed to examine the effect of digital transformation on expenditure efficiency. Digital transformation dimensions were entered as independent variables, while expenditure efficiency was treated as the dependent variable. The regression analysis enabled the assessment of the magnitude and statistical significance of the relationships between variables, thereby providing empirical evidence to support or reject the proposed hypotheses.

All statistical analyses were conducted at an appropriate **level of significance ($\alpha = 0.05$)**, which is commonly adopted in social science research to determine statistical significance.

7.8 Ethical considerations

Ethical considerations were carefully observed throughout the conduct of this study to ensure compliance with accepted research ethics standards. Participation in the study was entirely **voluntary**, and respondents were informed of the purpose of the research prior to completing the questionnaire.

Participants were assured that their responses would be treated with **strict confidentiality** and used solely for scientific research purposes. No personally identifiable information was collected, and all responses were analyzed in aggregate form to protect participants' anonymity.

Informed consent was obtained implicitly through participants' agreement to complete and submit the questionnaire. Respondents were also informed that they had the right to withdraw from the study at any stage without any consequences.

All collected data were stored securely and accessed only by the researcher. The study adhered to ethical principles related to data integrity, confidentiality, and responsible reporting of findings, ensuring that the research process respected participants' rights and maintained academic and professional integrity.

8 RESULTS AND DATA ANALYSIS

8.1 Sample characteristics

This section presents the demographic and professional characteristics of the study respondents. Descriptive statistics were used to summarize respondents' profiles in terms of job position, years of experience, level of involvement in financial decision-making, and degree of interaction with digital systems.

Table 1

Sample Characteristics

Variable	**Category**	**Frequency (n)**	**Percentage (%)**
Job Position	Academic Leader	38	21.3
	Administrative Leader	49	27.5
	Unit Head	56	31.5
	Senior Specialist	35	19.7
Years of Experience	< 5 years	11	6.2
	5–10 years	65	36.5
	11–15 years	63	35.4
	> 15 years	39	21.9
Involvement in Financial Decisions	Low	73	41.0
	Moderate	79	44.4
	High	26	14.6
Interaction with Digital Systems	Limited	52	29.2
	Moderate	79	44.4
	Extensive	47	26.4

Note: Percentages are calculated based on a total sample size of 178 respondents.

The sample characteristics indicate a well-balanced representation of key academic and administrative stakeholders involved in digital transformation and financial management processes. The majority of respondents occupy leadership and supervisory roles, including unit heads and administrative leaders, which enhances the relevance and credibility of their responses.

In terms of professional experience, most participants possess more than five years of experience, suggesting a strong understanding of institutional procedures and expenditure practices. Furthermore, a substantial proportion of respondents reported moderate to high involvement in financial decision-making, indicating direct exposure to budgeting and expenditure-related processes.

Regarding digital engagement, the results show that most respondents interact moderately to extensively with digital systems, reflecting adequate familiarity with digital platforms and tools. Overall, the diversity and experience of the sample support the suitability of the data for examining the relationship between digital transformation and expenditure efficiency in public universities.

8.2 Reliability analysis

Internal consistency reliability was assessed using Cronbach's Alpha coefficient for each construct and its corresponding dimensions. Prior to reliability testing, negatively worded items were reverse-coded to ensure consistency in the direction of measurement across all questionnaire items.

Cronbach's Alpha values were calculated for each dimension of digital transformation and expenditure efficiency, as well as for the overall constructs. According to established methodological guidelines, Cronbach's Alpha values equal to or greater than 0.70 indicate acceptable internal consistency (Hair et al., 2019).

The results, presented in Table 2, indicate that all constructs and dimensions achieved satisfactory levels of internal consistency, confirming the reliability of the measurement instrument and its suitability for subsequent correlation and regression analyses.

Table 2

Reliability Statistics (Cronbach's Alpha)

Construct	**Dimension**	**Number of Items**	**Cronbach's Alpha**
Digital Transformation	Governance & Strategy	4	0.84
	Process Digitization	4	0.81
	Systems Integration	4	0.86
	Analytics & Decision Support	4	0.83
Expenditure Efficiency	Budget Planning & Control	4	0.82
	Transparency & Monitoring	4	0.85
	Rationalization of Expenditure	4	0.79
	Value-for-Money	4	0.81
Overall Instrument	—	32	**0.91**

8.3 Descriptive statistics of study variables

Descriptive statistics were employed to assess respondents' perceptions of digital transformation practices and expenditure efficiency in public universities. Mean scores and standard deviations were calculated for each dimension as well as for the overall constructs. The results provide an initial indication of the prevailing level of digital transformation and expenditure efficiency within the study context.

Table 3

Descriptive Statistics of Study Variables

Construct / Dimension	Mean	Standard Deviation	Level
Digital Transformation (Overall)	3.71	0.62	High
Governance & Strategy	3.78	0.65	High
Process Digitization	3.66	0.68	Moderate
Systems Integration	3.74	0.61	High
Analytics & Decision Support	3.65	0.70	Moderate
Expenditure Efficiency (Overall)	3.59	0.64	Moderate
Budget Planning & Control	3.67	0.66	High
Transparency & Monitoring	3.72	0.63	High
Rationalization of Expenditure	3.48	0.69	Moderate
Value-for-Money	3.50	0.67	Moderate

The descriptive results indicated that the overall level of digital transformation in public universities is perceived as moderate to high. Among the examined dimensions, governance and strategic alignment recorded the highest mean value, reflecting the presence of institutional efforts to align digital initiatives with strategic objectives. Systems integration also achieved a high level, suggesting progress in connecting core administrative and financial systems.

In contrast, process digitization and data analytics capabilities were perceived at a moderate level, indicating that while digital tools are increasingly adopted, opportunities remain for further automation and advanced analytical use.

Regarding expenditure efficiency, the overall level was perceived as moderate. Transparency and expenditure monitoring achieved relatively higher mean scores, highlighting improvements in expenditure traceability and reporting. However, rationalization of administrative and operational expenditure and value-for-money orientation recorded moderate levels, suggesting ongoing challenges in fully optimizing expenditure practices. Overall, these results provide a foundation for examining the relationships between digital transformation and expenditure efficiency through correlation and regression analyses.

8.4 Correlation analysis

Pearson's correlation analysis was conducted to examine the direction and strength of the relationship between digital transformation and expenditure efficiency in public

universities. This analysis provides preliminary evidence regarding the association between the study variables prior to hypothesis testing using regression analysis.

Table 4

Correlation Matrix between Digital Transformation and Expenditure Efficiency

Variable	Digital Transformation (DT)	Expenditure Efficiency (SE)
Digital Transformation (DT)	1	
Expenditure Efficiency (SE)	**0.382****	1

****** Correlation is significant at the 0.01 level ($p < 0.01$).

The correlation results revealed a positive and statistically significant relationship between digital transformation and expenditure efficiency ($r = 0.382$, $p < 0.01$). This finding indicates that higher levels of digital transformation practices are associated with higher levels of perceived expenditure efficiency in public universities.

The strength and significance of the correlation provide initial empirical support for the proposed research hypothesis and justify proceeding to multiple regression analysis to further examine the predictive effect of digital transformation on expenditure efficiency.

8.5 Hypotheses testing (regression analysis)

8.5.1 Main effect of digital transformation on expenditure efficiency

A simple linear regression analysis was conducted to examine the effect of digital transformation on expenditure efficiency in public universities. Digital transformation was entered as the independent variable, while expenditure efficiency was treated as the dependent variable. The results of the regression analysis are presented in Table 5.

Table 5

Regression Results: Digital Transformation → Expenditure Efficiency

Predictor	Beta (β)	t-value	Sig. (p)
Digital Transformation	**0.386**	5.48	0.000
R^2	**0.146**		
F-value	**29.98**		
Sig. (F)	**0.000**		

The regression results indicated that digital transformation has a statistically significant positive effect on expenditure efficiency in public universities ($\beta = 0.386$, $p < 0.001$). The model explains approximately 14.6% of the variance in expenditure efficiency ($R^2 = 0.146$), indicating a meaningful explanatory power in the context of organizational and behavioral research.

The significant F-statistic further confirms the overall validity of the regression model. Accordingly, the main research hypothesis (H1), which posits that digital transformation positively influences expenditure efficiency in public universities, is supported.

8.5.2 Effects of digital transformation dimensions on expenditure efficiency

A multiple regression analysis was conducted to examine the relative effects of the digital transformation dimensions on expenditure efficiency in public universities. Digital governance and strategic alignment, process digitization and automation, systems integration and data interoperability, and data analytics and decision-support capabilities were entered simultaneously as independent variables, while expenditure efficiency was treated as the dependent variable. The results of the regression analysis are presented in Table 6.

Table 6

Regression Results by Digital Transformation Dimensions

Digital Transformation Dimension	**Beta (β)**	**t-value**	**Sig. (p)**
Digital Governance & Strategy	-0.004	-0.06	0.954
Process Digitization & Automation	0.012	0.27	0.786
Systems Integration & Data Interoperability	**0.226**	**5.36**	**0.000**
Data Analytics & Decision Support	0.070	1.31	0.193
R^2	**0.220**		
Adjusted R^2	**0.202**		
F-value	**12.18**		
Sig. (F)	**0.000**		

The results of the multiple regression analysis indicate that the digital transformation dimensions collectively have a statistically significant effect on expenditure efficiency, as reflected by the significant F-statistic ($F = 12.18$, $p < 0.001$).

The model explains approximately 22.0% of the variance in expenditure efficiency, demonstrating improved explanatory power compared to the single-predictor model.

At the dimensional level, systems integration and data interoperability emerged as the only statistically significant predictor of expenditure efficiency ($\beta = 0.226$, $p < 0.001$). This finding highlights the critical role of integrated institutional systems in enhancing financial control, reducing duplication, and supporting efficient resource utilization.

In contrast, digital governance, process digitization, and data analytics did not exhibit statistically significant direct effects when entered simultaneously in the model. This suggests that their influence on expenditure efficiency may be indirect or mediated through system integration, rather than exerting independent effects. Accordingly, hypothesis (H1c) is supported, while hypotheses (H1a), (H1b), and (H1d) are not supported in the multivariate model.

8.6 Summary of hypotheses testing

This section summarizes the results of hypothesis testing based on the correlation and regression analyses conducted in the previous sections. The summary provides a clear overview of the empirical support for the study hypotheses and facilitates interpretation of the key findings.

Table 7

Summary of Hypotheses Testing Results

Hypothesis	Statement	Result
H1	Digital transformation has a statistically significant positive effect on expenditure efficiency in public universities.	**Supported**
H1a	Digital governance and strategic alignment have a statistically significant positive effect on expenditure efficiency.	**Not Supported**
H1b	Process digitization and automation have a statistically significant positive effect on expenditure efficiency.	**Not Supported**
H1c	Systems integration and data interoperability have a statistically significant positive effect on expenditure efficiency.	**Supported**
H1d	Data analytics and decision-support capabilities have a statistically significant positive effect on expenditure efficiency.	**Not Supported**

Overall, the hypothesis testing results demonstrate that digital transformation plays a significant role in enhancing expenditure efficiency in public universities. While

the overall construct of digital transformation exhibits a positive and statistically significant effect, the findings indicate that systems integration and data interoperability constitute the most influential dimension in explaining expenditure efficiency outcomes. These results underscore the importance of integrated digital infrastructures as a foundational enabler of efficient financial management within public universities.

8.7 Key results overview

Overall, the hypothesis testing results demonstrate that digital transformation plays a significant role in enhancing expenditure efficiency in public universities. While the overall construct of digital transformation exhibits a positive and statistically significant effect, the findings indicate that systems integration and data interoperability **emerge as** the most influential dimension in explaining expenditure efficiency outcomes. These results underscore the importance of integrated digital infrastructures as a foundational enabler of efficient financial management within public universities.

These findings provide a coherent basis for the subsequent discussion, which interprets the results in relation to prior studies and the specific context of public universities.

9 DISCUSSION OF FINDINGS (VERSION: JOURNAL-READY, ENHANCED)

9.1 Digital transformation and expenditure efficiency

The findings of this study provide strong empirical evidence that digital transformation has a statistically significant positive effect on expenditure efficiency in public universities. This result is consistent with prior research in the public sector, which emphasizes that digital transformation enhances financial transparency, improves expenditure monitoring, and supports evidence-based decision-making (Dunleavy et al., 2006; OECD, 2020; Mergel et al., 2019).

Several studies have reported similar positive associations between digital transformation initiatives and efficiency outcomes in public organizations. For example, Dunleavy et al. (2006) argue that digital-era governance contributes to reducing

administrative inefficiencies and improving resource utilization. Likewise, OECD (2020) highlights that integrated digital financial management systems strengthen budget discipline and value-for-money in public institutions.

The present study extends these findings by providing empirical evidence from the context of public universities, which differs from many public sector organizations due to their complex governance structures and diversified expenditure responsibilities. This contribution is particularly important given the limited number of empirical studies that directly examine expenditure efficiency within higher education institutions.

9.2 Digital governance and process digitization as enabling rather than direct drivers of expenditure efficiency

Contrary to the expectations suggested in some prior studies, digital governance and process digitization did not demonstrate a statistically significant direct effect on expenditure efficiency when examined alongside other digital transformation dimensions. Previous research has often emphasized governance frameworks and digitization as critical drivers of organizational efficiency (Kane et al., 2015; De Haes et al., 2020).

However, the findings of this study suggest that, in the context of public universities, governance structures and digitized processes alone may not be sufficient to produce measurable efficiency gains. This result aligns with Vial (2019), who argues that governance and digitization represent enabling conditions rather than direct sources of value. Without effective system integration, governance mechanisms may remain formal in nature, and digitized processes may continue to operate in silos.

Thus, while governance and digitization remain essential components of digital transformation, their impact on expenditure efficiency appears to be indirect, operating through other mechanisms such as system integration and data consolidation.

9.3 Systems integration as the central mechanism: comparison with prior research

One of the most notable findings of this study is that systems integration and data interoperability emerged as the most influential dimension in explaining expenditure efficiency outcomes. This finding strongly supports previous research that identifies

integration as a foundational capability for realizing the benefits of digital transformation (Sebastian et al., 2017; OECD, 2020).

Sebastian et al. (2017) emphasize that organizations achieve superior performance when digital initiatives focus on connecting systems and harmonizing data across functional units. Similarly, OECD (2020) highlights that fragmented financial systems are a major source of inefficiency in public organizations, while integrated platforms enhance expenditure control and reduce duplication.

The findings of the present study reinforce these arguments within the higher education context. Public universities typically operate multiple standalone systems for finance, procurement, human resources, and projects. The results suggest that integration among these systems enables comprehensive visibility of expenditure patterns and supports more effective financial decision-making, thereby directly enhancing expenditure efficiency.

9.4 Data analytics and decision support: explaining the divergence from some studies

While several studies report a positive relationship between data analytics and organizational efficiency (Mergel et al., 2019; Vial, 2019), the results of this study indicate that data analytics and decision-support capabilities do not exert a statistically significant independent effect on expenditure efficiency in the multivariate model.

This apparent divergence can be explained by the dependency of analytics on data quality and system integration. As argued by Vial (2019), analytics capabilities generate value only when reliable, integrated data are available. In environments where systems remain partially fragmented, analytical outputs may be underutilized or fail to influence actual expenditure decisions.

Accordingly, the findings of this study suggest that analytics should be viewed as a complementary capability whose impact is contingent upon the maturity of system integration. This interpretation does not contradict prior studies but rather refines them by highlighting the conditions under which analytics contribute to expenditure efficiency.

9.5 Synthesis and contribution to the literature

Overall, the findings of this study are largely consistent with the broader literature on digital transformation in the public sector, while offering important contextual refinements. Unlike studies that treat digital transformation dimensions as equally influential, this research demonstrates that expenditure efficiency gains in public universities are primarily driven by systems integration rather than isolated digital initiatives.

This integrated perspective contributes to the literature by clarifying how digital transformation translates into financial efficiency outcomes in higher education institutions. It also highlights the need for policymakers and university leaders to prioritize system integration as a strategic foundation for achieving sustainable improvements in expenditure efficiency.

From an educational management perspective, the findings of this study highlight the managerial implications of digital transformation for public universities. The results suggest that expenditure efficiency is not achieved through isolated digital initiatives, but rather through integrated digital systems that support coordination, managerial oversight, and informed decision-making. These findings emphasize the role of university leadership in aligning digital transformation initiatives with managerial and governance objectives. By clarifying how digital transformation operates as a managerial enabler within higher education institutions, the study contributes to the educational management literature and offers actionable insights for university administrators seeking to enhance institutional efficiency and accountability.

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

This study examined the role of digital transformation in enhancing expenditure efficiency in public universities through an applied empirical investigation. Drawing on quantitative data collected from academic and administrative leaders, the study provides

evidence-based insights into how digital transformation practices influence financial efficiency outcomes within the public higher education context.

The findings confirm that digital transformation, as an overall organizational capability, has a statistically significant positive effect on expenditure efficiency in public universities. This result underscores the importance of adopting a holistic digital transformation approach that goes beyond isolated technological initiatives and emphasizes alignment between digital systems and financial management objectives.

At the dimensional level, the study reveals that systems integration and data interoperability represent the most influential driver of expenditure efficiency. Integrated systems enable comprehensive visibility of financial data, reduce duplication of administrative activities, and support effective budget monitoring and control. In contrast, digital governance, process digitization, and data analytics did not exhibit statistically significant direct effects when examined simultaneously, suggesting that their contribution to expenditure efficiency is largely indirect and contingent upon the level of system integration achieved.

Overall, the study concludes that expenditure efficiency gains in public universities are most likely to materialize when digital transformation initiatives prioritize the integration of core institutional systems and the harmonization of financial and administrative data. These conclusions contribute to the literature by clarifying the mechanisms through which digital transformation translates into tangible efficiency outcomes in public higher education institutions.

10.2 Practical recommendations

Based on the study findings, the following practical recommendations are proposed for public university leaders and policymakers seeking to enhance expenditure efficiency through digital transformation:

1. Prioritize Systems Integration as a Strategic Objective

Public universities should place systems integration at the core of their digital transformation strategies. Integrating financial, procurement, human resources, and project management systems can significantly improve data consistency, reduce operational fragmentation, and enable comprehensive oversight of institutional expenditure.

2. Align Digital Governance with Financial Management Goals

Digital governance frameworks should be explicitly aligned with expenditure efficiency objectives. Clear accountability mechanisms, leadership oversight, and strategic alignment are essential to ensure that digital initiatives contribute directly to improving financial discipline and resource utilization rather than operating as standalone technical projects.

3. Expand Process Digitization with an Integration-Oriented Approach

While process digitization remains important, universities should ensure that digitized workflows are embedded within integrated systems. Digitization efforts that operate in isolation may improve operational speed but are unlikely to deliver measurable efficiency gains unless they support unified financial data and cross-unit coordination.

4. Institutionalize Data-Driven Financial Decision-Making

Universities should strengthen the use of dashboards, analytical reports, and decision-support tools within routine financial planning and monitoring processes. However, investments in analytics should be accompanied by efforts to improve data quality and system interoperability to maximize their practical impact on expenditure decisions.

5. Promote a Value-for-Money Culture

University leaders should encourage a shift toward value-for-money thinking by integrating cost–benefit analysis and performance indicators into budgeting and expenditure decisions. Linking financial allocations to measurable outcomes can enhance accountability and support more rational use of public resources.

6. Invest in Digital and Financial Capacity Building

Continuous training programs should be implemented to enhance digital literacy and financial management competencies among academic and administrative leaders. Human capabilities play a critical role in translating digital transformation investments into sustainable improvements in expenditure efficiency.

10.3 Theoretical contributions and future research

This study contributes to the literature by empirically examining the relationship between digital transformation and expenditure efficiency within the underexplored

context of public universities. It advances existing research by demonstrating that systems integration constitutes a critical mechanism through which digital transformation influences financial efficiency outcomes.

Future research may extend this work by adopting longitudinal designs to examine the dynamic effects of digital transformation over time, conducting comparative studies across multiple universities, or exploring moderating factors such as organizational culture, regulatory frameworks, and leadership styles that may shape the effectiveness of digital transformation initiatives.

REFERENCES

Al-Haddad, S., & Kotnour, T. (2015). Integrating the organizational change literature: A model for successful change. *Journal of Organizational Change Management, 28*(2), 234–262.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. *MIS Quarterly, 37*(2), 471–482.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

De Haes, S., Van Grembergen, W., & Debreceny, R. (2020). COBIT as a framework for enterprise governance of IT. *ISACA Journal*, 1, 1–8.

Dunleavy, P., Margetts, H., Bastow, S., & Tinkler, J. (2006). *Digital era governance: IT corporations, the state, and e-government*. Oxford University Press.

Green, S. B. (1991). How many subjects does it take to do a regression analysis? *Multivariate Behavioral Research, 26*(3), 499–510.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.

Johnstone, D. B. (2018). Financing higher education: Worldwide perspectives and policy options. *International Higher Education, 94*, 3–5.

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2015). Strategy, not technology, drives digital transformation. *MIT Sloan Management Review, 14*, 1–25.

Mergel, I., Edelmann, N., & Haug, N. (2019). Defining digital transformation: Results from expert interviews. *Government Information Quarterly, 36*(4), 101385.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill. OECD. (2020). *Public governance and budgetary management*. OECD Publishing.

Salmi, J. (2017). The challenge of establishing world-class universities. *World Bank Publications*.

Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods for business students* (8th ed.). Pearson Education.

Schick, A. (2015). Why most developing countries should not try New Zealand's reforms. *World Bank Research Observer, 13*(1), 123–131.

Sebastian, I. M., Ross, J. W., Beath, C., Mocker, M., Moloney, K., & Fonstad, N. (2017). How big old companies navigate digital transformation. *MIS Quarterly Executive, 16*(3), 197–213.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *Journal of Strategic Information Systems, 28*(2), 118–144.

World Bank. (2019). *Improving public sector efficiency*. World Bank Group.

Authors' Contribution

All authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

How to cite this article (APA)

Alkasassbeh, W. A. (2026). THE ROLE OF DIGITAL TRANSFORMATION IN ENHANCING EXPENDITURE EFFICIENCY IN PUBLIC UNIVERSITIES: AN EMPIRICAL STUDY. *Veredas Do Direito*, 23(5), e235570. https://doi.org/10.18623/rvd.v23.5570