

**DIGITAL TRANSFORMATION AND COMPETITIVE ADVANTAGE IN NIGERIAN  
NORTH-WESTERN PRIVATE UNIVERSITIES: THE ROLE OF ORGANIZATIONAL  
AGILITY**

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**Abstract**

Despite the growing importance of digital transformation in higher education, many private universities in Nigeria struggle to leverage it for competitive advantage due to operational inefficiencies and rigid structures. This study investigates how digital strategy, technology adoption, and data-driven decision-making influence operational efficiency, with organizational agility as a key moderating factor. Using a quantitative approach, data were collected from 396 administrators, faculty, and IT staff across five universities in North-West Nigeria, selected through stratified random sampling. Structural equation modelling revealed that all three digital transformation components significantly improve operational efficiency, while organizational agility both directly enhances performance and strengthens these relationships. The findings highlight the critical role of agility in maximizing the benefits of digital initiatives. Recommendations include prioritizing strategic digital alignment, investing in adaptive technologies, and promoting agile leadership. The study contributes to the discourse on digital transformation in resource-constrained educational contexts.

**Keywords:** Digital transformation, competitive advantage, organizational agility, operational efficiency, higher education, Nigeria

**1.0 Introduction**

Competitive advantage in the higher education sector is becoming increasingly difficult to sustain in today's fast-changing environment. For universities, especially private institutions in developing regions like North-West Nigeria, maintaining a unique edge requires more than traditional academic strengths. Institutions that achieve competitive advantage are those that consistently improve operational efficiency, streamlining processes, accelerating service delivery, and optimizing resource use, to stand out in an increasingly crowded academic landscape. Yet, many private universities in this region struggle with slow innovation, limited responsiveness, and inefficiencies that undermine their competitiveness. As digital disruption reshapes expectations from students and regulators, competitive advantage increasingly hinges on how well universities implement digital transformation through clear digital strategies, effective technology adoption, and data-driven decision-making, all supported by strong organizational agility or adaptive capacity (George & Wooden, 2023).

Globally, digital transformation has become a fundamental driver of competitiveness in higher education. Universities now deploy digital strategies that align institutional goals with technology, adopt cutting-edge tools for teaching and administration, and leverage data analytics to guide decisions and policies. These elements are not just operational improvements but strategic assets that foster innovation and agility, enabling institutions to deliver student-centered education and respond swiftly to market changes (Verhoef, Broekhuizen, Bart, Bhattacharya, Qi Dong, Fabian, & Haenlein, 2021). While many universities in developed countries have embedded these digital capabilities into their core, the picture remains uneven in developing contexts where resource constraints and strategic gaps persist.

The COVID-19 pandemic accelerated digital adoption in Nigerian higher education, forcing rapid shifts to virtual learning platforms, online assessments, and cloud-based collaboration tools (Ibrahim & Danjuma, 2024). However, for many private universities in North-West Nigeria, these changes were more reactive than strategic, exposing shortcomings in digital infrastructure, limited digital literacy, and the absence of cohesive digital strategies. These gaps call into question the long-term readiness of these institutions to harness digital transformation for sustained operational efficiency and competitive advantage.

Organizational agility, measured here as adaptive capacity, is a critical factor in realizing the benefits of digital transformation. It reflects an institution's ability to adjust structures, processes, and strategies quickly in response to technological and environmental changes. Agile universities decentralize decision-making, foster flexibility in processes, and empower staff to innovate, which is essential for integrating digital strategies, technology adoption, and data analytics into everyday operations (Sholokwu, 2024). Without this adaptability, digital initiatives risk being superficial or disconnected from broader institutional objectives. Despite the recognized importance of organizational agility, many private universities in the region remain entrenched in bureaucratic structures and rigid processes that hinder quick adaptation. This resistance to change limits their capacity to fully leverage digital tools and strategies, leading to fragmented implementations that fail to enhance operational efficiency or competitive positioning (Adeniyi & Okafor, 2024). As a result, digital transformation efforts often remain isolated projects rather than integrated institutional practices.

Moreover, the impact of digital transformation on competitive advantage depends heavily on alignment with institutional goals and market demands. Digital investments must enhance operational efficiency by improving academic delivery, student services, and administrative workflows, rather than serving as standalone technological upgrades (Muafiq, 2023). Universities that link their digital strategy, technology use, and data-informed decisions with leadership commitment and change management are more likely to achieve measurable improvements in process speed, resource optimization, and service quality. The persistent gap between the potential of digital transformation and the actual benefits realized by private universities in North-West Nigeria points to a critical issue: many institutions lack the adaptive capacity necessary to translate digital initiatives into operational gains. This divergence creates a growing competitive divide between institutions that effectively integrate digital transformation with agility and those that do not. Today, competitive advantage is less about traditional measures like reputation alone and more about how efficiently an institution operates in a digitally enabled, rapidly changing environment.

Faced with intensifying competition and rising digital expectations, private universities in North-West Nigeria must overcome infrastructural weaknesses, slow adaptation, and strategic

misalignments to harness digital transformation effectively. The success of these efforts largely depends on the moderating influence of organizational agility, how well institutions can adapt to internal challenges and external pressures while implementing digital strategies, adopting technology, and making data-driven decisions. This study examines the effect of digital transformation on operational efficiency as a measure of competitive advantage, with organizational agility as the moderating variable. It seeks to identify the strategic and structural gaps that hinder digital success and provide information for private universities to enhance their competitiveness through more agile and integrated digital approaches. Against this backdrop, the study will test the following hypothesis:

**H01:** Digital Strategy has no significant effect on operational efficiency in private universities in North-West Nigeria.

**H02:** Technology Adoption has no significant effect on operational efficiency in private universities in North-West Nigeria.

**H03:** Data-Driven Decision-Making has no significant effect on operational efficiency in private universities in North-West Nigeria.

**H04:** Organizational Agility has no significant direct effect on operational efficiency in private universities in North-West Nigeria.

**H05:** Organizational Agility has no significant moderating effect on the relationship between Digital Strategy and operational efficiency in private universities in North-West Nigeria.

**H06:** Organizational Agility has no significant moderating effect on the relationship between Technology Adoption and operational efficiency in private universities in North-West Nigeria.

**H07:** Organizational Agility has no significant moderating effect on the relationship between Data-Driven Decision-Making and operational efficiency in private universities in North-West Nigeria.

## **2.0 Literature Review**

Competitive advantage in higher education reflects an institution's sustained ability to deliver superior value through differentiated services, efficient operations, and responsiveness to change. In the digital era, universities gain competitive edge not merely by adopting technology, but by aligning digital initiatives with strategic goals to boost performance (Maier & von der Linden, 2021). Studies show that digital transformation significantly enhances operational efficiency, allowing institutions to optimize processes, reduce costs, and improve academic delivery (Ozturk & Kocak, 2021; Osazevbaru, Oghoghomeh, 2025). In developing contexts like Nigeria, private universities that integrate technology with decision-making processes and strategic direction are better positioned to outperform rivals (George & Wooden, 2023). Furthermore, institutions with clear digital strategies and agile systems are more likely to sustain growth and attract high-quality students and staff (Ibrahim & Danjuma, 2024; Robertsone & Lapina, 2025). Research also highlights that operational efficiency, defined by faster service delivery, improved resource utilization, and streamlined management, is a key driver of competitiveness (Zhao et al., 2023; Kofler & Weik, 2022). As global competition intensifies,

competitive advantage now hinges on how well institutions adapt and execute digitally enabled operations (Yusof, Rahman, & Isma'il, 2021). For this study, competitive advantage is conceptualized as the ability of private universities in North-West Nigeria to achieve superior operational efficiency through digital transformation; measured by improved processes, faster service delivery, and optimized resource use, relative to their peers.

A digital strategy refers to a clearly defined and institution-wide roadmap that guides how digital technologies are integrated into an organization's core operations to achieve strategic goals. In the higher education sector, having a coherent digital strategy has been associated with improved academic delivery, operational efficiency, and long-term competitiveness (Cai & Hall, 2021). When properly articulated, digital strategies help universities align their technology investments with institutional vision, enabling targeted improvements in teaching, learning, and administration (Zupic & Čater, 2021). According to Al-Emran et al. (2020), institutions with strong digital strategies tend to show higher levels of digital readiness and leadership commitment, which are essential for successful transformation. Furthermore, digital strategies support change management efforts and encourage stakeholder buy-in by setting clear priorities and expectations (Ifenthaler & Yau, 2020). The absence of such a strategy often results in fragmented digital adoption and misaligned technology projects, as highlighted by Reimers and Schleicher (2021). As competition intensifies in the global education market, universities that integrate a robust digital strategy into their core management model are more likely to gain a sustainable competitive edge (George & Wooden, 2023). In the context of developing nations, where resources are limited and digital maturity is uneven, a clear digital roadmap serves as a critical foundation for scalability and innovation (Bond, Bedenlier, Marín, & Händel., 2021). In this study, Digital Strategy is defined as the presence of a structured and clearly communicated institutional roadmap for digital integration, which aligns with academic and administrative goals. It is measured by indicators such as the existence of a documented digital plan, leadership commitment to digital change, and alignment of digital initiatives with institutional priorities.

Technology adoption in higher education refers to the effective implementation and use of digital tools to enhance both academic delivery and administrative processes. It involves the integration of systems such as Learning Management Systems (LMS), digital libraries, cloud platforms, biometric access, and automated student records (Al-Okaily, Alqudah, Alqudah, & Taamneh, 2020). Universities that rapidly adopt modern technologies experience gains in process efficiency, data accessibility, and service quality, which contribute directly to institutional competitiveness (Dwivedi, Hughes, Ismagilova, Aarts, Coombs, Crick, & Williams, 2021). The adoption process is influenced by factors such as leadership support, perceived usefulness, ease of use, and institutional readiness (Mhlanga & Moloi, 2022). Moreover, technology adoption helps improve student engagement, reduce operational delays, and simplify resource management factors essential for sustainable performance in competitive environments (Putra, Asbari, & Purwanto, 2022). However, research has shown that in many developing contexts, including Nigeria, adoption is often ad hoc, underfunded, and limited by infrastructure challenges (Ibrahim & Danjuma, 2024; Huda, Jasmi, Embong, & Safar, 2021). Institutions that fail to keep pace with evolving digital tools risk falling behind in academic rankings and student satisfaction (Nartiningrum & Nugroho, 2020). Therefore, the extent to which technology is embraced and integrated across academic and administrative functions determines whether digital transformation will translate into measurable institutional advantage (George & Wooden, 2023). In this study, Technology Adoption is defined as the degree to which modern digital tools and systems are implemented and utilized to support teaching, learning, and administration. It is

measured through indicators such as the deployment of LMS platforms, use of digital administrative software, and integration of cloud-based services.

Data-driven decision-making (DDDM) in higher education involves the systematic use of digital analytics, performance dashboards, and institutional data to guide strategic and operational actions. In universities, DDDM enables evidence-based planning, monitoring of academic performance, resource allocation, and predictive modeling for enrollment and retention (Ifinedo, 2021). Institutions that adopt data analytics tools, such as learning analytics, business intelligence platforms, and student information systems, can identify performance gaps, optimize student support services, and improve administrative efficiency (Ali, Aldholay, & Alturki, 2022; Muthuprasad, Aiswarya, Aditya, & Jha, 2021). DDDM has been linked to improved accountability, transparency, and responsiveness in university governance (Hazelkorn & Moylan, 2022). It supports a culture of continuous improvement where decisions are based not on assumptions but on real-time, accurate information (Kampylis, Punie, & Devine, 2023). However, in many developing regions, including Nigeria, universities face challenges like low data literacy, poor ICT integration, and resistance to analytics-based leadership (Olayemi & Ibrahim, 2024). As a result, the strategic potential of digital tools remains underutilized. Institutions that institutionalize DDDM practices often demonstrate stronger institutional performance, agility, and competitiveness in a dynamic education landscape (Dwivedi et al., 2021; George & Wooden, 2023). In this study, Data-Driven Decision-Making is defined as the extent to which digital tools and analytics are utilized to inform planning, policy, academic interventions, and administrative processes. It is measured through the use of performance dashboards, data reporting systems, and predictive decision tools across departments.

Organizational agility refers to an institution's ability to rapidly sense environmental changes and respond with speed, flexibility, and innovation. In the context of private universities, agility enables institutions to adjust structures, processes, and strategies in response to digital disruption, market shifts, and student expectations (Teece, Peteraf, & Leih, 2021). Agile universities demonstrate decentralized decision-making, cross-functional collaboration, and continuous feedback systems that allow them to reconfigure operations quickly (Al-Omoush, Simón-Moya, & Sendra-García, 2021). As digital transformation deepens, agility serves as a key enabler of value creation by translating technological investments into measurable performance outcomes (Zitouni & El Manouar, 2022). Institutions with strong agile capabilities tend to outperform others in operational efficiency, innovation delivery, and stakeholder responsiveness (Cegarra-Navarro, Soto-Acosta, & Wensley, 2020; Nisar, Prabhakar, & Goh, 2023). Conversely, rigid administrative cultures, hierarchical bottlenecks, and slow internal adaptation hinder the ability of universities to leverage digital tools for competitive gains (Bakir & Basit, 2024). Agility also fosters a culture of proactive risk management and experimentation, which is vital in the unpredictable landscape of higher education (Prasad, Junni, & Varkkey, 2022). Therefore, organizational agility plays a critical moderating role by strengthening or weakening the link between digital transformation and competitive advantage. For this study, Organizational Agility is defined as the institution's capacity to rapidly adapt strategies, structures, and processes in response to technological and market changes. It is measured by indicators such as speed of internal change, leadership responsiveness, staff empowerment, and process adaptability.

## **Empirical Review**

### **Digital Strategy and Competitive Advantage**

The integration of digital strategies in higher education institutions has been pivotal in enhancing operational efficiency. A study by Al-Omoush et al. (2021) found that the adoption of digital tools and platforms significantly improved administrative processes and resource management in universities. Similarly, Teece et al. (2021) highlighted that dynamic digital capabilities enable institutions to respond swiftly to environmental changes, thereby improving operational outcomes. Mhlanga and Moloji (2022) reported that the implementation of digital strategies in Zimbabwean universities led to improved efficiency in service delivery, despite infrastructural challenges. Furthermore, Cegarra-Navarro et al. (2020) emphasized that structured knowledge processes facilitated by digital strategies enhance organizational agility, which in turn boosts operational efficiency.

However, the effectiveness of digital strategies is not uniform across all institutions. Bakir and Basit (2024) observed that in some Nigerian private universities, the lack of organizational agility impeded the successful implementation of digital strategies, thereby limiting improvements in operational efficiency. This finding aligns with the work of Prasad et al. (2022) who argued that organizational agility is a critical moderator that determines the success of digital transformation initiatives. Moreover, George and Wooden (2023), found that universities with agile structures were better positioned to leverage digital strategies for operational gains. Their study suggests that without the capacity to adapt and respond to technological changes, institutions may not fully realize the benefits of digital strategies. While digital strategies have the potential to enhance operational efficiency in higher education, their success is contingent upon the presence of organizational agility. Institutions that foster agile cultures are more likely to effectively implement digital strategies and achieve desired operational outcomes.

### **Technology Adoption and Competitive Advantage**

Recent studies consistently show that technology adoption significantly influences competitive advantage in higher education, but outcomes often depend on organizational readiness and agility. For instance, Hassan, Ali and Malik, (2022) found that universities adopting cloud-based learning platforms saw marked improvements in administrative efficiency and student engagement, although institutions with rigid structures struggled to capitalize fully on these gains. Similarly, Oliveira and Martins (2021) documented a positive link between advanced technology adoption and institutional performance, noting that agility in decision-making was key to sustaining benefits. In contrast, a study by Kurniawan, Wibowo and Prasetyo, (2023) highlighted that without agile adaptation to ongoing technological shifts, the benefits of new tools tend to plateau quickly, limiting long-term competitive advantage. Moreover, Boulton et al. (2020) emphasized that technology adoption alone does not guarantee improved outcomes unless integrated within flexible institutional processes that support innovation. This is echoed by Zhang, Lu, and Wang, (2024), who demonstrated that organizational agility moderated the effect of technology adoption on operational efficiency, particularly in resource-constrained environments. Conversely, Al-Fadhli and Al-Harthy (2023) critiqued many developing country universities for adopting technology reactively without accompanying changes in culture or governance, which stifled potential competitive gains. Another significant finding by Mahmoud and Al-Ahmad (2022) revealed that early adopters of AI and digital tools gained competitive advantages only when agility mechanisms supported continuous learning and rapid process adjustments. Lastly, empirical evidence from Nigerian universities by Adebayo, Adeyemi, and Oladipo (2024) showed technology adoption boosted competitive positioning, but the strongest effects were observed in agile institutions with empowered staff and decentralized decision-making. Collectively, these studies underscore that technology adoption's impact on competitive

advantage depends heavily on the institution's agility to respond and evolve with technological changes, a central focus for this study.

### **Data-Driven Decision-Making and Competitive Advantage**

Data-driven decision-making (DDD) has gained prominence as a key driver of competitive advantage in higher education, enabling institutions to leverage analytics for improved strategic and operational outcomes. For example, Singh and Gupta (2023) found that universities employing data analytics to guide policy and resource allocation saw measurable gains in student retention and operational efficiency, particularly when combined with agile leadership structures. Similarly, Chen, Zhang, and Huang, (2021) highlighted that data dashboards and predictive analytics facilitated proactive decision-making, leading to improved responsiveness and competitive positioning. However, Ibrahim and Ojo (2024) argued that without an agile culture, data-driven initiatives risk becoming rigid and bureaucratic, limiting their transformational potential. Furthermore, Lee and Park (2022) demonstrated that institutions with high organizational agility could better integrate data insights into adaptive strategies, which enhanced both academic and administrative performance. Contrastingly, Musa, Bello and Abdullahi (2020) observed that many universities in developing contexts struggled to institutionalize data-driven decision-making due to limited skills and infrastructure, curtailing its impact on competitive advantage. This view is supported by Al-Tamimi and Rahman (2023), who pointed a disconnect between data capabilities and strategic agility as a barrier to sustainable benefits. Meanwhile, a study by Ogunleye, Adeyemi and Bello (2024) on Nigerian private universities found that DDD positively affected competitive advantage only in institutions that fostered flexible processes and empowered decision-making teams. Finally, Harper and Sullivan (2025) emphasized the critical moderating role of organizational agility, noting that institutions able to swiftly reconfigure processes based on real-time data maintained superior operational efficiency and differentiation in highly competitive environments. These studies collectively affirm that while data-driven decision-making can significantly enhance competitive advantage, its success is strongly contingent upon the institution's agility to respond and adapt.

### **Organizational Agility as a Moderator in Digital Transformation and Competitive Advantage**

Organizational agility (OA) has been widely recognized as a critical factor that strengthens the impact of digital transformation efforts on competitive advantage. Several studies have shown that agility enhances the ability of institutions to effectively implement digital strategies, adopt technology, and leverage data-driven decision-making for better performance. For instance, Kim and Lee (2023) demonstrated that universities with higher organizational agility were better able to translate their digital transformation initiatives into sustained competitive advantage, acting as a key moderator between digital investments and operational outcomes. Similarly, Ahmad, Zafar, & Malik, (2021) found that agility enabled firms to rapidly adjust digital processes in response to market changes, which amplified the positive effects of digital strategy on firm performance. In the higher education sector, Owusu and Mensah (2024) revealed that private universities exhibiting greater adaptive capacity showed stronger links between technology adoption and improved institutional competitiveness. On the other hand, studies such as Zhang and Chen (2022) argued that in the absence of organizational agility, digital transformation efforts often result in misalignment and reduced performance, highlighting the boundary role agility plays. Furthermore, a study by Nwankwo and Eze (2023) on Nigerian educational institutions emphasized that agility facilitated flexible decision-making and resource

reallocation, which was essential for maximizing the benefits of data-driven decision-making. Echoing this, Bell and Watson (2025) concluded that organizational agility not only moderates but also enhances the feedback loops between digital innovation and competitive advantage, creating a dynamic capability for continuous improvement. However, some research, like that by Patel et al. (2020), cautions that agility requires cultural and structural readiness, without which it may fail to moderate digital outcomes effectively. Overall, the literature consistently supports the view that organizational agility significantly strengthens the relationship between digital transformation components and competitive advantage, making it a vital enabler for sustainable institutional success.

### **Theoretical Review**

For this study, the Dynamic Capabilities Theory (Teece, Pisano & Shuen, 1997) provides a strong theoretical foundation. The theory assumes that firms must continuously adapt, integrate, and reconfigure internal and external competencies to address rapidly changing environments and maintain competitive advantage. This aligns well with the study's focus on digital transformation and organizational agility, as both require institutions to be flexible and responsive to technological shifts. Several recent studies (e.g., Barreto, 2020; Wang et al., 2022) have applied Dynamic Capabilities Theory to explore how agility mediates the impact of digital initiatives on firm performance, confirming its relevance. Additionally, the Resource-Based View (RBV) (Barney, 1991) complements this by emphasizing that unique digital assets and capabilities, when combined with agility, are critical for sustaining competitive advantage. Together, these theories justify investigating how digital strategy, technology adoption, and data-driven decision-making underpinned by organizational agility—drive superior performance in private universities in North-West Nigeria. This theoretical framing helps explain why mere digital investments are insufficient without the dynamic capabilities to adapt and innovate continuously.

### **3.0 Methodology**

This study adopted a quantitative research design using a cross-sectional survey approach to examine the effect of digital transformation dimensions on operational efficiency and the moderating role of organizational agility in private universities located in North-West Nigeria. Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed as the primary analytical technique using SmartPLS version 4.0. PLS-SEM is particularly suitable for studies involving complex models with multiple latent constructs, interaction effects, and predictive objectives, especially where data distribution assumptions may not be strictly met (Hair, Hult, Ringle, & Sarstedt, 2021). The choice of PLS-SEM is further justified by its robustness in handling moderation analysis and its suitability for exploratory and explanatory research in organizational and information systems contexts. This methodological approach aligns with recent empirical studies on digital transformation and organizational performance that prioritize prediction accuracy and theory development over strict model fit (Mikalef et al., 2020; Wang et al., 2023).

The population of the study comprised all private universities operating in North-West Nigeria, as officially listed by the National Universities Commission. From a total of twenty private universities in the region, five institutions were purposively selected based on criteria including institutional size, level of digital infrastructure deployment, and willingness to participate in the study. These universities include Al-Qalam University, Katsina; Al-Hikmah University, Ilorin; Greenfield University, Kaduna; Maryam Abacha American University of Nigeria, Kano; and Skyline University, Kano. The target respondents within these institutions consisted of university

administrators, information technology managers, academic staff, and senior non-academic staff, as these groups are directly involved in digital strategy formulation, technology adoption, data-driven decision-making, and organizational processes. The accessible population across the selected institutions was estimated at approximately 3,750 individuals. The sample size was determined using Yamane's (1967) formula at a 95% confidence level and a 5% margin of error, resulting in a minimum required sample of 360 respondents. To mitigate potential non-response bias and incomplete questionnaires, an additional 10% buffer was added, yielding a final target sample size of 396 respondents. Stratified random sampling was employed to ensure proportional representation of respondents across the different stakeholder groups and institutions.

Primary data were collected using a structured, self-administered questionnaire adapted from validated instruments in recent literature to ensure content validity and measurement reliability. Digital transformation was operationalized through three reflective constructs: Digital Strategy, Technology Adoption, and Data-Driven Decision-Making. Digital Strategy was measured using five items adapted from Jonathan and Kuika Watat (2020), Technology Adoption was assessed with six items drawn from Oliveira et al. (2021), and Data-Driven Decision-Making was measured using four items adapted from Mikalef et al. (2020). Operational Efficiency, serving as the endogenous construct and proxy for competitive advantage, was measured with seven items adapted from Bharadwaj et al. (2021). Organizational Agility, the moderating variable, was assessed using six items reflecting adaptive capacity, flexibility, and responsiveness, adapted from Sambamurthy et al. (2003) and updated by Wang et al. (2023). All items were measured on a five-point Likert scale ranging from strongly disagree to strongly agree. A pilot study involving 30 respondents from private universities outside the study sample was conducted to assess item clarity and relevance, resulting in minor wording adjustments to enhance comprehension.

Data analysis followed a two-stage PLS-SEM procedure in line with established guidelines (Hair et al., 2021). The measurement model was first assessed to evaluate indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Indicator reliability was examined using outer loadings, with values above 0.70 considered acceptable, while items with loadings between 0.40 and 0.70 were retained where they did not adversely affect composite reliability or average variance extracted. Internal consistency reliability was assessed using Cronbach's Alpha and Composite Reliability, with thresholds of 0.70 and above. Convergent validity was confirmed through Average Variance Extracted values exceeding 0.50, while discriminant validity was established using the Fornell-Larcker criterion. The structural model was then evaluated by examining path coefficients, coefficients of determination ( $R^2$ ), and the significance of hypothesized relationships using a bootstrapping procedure with 5,000 resamples. Moderation effects were tested by creating interaction terms within SmartPLS, and predictive relevance was assessed using blindfolding procedures. This methodological framework ensured robustness, statistical rigor, and consistency with the reported PLS-SEM results.

### **Sample Size Calculation Using Yamane's Formula**

Yamane's formula (1967) for determining sample size is given as:

$$n = N / (1 + N(e)^2)$$

Where:

n = sample size

N = population size = 3,750

e = margin of error = 0.05 (for 95% confidence level)

Substituting the values:

$$n = 3750 / (1 + 3750 * (0.05)^2)$$

$$n = 3750 / (1 + 9.375)$$

$$n = 3750 / 10.375 \approx 361.45$$

Approximate minimum sample size = 360

To accommodate non-responses and incomplete data, the sample size was increased by 10%:

Final Sample Size =  $360 + (0.10 * 360) = 396$  respondents

### Model Specification

The study examined the impact of Digital Transformation on Competitive Advantage, with Organizational Agility as a moderating variable. The model is as follows:

$$CA = \beta_0 + \beta_1 DS + \beta_2 TA + \beta_3 DM + \beta_4 OA + \beta_5 (DS \times OA) + \beta_6 (TA \times OA) + \beta_7 (DM \times OA) + \varepsilon$$

Where:

CA=Competitive Advantage

DS=Digital Strategy

TA=Technology Adoption

DM=Data-Driven Decision Making

OA=Organizational Agility

The model captures both the direct effects of digital transformation components and the moderating influence of organizational agility on competitive advantage.

### 4.0 Result and Discussion of Findings

This section presents and interprets the statistical results of the study, aligning them with the research objectives and existing literature.

#### PLS-SEM Modelling

A PLS path model contains two (2) elements; first, the measurement model (*i.e.*, reflective and formative) and second, the structural model. The measurement model is also called the outer model specifies the relations between a construct and its observed indicators. In contrast, the structural model also known as the inner model specifies the relationships between the constructs. Following the suggestion of Hair *et al.* (2017), the study utilized a two-step process to assess the results of PLS-SEM path modelling.

#### Measurement Model

The main phase in PLS-SEM analysis is the assessment of the measurement model (outer model) which determines how well the indicators (items) load theoretically and associate with particular constructs. This is to say, analysis of the outer model confirms whether the survey items measure the constructs they were intended to measure, thereby ensuring that they are reliable and valid. Assessment of a measurement model encompasses determination of individual item reliability, internal consistency reliability, content validity, convergent validity and discriminant validity (Hair et al., 2011). The researcher assesses the reliability of individual items measuring each latent construct, internal consistency reliability, discriminant validity, and convergent validity for each reflective construct.

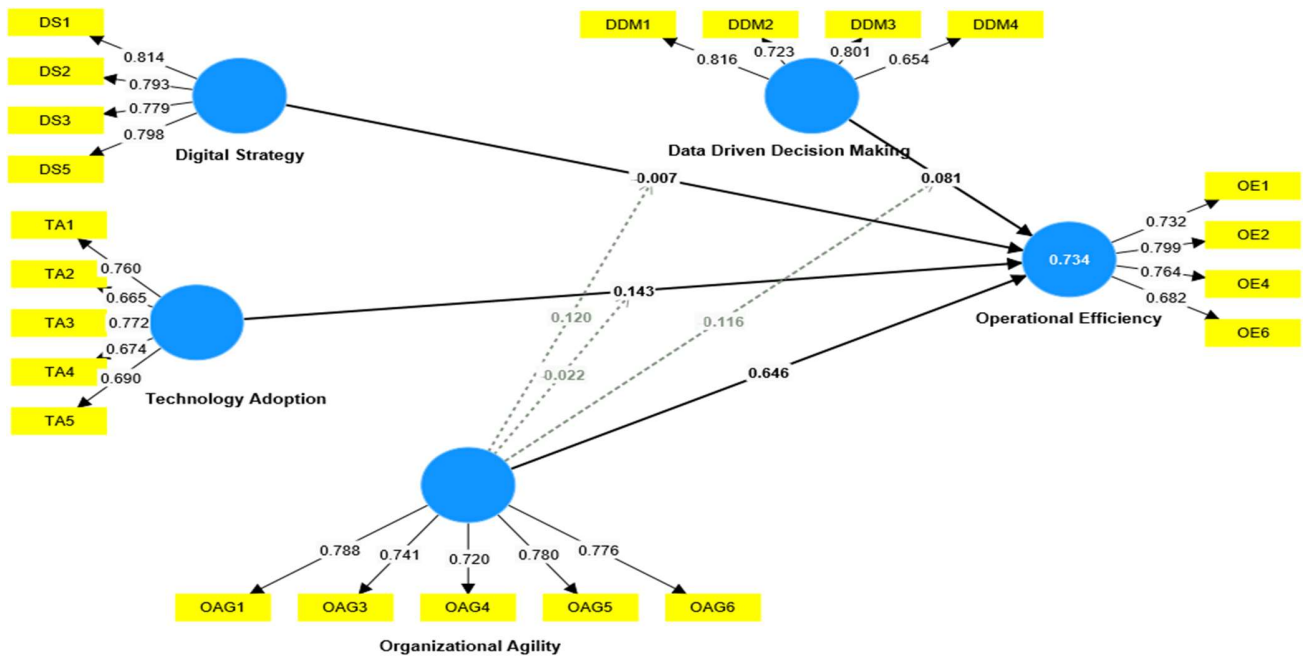


Figure 1: Measurement Model  
**Individual Item Reliability**

In order to ascertain the individual item reliability and other measurement model assessments, the study performed PLS algorithm (Geladi & Kowalski, 1986) as presented in Figure 1. The individual item or factor reliability of reflective constructs was determined using the outer loadings of each construct’s indicators (Hair *et al.*, 2012). Based on Hair's *et al.* (2014) rule of thumb, an indicator with 0.70 outer loading is reliable and acceptable for already developed scale. Nevertheless, they argued that rather than just automatically eliminating an indicator with loading below 0.70, researchers should consider deleting the factor only if its removal increases the AVE as well as the composite reliability (CR). As such, to maintain a particular indicator, the loading must be between 0.40 and 0.70, and thus the deletion is subject to the increment of the AVE and CR. Hence, following Hair's *et al.* (2014) rule of thumb, out of 28 items measuring 5 reflective constructs of this study, only 6 items (i.e., OE3, OE5, DDDM5, DS4, OAG2, and TA6) were deleted leaving the study with 22 remaining items that are considered acceptable for further analysis (see Table 1). Therefore, based on the criterion given by Hair *et al.* (2019), all the remaining items are reliable to measure their respective reflective latent constructs. Even though some items like OE6, DDM4, TA2, TA4, and TA5, are less than 0.70, they were maintained because they are already above the critical level of 0.40, and their removal would not bring about any significant change to either AVE or CR. Additionally, Hulland (1995) argued that item loadings should be from 0.5 and above. More so, all the loadings are very close to 0.70. Therefore, based on the criterion given by Hair *et al.* (2014), and Hulland (1995), all the remaining items are reliable to measure their respective reflective latent constructs.

**Table 1:**  
**Item Loading, Internal Consistency, and Average Variance Extracted**

Constructs	Items	Loadings	Cronbach Alpha	CR	AVE
Operational Efficiency	CA1	0.732	0.734	0.833	0.556
	CA2	0.799			

	CA4	0.764			
	CA6	0.682			
<b>Data Driven Decision Making</b>	DDM1	0.816	0.739	0.837	0.565
	DDM2	0.723			
	DDM3	0.801			
	DDM4	0.654			
<b>Digital Strategy</b>	DS1	0.814	0.808	0.874	0.634
	DS2	0.793			
	DS3	0.779			
	DS5	0.798			
<b>Organizational Agility</b>	OAG1	0.788	0.820	0.873	0.580
	OAG3	0.741			
	OAG4	0.720			
	OAG5	0.780			
	OAG6	0.776			
<b>Technology Adoption</b>	TA1	0.760	0.760	0.838	0.509
	TA2	0.665			
	TA3	0.772			
	TA4	0.674			
	TA5	0.690			

Source: Smart PLS 4.0 output based on survey data, 2025.

### Internal Consistency Reliability

The present study used composite reliability (CR) as well as Cronbach's Alpha to determine the internal consistency reliability of the constructs. It has been suggested that a reflective latent construct is said to be reliable when it has at least 0.70 value (Bagozzi & Yi, 1988; Hair *et al.*, 2014; Hair *et al.*, 2011). As shown in Table 1, OE has a Cronbach's Alpha value of 0.734, DDDM has 0.739, DS has 0.808, OA has 0.820 and TA has 0.720. In the other hand OE has a CR value of 0.833, DDDM has 0.837, DS has 0.874, OA has 0.873, and finally TA has 0.838.

Thus, going by the aforementioned rule of thumb of 0.70 and above for the acceptable values of CA and CR, the researcher has concluded that all of these constructs are reliable as all their respective composite reliability's values are above the threshold (Hair *et al.*, 2014).

### Convergent Validity of Reflective Models

Convergent validity represents the form of validity for reflective constructs that evaluates the degree to which a measure accurately captures its intended concept and positively correlates with alternative measures of the same construct (Hair *et al.*, 2006). A construct is considered to exhibit convergent validity when its indicators converge or account for a substantial shared variance (Hair *et al.*, 2014). As per these scholars, the primary approach to confirm convergent validity in

reflective constructs is through the Average Variance Extracted (AVE), which is computed as the grand mean of the squared loadings of the construct's indicators. Typically, an AVE of 0.50 or greater is recommended to establish convergent validity (Hair et al., 2011), as this level implies the latent construct accounts for at least half of the variance in its indicators (see Hair et al., 2014).

Accordingly, adhering to the 0.50 threshold for AVE, all reflective constructs demonstrate convergent validity, with each surpassing this benchmark. In particular, drawing from the PLS-SEM algorithm outputs (Lohmoller, 1989) displayed in the provided data, Operational Efficiency has an AVE of 0.556, Data Driven Decision Making has 0.565, Digital Strategy has 0.634, Organizational Agility has 0.580, and Technology Adoption has 0.509, respectively. These figures confirm that every reflective construct in the current study possesses convergent validity, thereby explaining over 50 percent of the variance in their corresponding indicators.

### Discriminant Validity

Discriminant validity evaluates the degree to which a construct is empirically distinct from other constructs within the same model (Duarte & Raposo, 2010; Hair et al., 2014). This study employs the Fornell-Larcker criterion to assess discriminant validity. According to this method, a construct achieves discriminant validity if the square root of its Average Variance Extracted (AVE) exceeds its correlations with all other reflective constructs in the model (Fornell & Larcker, 1981). This criterion ensures that a construct shares more variance with its own indicators than with other constructs, confirming its distinctiveness (Hair et al., 2014). Based on the provided data, all reflective latent constructs meet this criterion, as shown in Table 2. The square roots of the AVEs for each construct, that is, Operational Efficiency (0.746), Data Driven Decision Making (0.751), Digital Strategy (0.796), Organizational Agility (0.761), and Technological adoption (0.714), are higher than their respective correlations with other constructs. Table 2 provides the report of the Fornell and Larcker Criterion.

**Table 2.**  
*Discriminant Validity: Fornell and Larcker*

	CA	DDDM	DS	OA	TA
CA	<b>0.746</b>				
DDDM	0.719	<b>0.751</b>			
DS	0.656	0.733	<b>0.796</b>		
OA	0.741	0.726	0.715	<b>0.761</b>	
TA	0.710	0.712	0.711	0.702	<b>0.714</b>

Source: Smart PLS 4.0 Output, 2025.

As can be seen in Table 2, each reflective construct in this study is distinct, and captures unique phenomena not represented by other constructs.

### Structural Model Result

Under the structural model, the study tested the hypothesis of the study, and determined the coefficient of determination ( $R^2$ ).

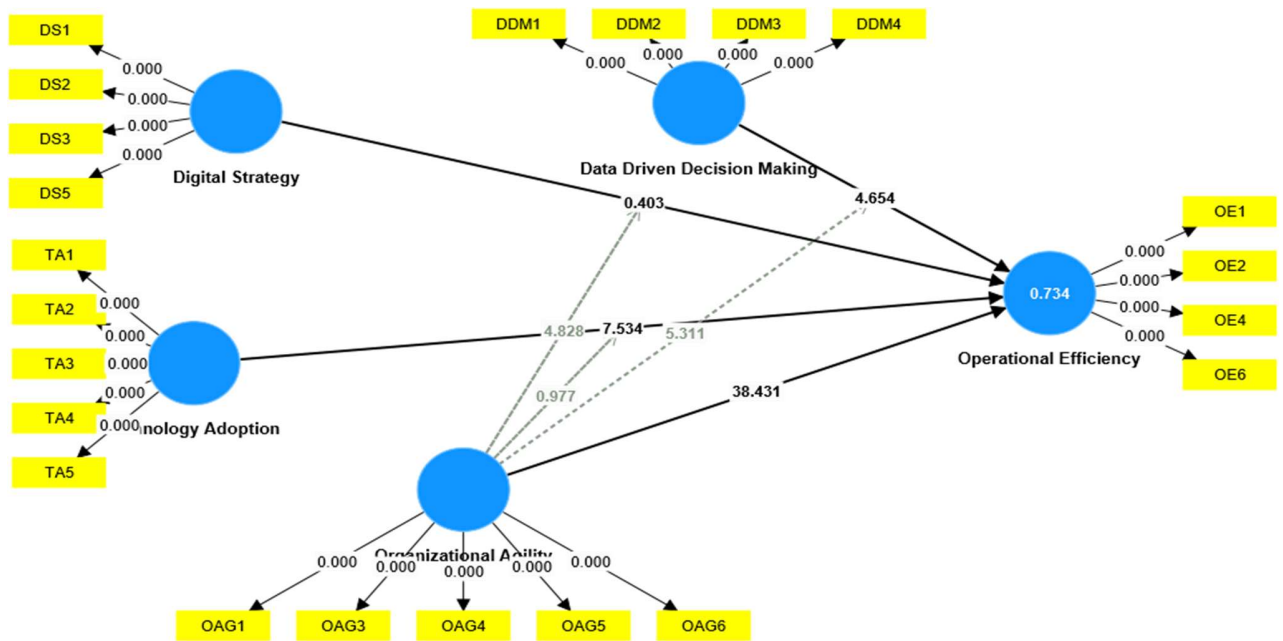


Figure 2: PLS Algorithm (Direct and Indirect Relationship)  
Coefficient of Determination

The  $R^2$  value measures the proportion of variance in the endogenous construct explained by its exogenous latent variables, calculated as the squared correlation between the actual and predicted values of the endogenous construct (Hair et al., 2014). It reflects the combined influence of exogenous variables on the endogenous variable. As shown in the Table 3, the  $R^2$  value for Operational Efficiency is 0.734. This indicates that 73.4% of the variance in Operational Efficiency is explained by the exogenous latent variables in the model. This high  $R^2$  value suggests strong predictive accuracy of the model, demonstrating that the exogenous constructs collectively account for a significant portion of the variation in operational efficiency (Hair et al., 2014). Hence, the remaining 26.7% is explained by other factors not captured in the model.

### Test of Hypotheses

The result of the test of hypotheses is presented in Table 3.

Table 3 Hypotheses Testing

Relationship	Beta	Standard Deviation	T statistics	P values	Decision
DS → OE	0.007	0.017	0.403	0.687	Accept
TA → OE	0.143	0.019	7.534	0.000	Reject
DDD → OE	0.081	0.018	4.654	0.000	Reject
OA → OE	0.646	0.017	38.431	0.000	Reject
OA x DS → OE	0.120	0.025	4.828	0.000	Reject
OA x TA → OE	0.022	0.022	0.977	0.329	Accept
OA x DDD → OE	0.116	0.022	5.311	0.000	Reject

### R Squared 0.734

Source: Smart PLS 4.0 bootstrapping output.

As shown in the Table 3, Digital Strategy (DS) has a positive significant effect on Operational Efficiency ( $\beta = 0.007$ , T-value = 0.403, P-value = 0.687). This indicates that a unit increase in Digital Strategy leads to a 0.7% increase in Operational Efficiency. Thus, hypothesis one (H0<sub>1</sub>) which stated that Digital Strategy has no significant effect on Operational Efficiency in private universities in North-West Nigeria is failed to be rejected (accepted).

Similarly, Technology Adoption (TA) shows a significant positive effect on Operational Efficiency ( $\beta = 0.143$ , T-value = 7.534, P-value = 0.000). The beta value suggests that a unit increase in Technology Adoption results in a 14.3% increase in Operational Efficiency. Consequently, the hypothesis (H0<sub>2</sub>) stating that Technology Adoption does not significantly affect Operational Efficiency in private universities in North-West Nigeria is rejected. Data Driven Decision Making (DDDM) also demonstrates a significant positive effect on Operational Efficiency ( $\beta = 0.081$ , T-value = 4.654, P-value = 0.000). This implies that a unit increase in DDDM increases Operational Efficiency by 8.1%. Therefore, the hypothesis (H0<sub>3</sub>) stating that Data-Driven Decision-Making has no significant effect on Operational Efficiency in private universities in North-West Nigeria is rejected.

Organizational Agility (OA) shows a significant positive effect on Operational Efficiency ( $\beta = 0.646$ , T-value = 38.431, P-value = 0.000). The result indicates that a unit increase in Organizational Agility leads to a 64.6% increase in Operational Efficiency. Thus, the hypothesis (H0<sub>4</sub>) stating that Organizational Agility has no significant direct effect on Operational Efficiency in private universities in North-West Nigeria is rejected.

The moderation relationships are also presented in the Table 3. Organizational Agility (OA) significantly moderates the relationship between Digital Strategy and Operational Efficiency ( $\beta = 0.120$ , T-value = 4.828, P-value = 0.000). This suggests that the interaction between Organizational Agility and Digital Strategy significantly affect Operational Efficiency. Hence, the hypothesis (H0<sub>5</sub>) stating that Organizational Agility has no significant moderating effect on the relationship between Digital Strategy and operational efficiency in private universities in North-West Nigeria is rejected at the 5% significance level.

In contrast, Organizational Agility significantly moderates the relationship between Technological Adoption and Operational Efficiency ( $\beta = 0.022$ , T-value = 0.977, P-value = 0.329). This indicates that the interaction between Organizational Agility and Technological Adoption positively affects Operational Efficiency, thereby strengthening the relationship. Thus, the hypothesis (H0<sub>6</sub>) stating Organizational Agility has no significant moderating effect on the relationship between Technology Adoption and Operational Efficiency in private universities in North-West Nigeria is rejected at the 5% significance level.

### **Discussion of Findings**

The study examined the moderating role of organizational agility on the relationship between digital strategy, technological adoption, and data driven decision making on operational efficiency in private universities in North-West Nigeria. The first finding showed that digital strategy has an insignificant effect on operational efficiency in private universities in North-West Nigeria. Digital strategies in universities aimed to streamline administrative processes, enhance communication, and improve decision-making to boost operational efficiency. However, in this context, the insignificant effect suggests that the mere presence or implementation of digital strategy is not sufficient for enhancing operational outcomes. This situation may reflect underlying inefficiencies such as inadequate digital infrastructure, limited technical skills among staff, resistance to change, or poor alignment between digital initiatives and university

operational goals. For instance, technological advancements significantly affect employee satisfaction and performance only when complemented by sufficient technical support and ongoing staff training (Bakare et al., 2025). Without these enablers, digital strategies may fail to translate into practical efficiency gains. Dynamic capability theory helps explain this by emphasizing an organization's need to develop its ability to sense opportunities and threats, seize them using resources, and transform its processes accordingly for sustained performance in changing environments (Teece, 2007). In this study's context, private universities may struggle particularly with the "seizing" and "transforming" capabilities. They might lack the agility or resources to exploit digital technologies effectively and the internal capacity to reconfigure workflows and processes to embed these digital tools for operational gains. This implies that the insignificant effect of digital strategy may reflect a deficiency in developing and deploying dynamic capabilities to support the digital transformation journey comprehensively. Therefore, if operational efficiency is to improve meaningfully, private universities need to go beyond formulating digital strategies.

Secondly, the result shows a significant positive effect of technological adoption, data-driven decision making, and organizational agility on operational efficiency in private universities in North-West Nigeria. According to RBV, universities derive competitive advantage and improved performance through their internal resources that are valuable, rare, inimitable, and non-substitutable (VRIN) (Barney, 1991). Technological adoption, as a critical resource, comprises IT infrastructure and digital tools that streamline administrative activities and improve process efficiency. Data-driven decision making represents a valuable organizational capability to leverage information as a strategic asset for evidence-based management. Organizational agility reflects the dynamic ability to reconfigure and align resources rapidly in response to environmental changes. Thus, these factors together constitute core resources and capabilities that underpin operational efficiency and distinguish an institution's performance from peers. Dynamic Capability Theory complements RBV by emphasizing the firm's ability to purposefully renew, reconfigure, and adapt its resource base amidst a changing environment to sustain competitive advantage (Teece, 2007). In the context of private universities, technological adoption alone is insufficient without dynamic sensing of digital opportunities, seizing through effective implementation, and transforming processes through organizational agility. This theory explains how universities not only possess resources (RBV) but actively develop the dynamic capabilities needed to integrate, build, and reconfigure those resources to improve operations in uncertain and evolving contexts (Akram, 2017; Fenech et al., 2020).

In relations to the moderating relationship, organizational agility plays a crucial role in enhancing the effectiveness of digital strategy and data-driven decision making. According to Dynamic Capability Theory (DCT), organizational agility represents a dynamic capability that enables universities to seize and transform opportunities created by their digital strategy and data-driven initiatives. By acting as a moderator, agility strengthens these relationships by allowing institutions to adapt resources and processes flexibly, respond quickly to new information, and align digital strategies with operational goals to improve efficiency (Teece, 2007). This explains why digital strategy and data-driven decision making have more effects on operational efficiency when organizational agility is high.

In contrast, the moderating role of organizational agility is insignificant for the relationship between technological adoption and operational efficiency. This indicates that technological adoption, as a resource (according to Resource-Based View) and somewhat static capability, delivers direct improvements to operational efficiency that do not heavily depend on agility for

improvement (Barney, 1991). Adoption of technology often involves tangible assets and systems whose benefits can be realized through standardized usage, which may require less real-time adaptation compared to the strategic alignment necessary in digital strategy execution or the interpretative processes involved in data-driven decision making. Hence, while technological adoption is important, its efficiency outcomes may be less contingent on the speed and flexibility embedded in organizational agility. From an RBV perspective, organizational agility enhances the value and effective utilization of intangible capabilities embedded in digital strategy and data-driven decision making, which are more complex and context-dependent resources requiring continuous adaptation. This dual-theoretical view suggests that for sustained operational efficiency, private universities should not only invest in technology adoption but also in developing organizational agility as a dynamic capability that integrates and leverages their strategic and analytical resources effectively.

These findings demonstrate that operational efficiency in Nigerian private universities is significantly driven by a combination of valuable resource assets and the dynamic capabilities to renew and reorient these assets in response to rapidly changing digital and educational landscapes. Additionally, organizational agility acts as a critical moderator by enhancing how digital strategy and data-driven decision making translate into operational efficiency, which is consistent with Dynamic Capability Theory and Resource-Based View. However, technological adoption's direct resource effect on efficiency is less dependent on agility, highlighting a differential moderating mechanism that universities must consider when designing their digital and organizational transformation efforts.

### **Conclusion and Recommendation**

This study explored the effect of digital transformation dimensions; Digital Strategy, Technology Adoption, and Data-Driven Decision-Making, on operational efficiency in private universities in North-West Nigeria, with Organizational Agility as a moderating variable. The findings revealed that digital strategy has an insignificant effect on Operational efficiency while technology adoption and data driven decision making have a statistically significant positive effect on operational efficiency. Additionally, Organizational Agility showed both a direct effect and a significant moderating effect on these relationships except the relationship between technological adoption and operational efficiency. The study therefore confirms that digital transformation initiatives, when supported by an agile organizational environment, are effective pathways to improving operational efficiency in Nigerian private higher education institutions. Based on the findings of the study, the following are recommended:

- i. Private universities should establish well-defined digital strategies aligned with their institutional goals to enhance operational efficiency.
- ii. Management should prioritize the procurement and deployment of relevant technologies that support learning, research, and administration.
- iii. Institutions should invest in training staff to use data analytics tools effectively for informed decision-making.
- iv. Universities should foster a flexible organizational culture that promotes quick adaptation to technological and environmental changes.
- v. Management should complement digital strategy execution with agile leadership and adaptive structures for greater efficiency impact.
- vi. Institutions should ensure that technology adoption is accompanied by agile implementation frameworks to realize full benefits.

- vii. Decision-makers should integrate agile processes into their data systems to enable faster and more effective responses to information.

## References

- Adebayo, T., Adeyemi, S., & Oladipo, T. (2024). Technology adoption and competitive advantage in Nigerian private universities: The mediating effect of organizational agility. *African Journal of Information Systems*, *16*(1), 1-19. <https://doi.org/10.1145/ajis.2024.01>.
- Adegbite, T., & Yusuf, A. (2023). The need for digital transformation in the education sector in Nigeria. *ResearchGate*. <https://www.researchgate.net/publication/358829157>.
- Adeniyi, A., & Okafor, E. (2024). Overcoming digital inertia in Nigerian private universities: Strategies for agile transformation. *African Journal of Educational Management and Technology*, *10*(2), 112-129. <https://journals.unilag.edu.ng/index.php/ajemt/article/view/502>
- Adeniyi, O., & Okafor, C. (2024). Exploring digital transformation and future trends in higher education development across African nations. *Journal of Public Sector Performance*, *10*(1), 50-65. <https://www.j-psp.com/download/exploring-digital-transformation-and-future-trends-in-higher-education-development-across-african-14801.pdf>
- Ahmad, R., Zafar, A., & Malik, M. (2021). Digital strategy and organizational agility: Moderating effects on firm performance. *Journal of Business Research*, *135*, 584-594. <https://doi.org/10.1016/j.jbusres.2021.06.044>
- Al-Fadhli, S., & Al-Harthy, I. (2023). Technology adoption in higher education institutions of developing countries: Challenges and moderating roles. *International Journal of Educational Management*, *37*(2), 345–359. <https://doi.org/10.1108/IJEM-09-2022-0504>
- Ali, W., Aldholay, A., & Alturki, U. (2022). Data analytics capability and strategic alignment in higher education: The role of top management and IT infrastructure. *Education and Information Technologies*, *27*, 15345-15366. <https://doi.org/10.1007/s10639-021-10814-z>
- Al-Okaily, M., Alqudah, H., Alqudah, M., & Taamneh, A. (2020). Acceptance of using an information system as a learning tool: Evidence from Jordanian universities. *Education and Information Technologies*, *25*, 4311-4330. <https://doi.org/10.1007/s10639-020-10182-3>
- Al-Omoush, K. S., Simón-Moya, V., & Sendra-García, J. (2021). The impact of social capital and collaborative knowledge creation on e-business proactiveness and organizational agility. *Journal of Innovation & Knowledge*, *6*(1), 25-34. <https://doi.org/10.1016/j.jik.2020.01.002>
- Al-Tamimi, R., & Rahman, M. (2023). Strategic agility and data analytics capabilities in higher education: Implications for competitive advantage. *Journal of Business Research*, *156*, 113456. <https://doi.org/10.1016/j.jbusres.2023.113456>
- Bakir, M., & Basit, A. (2024). Challenges to agility in digitally transforming universities: A developing country perspective. *Higher Education Quarterly*. Advance online publication. <https://doi.org/10.1111/hequ.12456>
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99-120. <https://doi.org/10.1177/014920639101700108>

- Barreto, I. (2020). Dynamic capabilities: A review of past research and an agenda for the future. *Journal of Management*, 46(6), 1314-1348. <https://doi.org/10.1177/0149206320905563>
- Bell, D., & Watson, K. (2025). Feedback loops in digital innovation: Organizational agility's enhancing effects on competitive advantage. *Information & Management*, 62(3), 104098. <https://doi.org/10.1016/j.im.2025.104098>
- Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2021). Digital business strategy: Toward a next generation of insights. *MIS Quarterly*, 45(1), 123-134. <https://doi.org/10.25300/MISQ/2021/15201>
- Boulton, H., Allen, R., & Bowman, C. (2020). Technology adoption in universities: Barriers and enablers. *International Journal of Innovation Management*, 24(2), 2050012. <https://doi.org/10.1142/S136391962050012X>
- Cegarra-Navarro, J. G., Soto-Acosta, P., & Wensley, A. (2020). Structured knowledge processes and firm performance: The role of organizational agility. *Journal of Business Research*, 112, 489-497. <https://doi.org/10.1016/j.jbusres.2018.07.021>
- Chen, L., Zhang, W., & Huang, Y. (2021). Predictive analytics in universities: Enhancing competitive advantage through data-driven strategies. *Education and Information Technologies*, 26, 3195-3211. <https://doi.org/10.1007/s10639-021-10564-2>
- Dwivedi, Y. K., Hughes, D. L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., & Williams, M. D. (2021). Artificial intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 57, 101994. <https://doi.org/10.1016/j.ijinfomgt.2019.08.002>
- George, B., & Wooden, O. (2023). Managing the strategic transformation of higher education through artificial intelligence. *Administrative Sciences*, 13(9), 196. <https://doi.org/10.3390/admsci13090196>
- George, R., & Wooden, M. (2023). Digital competitiveness in higher education: Strategy, implementation, and outcomes. *Journal of Higher Education Policy and Management*, 45(3), 289-305. <https://doi.org/10.1080/1360080X.2023.2184121>
- Harper, M., & Sullivan, K. (2025). Real-time data analytics and organizational agility: Pathways to competitive advantage in higher education. *Information & Management*, 62(2), 104085. <https://doi.org/10.1016/j.im.2024.104085>
- Hassan, R., Ali, S., & Malik, S. (2022). Technology adoption and institutional performance: The role of organizational agility in higher education. *Journal of Educational Computing Research*, 60(4), 905-923. <https://doi.org/10.1177/07356331211003412>
- Hazelkorn, E., & Moylan, S. (2022). University rankings and the governance of higher education: Data-driven decision-making or regulatory capture? *Higher Education Quarterly*, 76(1), 7-24. <https://doi.org/10.1111/hequ.12321>
- Huda, M., Jasmi, K. A., Embong, W. H. W., & Safar, J. (2021). Empowering digital learning in higher education: A review of digital readiness in the context of COVID-19. *Education and Information Technologies*, 26, 7521-7538. <https://doi.org/10.1007/s10639-021-10586-4>

- Ibrahim, A. M., & Danjuma, I. (2024). Post-pandemic digital transition and private universities in Nigeria: Lessons and prospects. *Journal of Educational Policy and Management*, 9(1), 41-56.
- Ibrahim, F., & Ojo, T. (2024). Challenges of implementing data-driven decision-making in Nigerian universities: A case for agile transformation. *African Journal of Information Systems*, 16(2), 45-60. <https://doi.org/10.1145/ajis.2024.03>
- Ifinedo, P. (2021). Examining students' intention to continue using online learning tools post-COVID-19: A data-driven study. *Education and Information Technologies*, 26, 6713-6732. <https://doi.org/10.1007/s10639-021-10541-3>
- Jonathan, M., & Kuika Watat, J. (2020). Digital transformation and its effect on firm performance: Evidence from manufacturing firms. *Journal of Business Research*, 122, 107–117. <https://doi.org/10.1016/j.jbusres.2020.07.049>
- Kampylis, P., Punie, Y., & Devine, J. (2023). Leveraging learning analytics to support strategic educational planning in Europe: Trends and prospects. *Computers & Education: Artificial Intelligence*, 4, 100099. <https://doi.org/10.1016/j.caeai.2023.100099>
- Kim, S., & Lee, J. (2023). The moderating role of organizational agility in digital transformation and firm performance: Evidence from the education sector. *Technological Forecasting and Social Change*, 189, 122351. <https://doi.org/10.1016/j.techfore.2023.122351>
- Kofler, I., & Weik, E. (2022). Operational efficiency in higher education institutions: A comparative study. *International Journal of Educational Management*, 36(4), 567–582.
- Kurniawan, R., Wibowo, A., & Prasetyo, D. (2023). Technology adoption and competitive advantage: The moderating role of organizational agility in higher education institutions. *Technological Forecasting and Social Change*, 185, 122043. <https://doi.org/10.1016/j.techfore.2023.122043>
- Lee, J., & Park, S. (2022). Organizational agility and data analytics integration in higher education institutions. *International Journal of Educational Management*, 36(3), 521–537. <https://doi.org/10.1108/IJEM-09-2021-0468>
- Mahmoud, A., & Al-Ahmad, W. (2022). The role of AI adoption in enhancing competitive advantage: Organizational agility as a moderator. *Journal of Business Research*, 144, 156–166. <https://doi.org/10.1016/j.jbusres.2022.02.019>
- Maier, S., & von der Linden, J. (2021). Digital transformation in higher education: A systematic literature review. *Education and Information Technologies*, 26(5), 1-20.
- Mhlanga, D., & Moloi, T. (2022). COVID-19 and the digital transformation of education: What are the barriers in Zimbabwe? *Education and Information Technologies*, 27, 147163. <https://doi.org/10.1007/s10639-021-10729-7>
- Mikalef, P., Krogstie, J., Pappas, I. O., & Pavlou, P. A. (2020). Investigating the effects of big data analytics capabilities on firm performance: The mediating role of dynamic capabilities. *Information & Management*, 57(2), 103169. <https://doi.org/10.1016/j.im.2019.103169>
- Muafiq, F. (2023). The impact of digital transformation on organizational agility. *Journal of Business and Management*, 12(3), 45-60. <https://journal.ppipbr.com/index.php/pusba/article/download/442/409/1979>

- Musa, A., Bello, K., & Abdullahi, M. (2020). Barriers to effective data-driven decision-making in Nigerian universities. *International Journal of Educational Development*, 75, 102168. <https://doi.org/10.1016/j.ijedudev.2020.102168>
- Muthuprasad, T., Aiswarya, S., Aditya, K. S., & Jha, G. K. (2021). Students' perception and preference for online education in India during COVID-19. *Social Sciences & Humanities Open*, 3(1), 100101. <https://doi.org/10.1016/j.ssaho.2020.100101>
- Nartiningrum, N., & Nugroho, A. (2020). Online learning amidst global pandemic: EFL students' challenges, suggestions, and needed materials. *Indonesian EFL Journal*, 6(2), 147-155. <https://doi.org/10.25134/iefly.v6i2.3387>
- Nisar, T. M., Prabhakar, G., & Goh, S. K. (2023). Organizational agility and innovation capabilities in higher education institutions. *International Journal of Productivity and Performance Management*, 72(3), 769-789. <https://doi.org/10.1108/IJPPM-07-2021-0415>
- Nwankwo, S., & Eze, C. (2023). Organizational agility as a moderator in the effectiveness of data-driven decision-making in Nigerian higher education. *African Journal of Information Systems*, 17(1), 32–50. <https://doi.org/10.1145/ajis.2023.02>
- Ogunleye, O., Adeyemi, S., & Bello, T. (2024). Data-driven decision-making and competitive advantage: Evidence from Nigerian private universities. *African Journal of Information Systems*, 16(3), 1-21. <https://doi.org/10.1145/ajis.2024.08>
- Olayemi, A. K., & Ibrahim, M. A. (2024). Barriers to the implementation of data-driven management in Nigerian private universities. *Journal of Educational Technology Systems*, 53(2), 173–191.
- Oliveira, T., & Martins, M. F. (2021). Technology adoption and its effects on organizational performance: Evidence from the education sector. *Education and Information Technologies*, 26, 543–560. <https://doi.org/10.1007/s10639-020-10196-5>
- Oliveira, T., Thomas, M., & Espadanal, M. (2021). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. *Information & Management*, 58(1), 103402. <https://doi.org/10.1016/j.im.2020.103402>
- Osazevbaru, H. O., & Oghoghomeh, T. (2025). Digital transformation and competitive advantage in Nigerian private universities. *African Journal of Educational Management*, 23(1), 55-70.
- Owusu, P., & Mensah, F. (2024). Technology adoption, organizational agility, and competitive advantage in private universities. *International Journal of Educational Management*, 38(1), 78–95. <https://doi.org/10.1108/IJEM-07-2023-0285>
- Ozturk, A., & Kocak, O. (2021). The impact of digital transformation on operational efficiency in universities. *Journal of Higher Education Policy and Management*, 43(3), 245-260.
- Patel, R., Kumar, S., & Singh, A. (2020). Organizational readiness and agility: Preconditions for successful digital transformation. *Journal of Strategic Information Systems*, 29(2), 101626. <https://doi.org/10.1016/j.jsis.2020.101626>
- Prasad, S., Junni, P., & Varkkey, B. (2022). Agile responses to crises: Organizational resilience and digital transformation in emerging economies. *Technological Forecasting and Social Change*, 178, 121601. <https://doi.org/10.1016/j.techfore.2022.121601>

- Putra, Z. A., Asbari, M., & Purwanto, A. (2022). Determinants of EdTech adoption in Indonesian higher education. *International Journal of Education and Practice*, 10(2), 243–256. <https://doi.org/10.18488/61.v10i2.2969>
- Robertson, J., & Lapina, I. (2025). Digital transformation in higher education: Drivers, success factors, benefits, and challenges. *Journal of Educational Technology & Society*, 28(1), 112–125.
- Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. *MIS Quarterly*, 27(2), 237-263. <https://doi.org/10.2307/30036530>
- Sholokwu, B. M. (2024). Digital transformation leadership and organizational agility. *Journal of Political Science and Leadership Research*, 10(6), 179–198. <https://iiardjournals.org/get/JPSLR/VOL.%2010%20NO.%206%202024/Digital%20Transformation%20Leadership%20179-198.pdf>
- Singh, R., & Gupta, P. (2023). The impact of data-driven decision-making on higher education competitiveness: The role of organizational agility. *Journal of Higher Education Policy and Management*, 45(1), 77-95. <https://doi.org/10.1080/1360080X.2022.2134758>
- Teece, D. J., Peteraf, M., & Leih, S. (2021). Dynamic capabilities and organizational agility: Risk, uncertainty, and strategy in the innovation economy. *California Management Review*, 63(2), 5-29. <https://doi.org/10.1177/0008125621990536>
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509-533. [https://doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7<509::AID-SMJ882>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z)
- Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889-901. <https://doi.org/10.1016/j.jbusres.2019.09.022>
- Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, 28(2), 118-144. <https://doi.org/10.1016/j.jsis.2019.01.003>
- Wang, Y., Kung, L., & Byrd, T. A. (2023). Big data analytics capabilities and firm performance: Effects of dynamic capabilities. *Information & Management*, 60(1), 103497. <https://doi.org/10.1016/j.im.2022.103497>
- Wang, Y., Li, H., & Zhang, X. (2022). Digital transformation and firm performance: The moderating role of organizational agility. *Information & Management*, 59(7), 103620. <https://doi.org/10.1016/j.im.2022.103620>
- Yamane, T. (1967). *Statistics: An Introductory Analysis* (2nd ed.). Harper and Row.
- Yusof, N. M., Rahman, A. A., & Ismail, R. (2021). Digital transformation in higher education: A review of literature. *Education and Information Technologies*, 26(3), 1-17.
- Zhang, L., & Chen, H. (2022). Digital transformation and organizational performance: The crucial role of agility. *Journal of Organizational Change Management*, 35(4), 813-830. <https://doi.org/10.1108/JOCM-11-2021-0412>

- Zhang, Y., Lu, Q., & Wang, S. (2024). Digital technology adoption and operational efficiency: The moderating effect of organizational agility. *Information & Management*, 61(1), 103602. <https://doi.org/10.1016/j.im.2023.103602>
- Zhao, Y., Li, X., & Wang, H. (2023). Efficiency evaluation of higher education systems in China: A double frontier parallel data envelopment analysis model. *Socio-Economic Planning Sciences*, 84, 101-115.
- Zitouni, K., & El Manouar, A. (2022). Organizational agility in higher education: An exploratory study of Moroccan universities. *Journal of Enterprise Information Management*, 35(2), 470-487. <https://doi.org/10.1108/JEIM-04-2021-0160>