DIGITAL TRANSFORMATION AS A CATALYST FOR SUSTAINABLE PERFORMANCE: INTRODUCING DIGITAL COMPETITIVE ADVANTAGE IN SOUTH AFRICAN HOSPITALITY INDUSTRY

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ABSTRACT

Drawing on the Dynamic Capabilities Theory, this study examines the direct and indirect effects of DT on firm performance conceptualised through economic, social, environmental, and digital competitive advantage (DCA) dimensions, while investigating the mediating role of green innovation (GI). A quantitative research design was employed using cross-sectional data collected from 314 hospitality firms. Structural equation modelling (SEM) was applied to test the proposed relationships. The findings reveal that DT positively and significantly influences all dimensions of firm performance, demonstrating its strategic role in enhancing both economic and sustainability-oriented outcomes. The results further indicate that DT significantly strengthens GI, suggesting that digital capabilities serve as important enablers of environmentally sustainable innovation practices within hospitality firms. In turn, GI positively affects economic, social, and environmental performance, confirming its importance in supporting sustainable organisational development. However, GI was found to exert a negative effect on DCA, implying that investments in sustainability-oriented innovation may not generate immediate digitally driven competitive benefits due to associated implementation costs and capability adjustment challenges. Mediation analysis further demonstrates that GI significantly mediates the relationships between DT and economic, environmental, and DCA outcomes, while a negative mediating effect was observed for social performance. This study makes several important contributions to theory and practice. First, it advances DT literature by adopting a multidimensional perspective of firm performance that extends beyond traditional financial indicators. Second, the study introduces and empirically validates DCA as a novel strategic outcome within the DT framework. Third, the findings provide deeper insight into the role of GI as a critical mechanism linking digitalisation and sustainable performance outcomes. Practically, the study highlights the importance of aligning digitalisation and sustainability strategies to improve long-term competitiveness, innovation, and resilience within the hospitality sector. The study further offers policy-relevant insights for promoting sustainable digital transformation within emerging economies.

Keywords: Digital transformation, Green innovation, Sustainable performance, Digital competitive advantage, Gauteng Province

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1. INTRODUCTION

The hospitality industry remains one of the most important sectors within the global tourism economy due to its contribution to employment creation, economic growth, infrastructure development, and sustainable destination competitiveness (United Nations World Tourism Organisation [UNWTO], 2023). Beyond its economic significance, the sector plays a critical role in achieving sustainable development objectives through responsible resource utilisation, community empowerment, and environmental stewardship (Buhalis et al., 2019). However, the industry increasingly faces significant sustainability-related challenges, including rising operational costs, environmental degradation, resource inefficiencies, changing consumer expectations, and rapid technological disruptions (Mensah, 2020; Elshaer et al., 2022). These pressures have intensified the need for hospitality firms to adopt innovative and sustainable strategic approaches capable of improving organisational resilience and long-term competitiveness. In response to these challenges, digital transformation (DT) has emerged as a strategic imperative across the global hospitality industry. DT refers to the integration of digital technologies into organisational operations, processes, and business models to enhance value creation and organisational performance (Vial, 2019; Verhoef et al., 2021). Within hospitality contexts, DT involves the adoption of technologies such as artificial intelligence, big data analytics, cloud computing, smart tourism systems, and digital platforms to improve operational efficiency, customer experiences, and sustainability practices (Sigala, 2020; Pratono, 2022). More importantly, DT has increasingly been recognised as a driver of sustainable development because digital technologies enable firms to optimise resource utilisation, reduce environmental waste, improve energy efficiency, and strengthen innovation capabilities (George et al., 2021). Consequently, organisations are increasingly expected to align digitalisation initiatives with sustainability goals to ensure long-term competitiveness and organisational survival.

Despite the growing relevance of DT, existing literature presents mixed findings regarding its impact on firm performance. Most previous studies have primarily focused on financial and operational outcomes such as profitability, productivity, and efficiency, while paying limited attention to broader sustainability-oriented performance dimensions (Mukherjee et al., 2023; Ou & Zhang, 2023). However, contemporary organisations are increasingly evaluated not only by their economic outcomes but also by their environmental and social contributions (Li et al., 2020). This suggests that understanding the relationship between DT and sustainable firm

performance requires a multidimensional perspective that incorporates economic, environmental, and social performance simultaneously. Furthermore, prior studies have produced inconsistent findings concerning the DT–performance relationship, with some reporting positive effects and others reporting weak or insignificant relationships (Feroz et al., 2021; Tseng et al., 2023). These inconsistencies indicate the need for further empirical investigation, particularly regarding the mechanisms through which DT contributes to sustainable organisational outcomes. Another important limitation within existing scholarship is the limited attention given to digital competitive advantage (DCA) as a strategic outcome of DT. DCA refers to a firm's ability to leverage digital technologies and capabilities to strengthen innovation, responsiveness, customer value, and long-term market competitiveness (Bharadwaj et al., 2013; Rialti et al., 2019). In contemporary business environments, competitive advantage increasingly depends on firms' ability to integrate digitalisation with sustainability-oriented strategies. However, despite its strategic importance, DCA remains insufficiently explored within hospitality and sustainability literature. Existing studies have rarely examined how DT simultaneously influences economic performance, environmental performance, social performance, and DCA within a single framework, particularly within emerging economies.

These concerns are particularly relevant within the South African hospitality industry. Tourism and hospitality contribute significantly to South Africa's GDP, employment, and socio-economic development (World Travel and Tourism Council [WTTC], 2022). Nevertheless, the sector continues to face several challenges, including inadequate infrastructure, energy instability, financial constraints, environmental pressures, and low levels of technological readiness (Olowoyo et al., 2021; Mhlanga, 2023). Although DT has been recognised globally as a mechanism for improving sustainability and competitiveness, digital penetration within South Africa's hospitality sector remains relatively low, limiting firms' ability to achieve sustainable growth and innovation (McKinsey, 2020; Gaffley & Pelser, 2021). Furthermore, empirical studies examining DT within the South African hospitality context remain limited and fragmented, particularly regarding sustainability-oriented performance outcomes. To provide deeper insight into the DT–performance relationship, this study introduces green innovation (GI) as a mediating mechanism. GI refers to environmentally oriented innovations aimed at reducing ecological harm while improving organisational efficiency and competitiveness (Chen et al., 2006; Takalo & Tooranloo, 2021). Within hospitality firms, GI may include sustainable technologies, waste reduction systems, energy-efficient processes, and environmentally responsible operational practices. Existing literature suggests that DT can facilitate GI by enabling firms to optimise resources, improve environmental monitoring, and support sustainable decision-making processes (Bag et al., 2022). However, limited empirical evidence exists regarding the mediating role of GI between DT and multidimensional firm performance, particularly in emerging-economy hospitality contexts.

The study is grounded in the Dynamic Capabilities Theory (DCT) proposed by Teece et al. (1997), which explains how firms integrate, reconfigure, and deploy organisational resources to

respond to rapidly changing business environments. DCT is particularly relevant because DT represents a dynamic organisational capability that enables firms to adapt to technological disruptions and sustainability pressures through innovation and strategic transformation. Similarly, GI reflects a firm's capability to convert digital resources into environmentally sustainable practices and competitive outcomes. Therefore, DCT provides an appropriate theoretical lens for understanding how hospitality firms leverage DT and GI to improve sustainable firm performance and DCA. Against this background, the present study investigates the direct effects of DT on economic performance, environmental performance, social performance, and DCA within the South African hospitality sector. In addition, the study examines the mediating role of GI in these relationships. By integrating sustainability, digitalisation, and innovation perspectives within a single framework, the study contributes to the growing discourse on sustainable digital transformation in hospitality research. The study also extends existing literature by broadening the conceptualisation of firm performance beyond traditional financial outcomes and by introducing DCA as a strategic sustainability-oriented outcome of DT. Practically, the findings may assist hospitality managers and policymakers in developing integrated digital and sustainability strategies capable of enhancing long-term competitiveness, resilience, and sustainable development within the South African hospitality industry.

2. LITERATURE REVIEW

2.1 Theoretical literature review

This study is grounded in the DCT developed by Teece et al. (1997). DCT emerged as an extension of the Resource-Based View (RBV) and argues that firms achieve sustainable competitive advantage not merely through the possession of valuable resources, but through their ability to integrate, reconfigure, and deploy organisational capabilities in response to dynamic environmental conditions (Teece et al., 1997; Gaffley & Pelser, 2021). The theory is particularly relevant within contemporary business environments characterised by rapid technological change, sustainability pressures, and increasing market uncertainty. DCT emphasises that organisations must continuously sense opportunities and threats, seize strategic opportunities, and transform internal processes to remain competitive and sustainable (Teece, 2007). Within the hospitality industry, where technological disruptions and changing customer expectations continue to intensify, firms increasingly rely on adaptive capabilities such as digital transformation (DT) and innovation to improve operational resilience, sustainability performance, and long-term competitiveness. The application of DCT in this study provides a strong theoretical explanation for the relationships among DT, green innovation (GI), sustainable firm performance, and digital competitive advantage (DCA). DT can be conceptualised as a dynamic organisational capability that enables hospitality firms to integrate digital technologies into organisational operations, improve resource utilisation, enhance customer experiences, and strengthen sustainability practices (Vial, 2019; Warner & Wäger, 2019). Similarly, GI reflects a

firm's capability to transform technological resources into environmentally sustainable products, services, and operational processes (Chen et al., 2006). According to DCT, firms capable of effectively leveraging digital and innovation capabilities are more likely to achieve superior economic, environmental, and social performance while simultaneously strengthening DCA. Therefore, DCT provides an appropriate theoretical lens for explaining how hospitality firms in South Africa utilise DT and GI to adapt to environmental challenges, improve sustainability outcomes, and sustain competitiveness in an increasingly digital and sustainability-oriented business environment.

2.2 Empirical literature review

2.2.1 Digital Transformation and Firm Performance

- *Digital transformation and economic performance*

DT has been widely recognised as a key driver of economic performance through its ability to improve operational efficiency, productivity and profitability (Li, 2022; Mukherjee et al., 2023). Empirical studies suggest that digital technologies such as artificial intelligence, cloud computing and big data analytics enable firms to streamline processes, reduce operational costs and enhanced decision-making, leading to improved financial outcomes (Feroz et al., 2021). In the hospitality and tourism sector, DT facilitates personalised services, efficient booking systems and enhanced customer relationship management, which contribute to revenue growth and business performance (Teng et al., 2022). However, some studies report that the financial benefits of DT may not be immediately realised due to high implementation costs, technological complexity and organisational restructuring requirements (Ou & Zhang, 2023; Tseng et al., 2023). These challenges may temporarily weaken firm performance during the early stages of digital adoption. Nevertheless, most of the empirical evidence indicates that firms that successfully implement digital technologies tend to achieve superior economic performance compared to their less digitally mature counterparts (Li, 2022; Mukherjee et al., 2023). Accordingly, it is expected that DT positively influences economic performance.

H1a: Digital transformation has a significant positive effect on economic performance.

- *Digital transformation and social performance*

Digital transformation (DT) has emerged as an important mechanism for enhancing social performance by improving stakeholder engagement, customer satisfaction, and employee collaboration (Feroz et al., 2021; Tseng et al., 2023). Through digital platforms and communication technologies, firms can better understand customer needs, deliver personalised services, and strengthen relationships with key stakeholders (Teng et al., 2022). Furthermore, digital tools facilitate employee engagement through knowledge sharing, flexible work arrangements, and enhanced organisational communication, contributing to improved workplace outcomes (Li, 2022). Despite these benefits, some studies suggest that DT may create social challenges such as employee resistance, job insecurity, and concerns regarding data privacy and security (Ou & Zhang, 2023). Additionally, inadequate digital skills among employees may

hinder the effective utilisation of digital technologies and limit their social benefits (Tseng et al., 2023). Nevertheless, empirical evidence largely demonstrates that organisations that effectively manage DT initiatives are more likely to achieve higher levels of stakeholder satisfaction and social performance (Mukherjee et al., 2023). Therefore, DT is expected to positively influence social performance.

H1b: Digital transformation has a significant positive effect on social performance.

- *Digital transformation and environmental performance*

Empirical studies increasingly highlight digital transformation (DT) as a critical enabler of environmental performance through its ability to improve resource efficiency and support sustainable business practices (Tseng et al., 2023; Teng et al., 2022). Digital technologies such as IoT, artificial intelligence, and cloud-based systems enable firms to monitor resource consumption, reduce waste, and optimise energy usage, thereby minimising environmental impacts (Feroz et al., 2021). In the hospitality and tourism industry, DT supports environmentally responsible operations through smart energy management, paperless processes, and sustainable supply chain practices (Mukherjee et al., 2023). However, some scholars argue that digital technologies may also contribute to increased energy consumption, electronic waste, and environmental pressures associated with digital infrastructure (Ou & Zhang, 2023). Consequently, the environmental benefits of DT may vary depending on the technologies adopted and the effectiveness of their implementation (Tseng et al., 2023). Despite these concerns, the prevailing evidence suggests that DT generally contributes to improved environmental performance when aligned with sustainability objectives (Li, 2022). Thus, DT is expected to have a positive effect on environmental performance.

H1c: Digital transformation has a significant positive effect on environmental performance.

- *Digital transformation and digital competitive advantage*

Digital transformation (DT) is widely regarded as a strategic capability that enhances digital competitive advantage by enabling firms to innovate, differentiate their offerings, and respond rapidly to market changes (Feroz et al., 2021; Mukherjee et al., 2023). Empirical studies show that digitally transformed firms are better positioned to leverage data analytics, automation, and customer insights to create superior value propositions and strengthen their competitive position (Li, 2022). In service industries such as hospitality and tourism, DT facilitates personalised customer experiences, real-time service delivery, and enhanced organisational agility, all of which contribute to competitive differentiation (Teng et al., 2022). Nevertheless, some researchers argue that the competitive benefits of DT may be constrained by limited organisational capabilities, inadequate digital infrastructure, and the ease with which competitors can imitate certain technologies (Ou & Zhang, 2023; Tseng et al., 2023). These factors may reduce the sustainability of competitive advantages derived from digital investments. However, the majority of empirical evidence indicates that firms with strong digital capabilities are more likely to achieve and sustain digital competitive advantages through innovation and strategic

flexibility (Mukherjee et al., 2023). Therefore, DT is expected to positively influence digital competitive advantage.

H1d: Digital transformation has a significant positive effect on digital competitive advantage.

2.2.2 Digital Transformation and Green Innovation

DT has been identified as a key enabler of innovation, particularly in facilitating environmentally sustainable practices (Khan et al., 2019). Digital technologies such as big data analytics, Internet of Things (IoT), and artificial intelligence support the development of green products and processes by enhancing monitoring, efficiency, and resource optimisation (Takalo & Tooranloo, 2021). Empirical evidence suggests that firms adopting DT are more likely to engage in GI initiatives, as digital tools provide the necessary infrastructure for sustainable innovation (Mhlanga et al., 2022). In the hospitality sector, DT can support energy efficiency, waste reduction, and environmentally responsible service delivery, thereby strengthening the firm's sustainability orientation. Consequently, DT is expected to positively influence GI.

H2: Digital transformation has a significant positive effect on green innovation.

2.2.3 Green Innovation and Firm Performance

- *Green innovation and economic performance*

Green innovation (GI) has been widely associated with improved economic performance through enhanced resource efficiency, cost reduction, and the development of environmentally friendly products and services (Takalo & Tooranloo, 2021). Empirical studies indicate that firms adopting GI can reduce waste, optimise resource utilization, and strengthen their market reputation, thereby improving profitability and long-term financial performance (Feroz et al., 2021; Xie et al., 2019). Furthermore, environmentally conscious consumers increasingly favour firms that demonstrate sustainable practices, creating additional market opportunities (Chen et al., 2020). However, some scholars argue that green innovation often requires substantial investments in technology and organisational change, which may reduce short-term financial returns (Takalo & Tooranloo, 2021). Despite these challenges, the majority of empirical evidence supports a positive relationship between GI and economic performance. Therefore, the following hypothesis is proposed:

H3a: Green innovation has a significant positive effect on economic performance.

- *Green innovation and social performance*

Green innovation (GI) contributes to social performance by enhancing stakeholder trust, corporate reputation, and organisational commitment to sustainability (Chen et al., 2020). Empirical studies suggest that firms implementing GI are more likely to address stakeholder concerns regarding environmental responsibility, resulting in improved customer satisfaction and stronger community relationships (Feroz et al., 2021). Additionally, GI encourages employee

involvement in sustainability initiatives, fostering a positive organisational culture and stakeholder engagement (Xie et al., 2019). Nevertheless, the effectiveness of GI in generating social benefits may depend on stakeholder awareness and organisational commitment to sustainability practices (Takalo & Tooranloo, 2021). Despite these limitations, existing evidence largely supports the positive contribution of GI to social performance. Therefore, the following hypothesis is proposed:

H3b: Green innovation has a significant positive effect on social performance.

- *Green innovation and environmental performance*

Environmental performance is one of the most frequently reported outcomes of green innovation because GI promotes the adoption of sustainable products, processes, and technologies (Takalo & Tooranloo, 2021). Empirical evidence shows that GI improves environmental performance by reducing emissions, minimising waste, and enhancing energy and resource efficiency (Feroz et al., 2021; Xie et al., 2019). Furthermore, green innovations assist firms in complying with environmental regulations and meeting growing stakeholder demands for sustainability (Chen et al., 2020). However, the environmental benefits of GI may vary depending on the extent of implementation and organisational capabilities (Takalo & Tooranloo, 2021). Nonetheless, the prevailing literature consistently demonstrates that GI contributes positively to environmental sustainability and performance. Therefore, the following hypothesis is proposed:

H3c: Green innovation has a significant positive effect on environmental performance.

- *Green innovation and digital competitive advantage*

Green innovation (GI) can strengthen digital competitive advantage by enabling firms to differentiate themselves through sustainable and innovative offerings (Takalo & Tooranloo, 2021). Studies indicate that organisations integrating green innovation into their strategies develop unique capabilities that enhance competitiveness and long-term resilience (Xie et al., 2019). When combined with digital technologies, GI facilitates the development of smart and sustainable solutions that improve operational efficiency and customer value creation (Feroz et al., 2021). However, some scholars argue that achieving competitive benefits from GI requires significant investments and may be constrained by competitors' ability to imitate green practices (Chen et al., 2020). Despite these concerns, empirical evidence generally supports the view that GI enhances competitive differentiation and strategic advantage. Therefore, the following hypothesis is proposed:

H3d: Green innovation has a significant positive effect on digital competitive advantage.

2.2.4 Mediating Role of Green Innovation

- *The mediating role of green innovation in the relationship between digital transformation and economic performance.*

While DT has been shown to enhance economic performance, scholars argue that this relationship may operate through intermediate mechanisms such as innovation (Li et al., 2019).

GI provides a valuable pathway through which digital technologies can generate financial benefits by improving resource efficiency, reducing operational costs, and creating sustainable products and services (Khan et al., 2019). Empirical studies suggest that firms with strong digital capabilities are better positioned to develop green innovations that subsequently improve profitability and business growth (Mhlanga et al., 2022). However, some studies indicate that the economic benefits of DT may not materialize when organisations fail to translate digital investments into innovative sustainability initiatives. Therefore, GI is expected to strengthen the economic value derived from DT. Accordingly, the following hypothesis is proposed:

H4a: Green innovation mediates the relationship between digital transformation and economic performance.

- *The mediating role of green innovation in the relationship between digital transformation and social performance.*

Digital transformation enhances stakeholder engagement and organisational responsiveness, yet its impact on social performance may be strengthened through green innovation initiatives (Li et al., 2019). GI enables firms to address stakeholder concerns regarding environmental responsibility, improve corporate reputation, and foster stronger relationships with customers, employees, and communities (Khan et al., 2019). Empirical evidence suggests that digital technologies facilitate the development and implementation of green innovations, which subsequently enhance social outcomes and stakeholder satisfaction (Mhlanga et al., 2022). Nevertheless, organisations that fail to integrate sustainability objectives into their digital strategies may experience weaker social benefits. Consequently, GI is expected to act as an important mechanism linking DT to improved social performance. Therefore, the following hypothesis is proposed:

H4b: Green innovation mediates the relationship between digital transformation and social performance.

- *The mediating role of green innovation in the relationship between digital transformation and environmental performance.*

The relationship between digital transformation and environmental performance is increasingly explained through the adoption of green innovation practices (Li et al., 2019). Digital technologies provide firms with the capabilities to monitor resource consumption, improve operational efficiency, and develop environmentally sustainable solutions that reduce ecological impacts (Khan et al., 2019). Empirical studies show that organizations leveraging DT are more likely to implement green innovations that contribute to reduced emissions, waste minimisation, and efficient resource utilisation (Mhlanga et al., 2022). However, digital technologies alone may not guarantee environmental improvements unless they are effectively translated into sustainability-oriented innovations. Therefore, GI is expected to serve as a key mechanism through which DT enhances environmental performance. Accordingly, the following hypothesis is proposed:

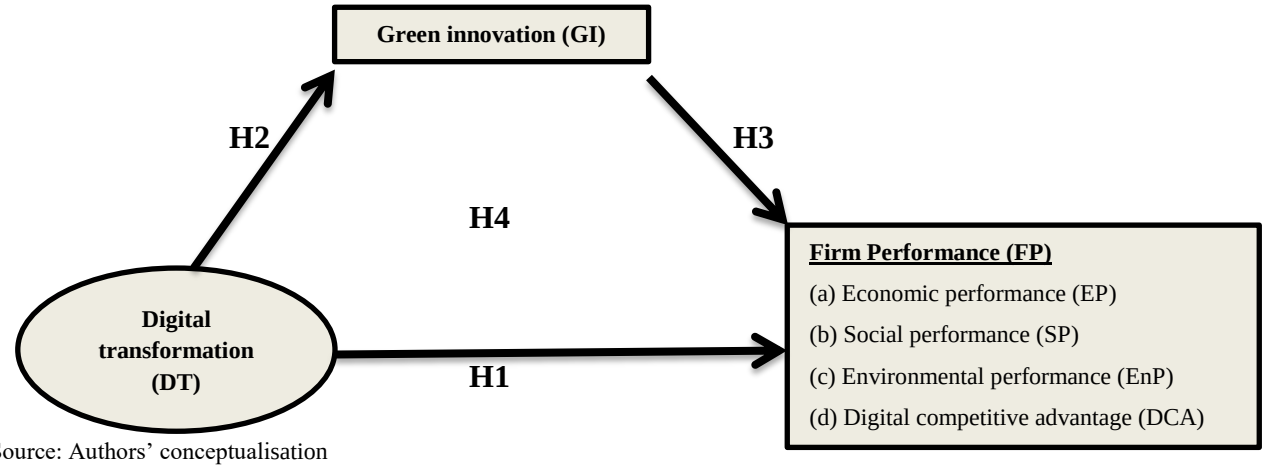
H4c: Green innovation mediates the relationship between digital transformation and environmental performance.

- *The mediating role of green innovation in the relationship between digital transformation and digital competitive advantage.*

Digital transformation enables firms to develop advanced technological capabilities that can enhance competitive positioning; however, the realisation of these benefits may depend on the firm's ability to generate green innovations (Li et al., 2019). Green innovation facilitates competitive differentiation by enabling firms to offer sustainable products, services, and business processes that are difficult for competitors to replicate (Khan et al., 2019). Empirical evidence suggests that digital capabilities support the development of green innovations, which subsequently strengthen digital competitive advantage through enhanced innovation, sustainability, and customer value creation (Mhlanga et al., 2022). Nonetheless, firms that invest in digital technologies without pursuing innovative sustainability initiatives may struggle to achieve lasting competitive benefits. Therefore, GI is expected to mediate the relationship between DT and digital competitive advantage. Accordingly, the following hypothesis is proposed:

H4d: Green innovation mediates the relationship between digital transformation and digital competitive advantage.

Figure 1: conceptual model



Source: Authors' conceptualisation

3. METHODOLOGY

3.1 Sample selection and data basis

This study was anchored in the positivist research paradigm, which emphasises objective measurement and empirical validation of relationships among variables. Consistent with this philosophical stance, a deductive research approach was adopted to test theoretically derived hypotheses (Saunders et al., 2019). A quantitative methodology was employed, integrating both

descriptive and causal research designs to enable the examination of relationships between constructs and the testing of proposed hypotheses (Hair et al., 2019). Data were collected through a cross-sectional survey design using a structured, self-administered questionnaire, which is widely regarded as appropriate for capturing standardised responses across a large sample (Bryman, 2016). The study focused on small and large hospitality firms situated within the Johannesburg Metropolitan Municipality and the City of Tshwane Metropolitan Municipality in Gauteng Province, South Africa. The unit of analysis comprised firm owners and managers, given their strategic role and knowledge of organisational operations and performance. Due to the absence of a comprehensive sampling frame for hospitality establishments in the selected regions, a non-probability convenience sampling technique was utilised, which is commonly applied in exploratory and business research contexts where population lists are unavailable (Etikan et al., 2016). The sample size was determined using the "10-times rule" associated with structural equation modelling, which recommends that the minimum sample should be at least ten times the maximum number of formative indicators or structural paths directed at a particular construct (Hair et al., 2019). To identify potential respondents, a database of hospitality establishments including hotels, lodges, and guesthouses was compiled from the official websites of TGASA, FHASA, NAASA, and GHSASA.

Participants were approached through a combination of personal visits, telephone communication, and email correspondence to explain the purpose of the study and solicit their participation. A total of 314 firms agreed to participate in the study, with the majority employing between 11 and 50 employees (74%), followed by firms with 51–250 employees (23%), more than 250 employees (2%), and 0–5 employees (1%). Prior to the main data collection, a pilot study involving 30 hospitality firms was conducted to assess the clarity, reliability, and validity of the measurement instrument. Feedback obtained from the pilot study informed minor revisions to the questionnaire. Furthermore, expert evaluations from scholars in leadership and small business research were incorporated to enhance content validity and ensure alignment with established measurement standards (Hair et al., 2019). The main data collection process was conducted between May and July 2024, during which respondents were given a two-week period to complete the questionnaire, with follow-up reminders issued to improve the response rate. For data analysis, the study employed IBM SPSS AMOS 27, a robust statistical tool widely used for structural equation modelling. Confirmatory factor analysis (CFA) was conducted to assess the reliability and validity of the measurement model, while structural modelling techniques were applied to examine the relationships between observed and latent variables (Byrne, 2016). This analytical approach is consistent with best practices in quantitative research, particularly in studies aiming to test complex theoretical models involving multiple constructs and mediating effects (Hair et al., 2019).

3.1.1 Measurement items

All constructs were operationalised using multi-item scales adapted from prior studies. Responses was measured on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), consistent with prior research (Hair et al., 2019).

Table 1: measurement items operationalisation

Constructs' name	Author(s)
Digital Transformation (DT)	Adapted from Li et al. (2020); Verhoef et al. (2021); Kane et al. (2015)
Green innovation (GI)	Chen et al. (2006); Takalo & Tooranloo (2021)
Economic performance (EP)	Venkatraman (1989); Li (2022)
Social performance (SP)	Turker (2009); Tseng et al. (2023)
Environmental performance (EnP)	Zhu et al. (2008); Feroz et al. (2021)
Digital competitive advantage (DCA)	Bharadwaj (2000); Rai et al. (2006)

4. EMPIRICAL ANALYSIS AND OUTCOMES

4.1 Response rate and demographic examination

A total of 470 questionnaires were distributed to potential respondents, of which 321 were returned. Following data screening procedures, seven questionnaires were removed due to significant missing data in critical sections, resulting in a final usable sample consistent with recommended data quality standards in survey-based research (Hair et al., 2019). As such, 314 cases were found eligible for further statistical analysis. Table 2 summarizes the demographic characteristics of the respondents. With respect to gender, the sample consisted of 141 male and 173 female participants, indicating a relatively balanced representation. In terms of age distribution, the majority of respondents were concentrated in the middle-age categories, with 3 participants aged 18–29 years, 72 between 30–39 years, 107 within the 40–49 age group, 104 between 50–59 years, and 28 aged 60 years and above. This distribution suggests that the respondents largely possess substantial managerial and industry experience, which enhances the reliability of the data collected (Bryman, 2016). Furthermore, most of the participating firms were privately owned and had been in operation for more than five years, reflecting a relatively mature and stable business profile. This characteristic is important, as firm age is often associated with organisational learning, strategic capability, and performance outcomes (Coad et al., 2013). Regarding firm size, the majority of organisations employed between 11 and 50 employees, indicating a strong representation of small and medium-sized enterprises (SMEs), which are widely recognised as the backbone of the hospitality sector and a key driver of economic activity (OECD, 2017).

Table 2: Participants demographic profile

Biographic details	Frequency	Percentage (%)
Gender		
Female	173	55
Male	141	45
Age of the respondents		
18-29	3	1
30-39	72	23
40-49	107	34
50-59	104	33
Above 60	28	9
Business category		
Sole proprietor	15	5
Close corporation	28	9
Partnership	101	32
Private	154	49
Public	16	5
Age of business		
Less than a year	13	4
1-5 years	141	45
6-10 years	94	30
11-15 years	60	19
More than 15 years	6	2
Number of employees		
0-10 employees	3	1
11-50 employees	233	74
51-250 employees	72	23
More than 250 employees	6	2

Source: Authors' own research

4.2 Confirmatory analysis

Table 3: Reflective model

Constructs	Variables/Items	Factor loadings
Digital transformation	• DT1: Our business is driving new business processes built on technologies.	**.790**
	• DT2: Our business is integrating digital technologies in its operation.	**.847**
	• DT3: Our business aspires to use digital technologies for additional activities.	**.888**
	• DT4: Our business strives towards digital information sharing.	**.901**
	• GI1: Our business has improved environmentally	**.814**

Green innovation	friendly packaging for new and existing products/services. • GI2: Our business uses recycled and reused material in the process of providing services to customers. • GI3: Our business uses less material in the process of providing services to customers.	 **.865** **.854**
Firm performance	*Economic performance (EP)* • FP1: Our sales have increased during the last 3 years. • FP2: Our market share has increased during the last 3 years. • FP3: Our profit growth rate has increased during the last 3 years. • FP4: Our return on investment (ROI) increased during the past 3 years. *Social performance (SP)* • SP1: Customer satisfaction with products and services has increased during the last 3 years. • SP3: Employee satisfaction has increased during the last 3 years. • SP4: Increased contribution to local community for social issues. *Environmental performance (EnP)* • EnP1: Our efficiency in the use of raw materials has improved during the last 3 years. • EnP2: Our resource consumption (energy and water) has reduced during the last 3 years. • EnP3: Our recycling of materials has improved during the last 3 years. • EnP4: Reduced cost of environmental compliance. *Digital competitive advantage (DCA)* • DCA1: Digital transformation has helped our business to reduce costs. • DCA2: Digital transformation has helped our business increase our offerings in the market. • DCA3: Digital transformation has resulted in seamless customer and employee experience for our business.	 **.894** **.867** **.907** **.777** **.847** **.810** **.798** **.900** **.865** **.740** **.808** **.874** **.885** **.895**

Data normality was assessed using skewness and kurtosis statistics in line with the thresholds recommended by Pallant (2020). The results indicated that all measurement items exhibited skewness and kurtosis values within the acceptable range of ±3, suggesting that the data approximated a normal distribution. Confirmatory factor analysis (CFA) was subsequently conducted using IBM AMOS (version 27) to validate the measurement model prior to hypothesis testing. The CFA procedure was employed to evaluate the psychometric properties of the constructs, including convergent validity, discriminant validity, and overall model fit, consistent

with the criteria proposed by Heterotrait–Monotrait (HTMT) ratio. In addition, IBM SPSS was used to compute descriptive statistics, perform correlation analyses, and examine direct effects, while the process macro facilitated further effect analysis. The CFA results revealed several indicators with low factor loadings and evidence of cross-loadings, which necessitated the removal of three items across different constructs. Specifically, one item was removed from each of the green innovation (GI), social performance (SP), and digital competitive advantage (DCA) constructs namely GI4, SP2, and DCA3, due to insufficient factor loadings (see Table 3). Following these modifications, the revised six-factor model demonstrated an acceptable model fit (χ^2 = 701.179, df = 231, χ^2/df = 3.035, CFI = .881, TLI = .904, RMSEA = .065, SRMR = .069). Convergent validity was supported, as all average variance extracted (AVE) values exceeded the recommended threshold of 0.50, with the following values: DT = .670, GI = .627, EP = .559, SP = .554, EnP = .582 and DCA = .614. Furthermore, composite reliability values ranged from .767 to .890 (DT = .890, GI = .834, EP = .787, SP = .767, EnP = .848, DCA = .827), all surpassing the acceptable threshold of 0.70. Internal consistency reliability was also confirmed, as Cronbach's alpha coefficients for all constructs exceeded 0.70, in accordance with the recommendations of Hair et al. (2019). Finally, discriminant validity was established using the Heterotrait–Monotrait (HTMT) ratio (see Table 4).

4.3 Reliability and validity assessment

Table 4: Reliability and validity analysis

Constructs	DT	GI	EP	SP	EnP	DCA	CA	CR	AVE
DT	-						**.897**	**.890**	**.670**
GI	0.445	-					**.784**	**.834**	**.627**
EP	0.289	0.312	-				**.875**	**.787**	**.559**
SP	0.372	0.380	0.421	-			**.880**	**.767**	**.554**
EnP	0.354	0.440	0.482	0.542	-		**.821**	**.848**	**.582**
DCA	0.272	0.375	0.514	0.578	0.614	-	**.904**	**.827**	**.614**

4.4 Common method bias

To mitigate the potential influence of common method bias (CMB), the study adopted the procedural remedies recommended by Podsakoff et al. (2003). Specifically, a multi-stage approach was implemented, encompassing pre-hoc, concurrent, and post-hoc strategies. At the pre-hoc stage, several design-based measures were introduced to minimise social desirability bias. Participants were assured of anonymity, confidentiality, and voluntary participation. They were explicitly informed that there were no correct or incorrect responses and that their answers would remain private, thereby reducing evaluation apprehension and response distortion. In addition, a time-lagged data collection design was employed to further reduce CMB. The survey instrument was divided into two temporally separated phases, namely ex ante (T1) and ex post (T2). Data on the independent and mediating variables were collected during the first phase (T1), while data on the dependent variables were gathered in the second phase (T2). This temporal separation helped to minimise respondents' ability to infer relationships among variables,

thereby lowering the likelihood of method bias. At the concurrent stage, the questionnaire design incorporated randomisation of item order across sections. This approach disrupted potential response patterns and reduced the risk of systematic bias arising from the survey structure. For post-hoc assessment, Harman's single-factor test was conducted to evaluate the extent of CMB. The results revealed multiple factors, with the first factor accounting for only 32.14% of the total variance, which is below the commonly accepted threshold. This finding suggests that CMB is unlikely to pose a serious concern in the dataset, consistent with prior studies such as Albloushi et al. (2023) and Ullah et al. (2021). Furthermore, model fit comparisons were performed using key indices, including χ^2, degrees of freedom (df), χ^2/df, CFI, TLI, RMSEA, and SRMR. The differences between the baseline measurement model and the model incorporating the unmeasured latent method factor (ULMF) were all below the recommended threshold of 0.05 for CFI, TLI, RMSEA, and SRMR. This further confirms that common method bias does not significantly affect the results of this study.

4.5 Structural equation model

Table 5 below depicts the descriptive statistics (means and standard deviations) and the correlations among the constructs. Figure 2, Table 5 and 6 depict the statistical representation of the model. The figure also shows the regression coefficients, t-statistics and the significance levels (p-values). Primary hypothesis one proposes that digital transformation is significantly positively related to firm performance (EP, SP, EnP and DCA). Firstly, the findings indicate that the direct effect (ß = .245, t = 3.068, p < .05) between the two DT-EP is significant. Thus, H1a is supported. H2b proposes that digital transformation is significantly positively related to social performance. The discoveries indicates that the direct effect between the DT-SP link (ß = 0.089, t = 5.248, p < .001) is significant. Therefore, H2b is then supported. In addition, H1c propose that digital transformation significantly positively influence environmental performance. The findings suggest the following significant effect: ß = .147, t = 9.473, p < .01). As such, H1c is supported. Lastly, hypothesis 1d proposes that there is a link between DT and DCA. The results contemplate a significant direct effect of ß = .068, t = 10.100, p < .05. Therefore, H1d was supported. For primary hypothesis 2, the study proposes that there is a significant positive link between DT and GI. The verdicts reveal that DT is significantly positively related to GI (ß = .024, t = 7.168, p < .01). Therefore, hypothesis 2 was supported. Moreover, primary hypothesis 3 emanates that there is a significant positive relationship between GI and FP (EP, SP, EnP and DCA). H3a proposes that there is a significant positive effect between GI-EP link. The findings reveal the following: ß = .071, t = 1.087, p < .01, indicating significant. Therefore, H3a was supported. H3b proposes that there is significant effect of GI on SP. The discoveries vent that GI is significantly positively related to SP (ß = .067, t = 3.811, p < .05). As such, H3b was supported. Furthermore, H3c proposes that there is a significant positive relationship between GI and EnP. The findings postulate that GI clearly affects EnP (ß = .280, t = 7.015, p < .05). Thereto, H3c was supported. Finally, secondary hypothesis 3d proposes that green innovation is significantly positively related to digital competitive advantage. The findings suggest that a negative and insignificant effect (ß = -.014, t = -1.088, p < .078) between the two variables. As

such, H3d was rejected. The last primary hypothesis 4 was rooted on the mediating effect of GI on DT-FP link. The study evaluated mediation using the VAF by Hair et al., (2021): thus, VAF=indirect effect/total effect. VAF between 0 and 20 emanates no mediation, between 20 and 80 is partial mediation and between 80 and 100 is full mediation (Hair jr et al., 2019). VAF for all secondary hypotheses under primary hypothesis 4 are as follow: H4a=24 (partial mediation), H4b=9 (no mediation), H4c=67 (partial mediation) and H4d=36 (partial mediation) (see table 6 below).

Table 5: Descriptive and correlation analysis

Construct	Mean	Standard deviation	DT	GI	EP	SP	EnP	DCA
DT	**3.98**	**1.20**	-					
GI	**4.01**	**.99**	.488**	-				
EP	**4.28**	**1.02**	.428*	.320**	-			
SP	**4.67**	**1.31**	.367**	.410*	.211**	-		
EnP	**3.99**	**1.07**	.392*	.421**	.317*	.247*	-	
DCA	**4.10**	**.98**	.401**	.390*	.247**	.311*	.297*	-

Note: **P<.10 and *P<.50.

Figure 2: Final model

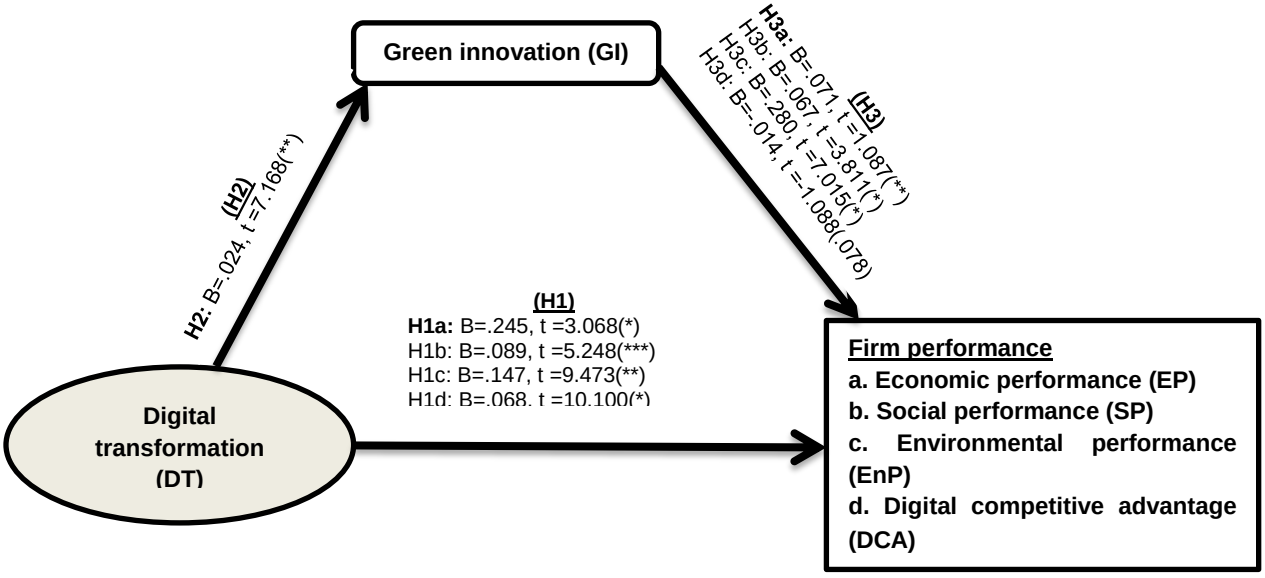


Table 6: Mediation analysis (indirect and direct effects)

Relationship(s)	Indirect effects		Direct effects	VAF (%)	Decision
DT->GI->FP		**GI->EP**	**DT->EP**	**27**	**Partial mediation**
		.071	.245		
		GI->SP	**DT->SP**	**9**	**No mediation**
	DT->GI	.022	.489		
	.024	**GI->EnP**	**DT->EnP**	**67**	**Partial**

		.280	.147		**mediation**
		GI->DCA	**DT->DCA**	**36**	**Partial mediation**
		.014	.068		

5. DISCUSSION

This study examined the direct and indirect relationships between digital transformation (DT), green innovation (GI), and multidimensional firm performance: economic, social, environmental, and digital competitive advantage (DCA) within the hospitality sector. The findings provide robust empirical support for the majority of the hypothesised relationships, while also revealing several nuanced and counterintuitive effects that advance both theory and practice. The results confirm that DT exerts a positive and significant influence across all performance dimensions (H1a–H1d). This suggests that digitalisation enhances not only financial outcomes but also broader social and environmental performance, reinforcing its role as a strategic enabler of sustainable value creation (Li, 2022; Tseng et al., 2023). The strong effect of DT on DCA further underscores the importance of digital capabilities in shaping competitive positioning, supporting the Resource-Based View, which emphasises firm-specific resources as key drivers of sustained competitive advantage (Barney, 1991). In this regard, digital assets such as data analytics, platform integration, and customer-centric technologies emerge as critical sources of differentiation in the hospitality industry.

The positive relationship between DT and GI (H2) highlights the enabling role of digital technologies in fostering environmentally sustainable innovation. By facilitating real-time monitoring, process optimisation, and resource efficiency, DT enhances firms' capacity to develop and implement green innovations (Khan et al., 2019; Mhlanga et al., 2022). This finding aligns with the Dynamic Capabilities Theory**,** which posits that firms leverage internal capabilities to adapt to changing environments and drive innovation (Teece et al., 1997). Thus, DT not only improves operational efficiency but also strengthens firms' sustainability orientation. Consistent with expectations, GI was found to positively influence economic, social, and environmental performance (H3a–H3c), confirming its role as a key driver of sustainable performance (Feroz et al., 2021; Takalo & Tooranloo, 2021). However, the negative relationship between GI and DCA (H3d) suggests that sustainability-oriented initiatives do not automatically translate into digital-based competitive advantages. This may be attributed to the resource-intensive nature of green innovation, which can divert attention and investment away from digital capability development, particularly in the short term (Horbach et al., 2012). This finding highlights an important trade-off and suggests that firms must carefully balance their digital and sustainability investments to avoid undermining competitive positioning.

The mediation analysis further reveals that GI plays a significant role in translating DT into improved economic, environmental, and digital competitive advantage outcomes (H4a, H4c, H4d). These results confirm that GI acts as a critical mechanism through which digital

capabilities are leveraged to achieve performance gains, consistent with prior research on innovation as a conduit between technology adoption and organisational outcomes (Li et al., 2019; Khan et al., 2019). However, the negative mediating effect observed for social performance (H4b) indicates that the integration of green innovation may introduce organisational challenges, such as increased workload, resistance to change, or misalignment with employee expectations. This underscores the complexity of implementing sustainability initiatives and suggests that their social implications must be carefully managed.

6. CONCLUSION

This study provides comprehensive empirical and theoretical insights into the increasingly important relationship among DT, GI, sustainable firm performance, and DCA within the South African hospitality sector. A major contribution of this study lies in its multidimensional conceptualisation of firm performance. Unlike many previous studies that focused predominantly on financial or operational outcomes, this research extends existing DT literature by simultaneously examining economic performance, environmental performance, social performance, and DCA within a single integrated framework. This broader sustainability-oriented perspective aligns closely with the expectations of contemporary organisations and the sustainability agenda, where organisational success is increasingly evaluated according to the triple-bottom-line approach encompassing economic prosperity, environmental responsibility, and social well-being. In doing so, the study responds directly to recent scholarly calls for more comprehensive investigations into how DT contributes to sustainable development outcomes, particularly within service-intensive sectors such as hospitality. The findings therefore strengthen the growing argument that DT should not merely be viewed as a technological initiative, but rather as a strategic mechanism for achieving long-term sustainable value creation.

The study further advances theory by introducing and empirically validating DCA as an emerging strategic outcome of DT within hospitality research. Although prior literature has acknowledged the importance of digital technologies for improving competitiveness, limited empirical attention has been devoted to understanding how DT contributes specifically to the development of digitally enabled competitive capabilities. By confirming the relevance of DCA, this study extends the application of the DCT by demonstrating that firms capable of effectively integrating digital technologies, organisational capabilities, and sustainability-oriented innovation practices are more likely to sustain competitive superiority in dynamic business environments. Importantly, the findings suggest that hospitality firms increasingly derive competitive advantage not only from physical resources or traditional operational efficiencies, but also from their ability to leverage digital technologies to improve adaptability, innovation, customer engagement, and environmental sustainability. Another important contribution of this study concerns the mediating role of GI in the relationship between DT and sustainable firm performance. The findings demonstrate that GI serves as a critical mechanism through which digital capabilities are translated into tangible sustainability outcomes. This result provides important insight into the “black box” relationship between DT and organisational performance

that has remained insufficiently explained in prior studies. Specifically, the findings indicate that digital technologies alone may not automatically generate sustainable performance unless organisations develop complementary innovation capabilities capable of transforming digital resources into environmentally responsible operational practices, sustainable service innovations, and resource-efficient processes. This contribution is particularly significant within the hospitality sector, where firms face increasing pressure to reduce environmental impacts, optimise energy consumption, minimise waste generation, and improve sustainability reporting practices. Thus, the study strengthens the growing sustainability literature by illustrating how GI enables hospitality firms to align digitalisation initiatives with environmental and social sustainability objectives.

The contextual contribution of the study is equally important. By focusing on the South African hospitality sector, the study addresses a major empirical gap within existing digital transformation and sustainability literature, which has largely concentrated on developed economies despite the unique structural and institutional challenges confronting emerging markets. The findings confirm concerns raised in the introduction regarding the relatively low levels of digital maturity and technological readiness within South Africa's hospitality industry. Given persistent challenges such as inadequate digital infrastructure, energy instability, resource limitations, and financial constraints, the study highlights the urgent need for hospitality firms within emerging economies to accelerate digital capability development and sustainability-oriented innovation. Consequently, the study provides context-specific evidence demonstrating that DT and GI can serve as important strategic pathways for improving resilience, sustainability, and competitiveness within resource-constrained environments. From a managerial perspective, the findings carry several important implications for hospitality practitioners and organisational leaders. First, hospitality firms should treat DT as a long-term strategic investment rather than a short-term technological adjustment. Managers must recognise that digital technologies can significantly improve operational efficiency, customer experiences, environmental management, and organisational adaptability when effectively aligned with broader sustainability objectives. Second, the findings suggest that organisations should adopt integrated digital and sustainability strategies capable of simultaneously addressing economic, environmental, and social performance goals. This integration requires continuous investment in employee digital competencies, organisational learning, innovation culture, and change management processes to ensure the effective implementation of digital initiatives. Third, managers should prioritise GI practices such as energy-efficient technologies, waste reduction systems, smart resource management, and environmentally sustainable operational processes, as these initiatives play a critical role in translating digital capabilities into sustainable performance outcomes. Importantly, the study also cautions managers that sustainability-oriented transformation may involve short-term organisational trade-offs and adjustment costs, particularly regarding employee adaptation and digital capability development. Therefore, successful implementation requires strong leadership commitment, stakeholder engagement, and continuous capability enhancement.

The study also offers several important policy implications relevant to governments, regulatory authorities, and industry stakeholders. Given the strategic role of the hospitality sector in economic development and employment creation, policymakers should prioritise the development of digital infrastructure and supportive regulatory environments capable of accelerating digital transformation across the sector. Governments should further introduce targeted incentives such as subsidies, tax relief programmes, and financial support mechanisms aimed at encouraging investments in green technologies and sustainable digital innovations. Particular attention should be devoted to supporting small and medium-sized enterprises (SMEs), which often face severe financial and technological resource constraints limiting their ability to adopt advanced digital and sustainability practices. In addition, the development of clear sustainability standards, digitalisation frameworks, and industry-specific environmental guidelines may help improve consistency, accountability, and long-term sustainability performance across the hospitality sector. Investments in digital training programmes, technical support initiatives, and sustainability education will also be essential for strengthening industry-wide digital readiness and innovation capabilities.

6.1 Limitations and direction for future studies

Despite its contributions, this study is subject to several limitations. The cross-sectional research design limits the ability to capture dynamic changes and establish causality (Saunders et al., 2019). The use of self-reported data may also introduce common method bias, although procedural remedies were implemented to mitigate this issue (Podsakoff et al., 2003). Additionally, the reliance on convenience sampling and the focus on a specific geographic region may limit the generalisability of the findings. Future research should address these limitations by employing longitudinal designs to examine the evolving impact of digital transformation and green innovation over time. Further studies could also explore additional mediating and moderating variables, such as organisational culture, leadership, and technological readiness, to provide a more comprehensive understanding of these relationships. Comparative research across industries and countries would enhance generalisability, while further refinement and validation of the digital competitive advantage construct would strengthen its theoretical and practical relevance.

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