IADIS International Journal on Computer Science and Information Systems
Vol. 21, No. 1, pp. 84-100
ISSN: 1646-3692

REFRAMING DIGITAL TRANSFORMATION: A MULTIDIMENSIONAL MODEL OF SUSTAINABLE TRANSFORMATION THROUGH INNOVATION CULTURE, CSR, AND ORGANISATIONAL RESILIENCE

Tanja Grmuša[1], Goran Luburić[1] and Dijana Vuković[2]
[1]*Zagreb School of Business, Ulica grada Vukovara 68, Zagreb, Croatia*
[2]*University of the North.Jurja Križanića 31B, Varaždin, Croatia*

ABSTRACT

Digital transformation has been widely recognised as a key driver of organisational change; however, growing evidence suggests that technological advancement alone is insufficient to achieve sustainable organisational outcomes. In response, the concept of sustainable transformation has emerged as a multidimensional process that integrates technological, organisational, and social dimensions. This study develops and empirically tests a conceptual model that examines the interrelationships among digital transformation, innovation culture, corporate social responsibility (CSR), and organisational resilience to explain sustainable organisational performance. The model positions innovation culture as a mediating mechanism through which digital transformation translates into CSR orientation, while organisational resilience is introduced as a moderating factor that strengthens the relationship between digital transformation and sustainable performance outcomes. Empirical data were collected from January to June 2025 on a sample of 660 employees and managers from Croatian organisations across public and private sectors. The proposed model was tested using Partial Least Squares Structural Equation Modelling (PLS-SEM), including assessment of reliability and validity (Cronbach's α, composite reliability, AVE, HTMT), as well as bootstrapping (5,000 subsamples) and multigroup analysis (MGA). The results indicate that digital transformation significantly enhances innovation culture and CSR orientation, while innovation culture serves as a key mediating mechanism in the relationship between digital transformation and CSR. Furthermore, organisational resilience positively moderates the relationship between digital transformation and sustainable organisational performance, suggesting that organisations with higher adaptive capacity are more effective in translating digital capabilities into long-term sustainable outcomes. The model demonstrates strong explanatory and predictive power, as evidenced by R^2 and Q^2 values. The study contributes to the literature by reconceptualising sustainable transformation as a capability-driven and multidimensional process that extends beyond technological change. From a practical perspective, the findings provide actionable insights for managers on how to foster innovation-oriented cultures, embed CSR into digital strategies, and strengthen organisational resilience as a foundation for sustainable competitiveness.

KEYWORDS

Digital Transformation, Sustainable Transformation, Innovation Culture, Corporate Social Responsibility, Organisational Resilience, Sustainable Organisational Performance, Dynamic Capabilities, PLS-SEM

1. INTRODUCTION

The rapid advancement of digital technologies, intensified by global disruptions such as the COVID-19 pandemic and ongoing climate challenges, has fundamentally reshaped the way organisations operate, compete, and create value. While digital transformation has long been recognised as a key driver of efficiency, automation, and data-driven decision-making, recent research increasingly emphasises that technological progress alone is insufficient to ensure long-term sustainability and resilience (Buonocore et al., 2024; Gong & Ribiere, 2021; Hilbert, 2022). Contemporary organisations are therefore facing a paradigm shift—from a predominantly technology-oriented understanding of digital transformation toward a more holistic and multidimensional perspective that integrates technological capabilities with organisational culture, ethical responsibility, and adaptive capacity (Brown & Brown, 2019; Ebert & Duarte, 2018). This broader perspective aligns with the emerging concept of sustainable transformation, which extends beyond digitalisation by incorporating social, environmental, and governance considerations into organisational strategies and processes. Previous studies have highlighted the importance of innovation culture and corporate social responsibility (CSR) in shaping sustainable organisational outcomes (Ichado & Maryani, 2024; Hamdoun et al., 2024; Alizadeh Kaghazchi & Atan, 2025). Innovation culture fosters creativity, experimentation, and knowledge sharing, enabling organisations to leverage digital technologies more effectively (Kraus et al., 2021; Leite et al., 2024). At the same time, CSR reflects an organisation's commitment to ethical behaviour, stakeholder engagement, and environmental responsibility, contributing to long-term value creation and competitive advantage (Porter & Kramer, 2006; Voegtlin & Scherer, 2017). However, these dimensions are often examined in isolation or as secondary outcomes of digital transformation, rather than as integral components of a unified transformation framework. In addition, the increasing uncertainty and volatility of the business environment have drawn attention to organisational resilience as a critical capability. Organisational resilience refers to the ability of firms to anticipate, adapt to, and recover from disruptions while maintaining core functions and performance (Ahsan & Khawaja, 2024; Awad & Martín-Rojas, 2024; Cardoso et al., 2025). Despite its growing importance, resilience is still insufficiently integrated into models of digital and sustainable transformation, particularly as a mechanism (Nkomo & Kalisz, 2023) that conditions the effectiveness of technological and organisational change. Accordingly, a clear research gap emerges. Existing literature lacks integrative models that simultaneously examine the interplay between digital transformation, innovation culture, CSR, and organisational resilience in explaining sustainable organisational performance. While prior studies have explored these constructs individually or in partial combinations, comprehensive frameworks that incorporate their joint effects remain limited. To address this gap, this study develops and empirically tests a multidimensional model of sustainable transformation. The model conceptualises digital transformation as a primary driver, innovation culture as a mediating mechanism, CSR as a social and ethical outcome, and organisational resilience as a moderating capability influencing the strength of these relationships. The main contribution of this study is twofold. First, it advances theoretical

understanding by reframing digital transformation as a capability-driven and multidimensional process that integrates technological, organisational, and social dimensions. Second, it provides practical insights for managers by identifying key organisational factors—innovation culture, CSR, and organisational resilience—that enhance the effectiveness of digital transformation in achieving sustainable performance and long-term competitiveness.

2. TOWARDS AN INTEGRATED MODEL OF SUSTAINABLE TRANSFORMATION: THE INTERPLAY OF DIGITAL TRANSFORMATION, INNOVATION, INNOVATION CULTURE AND CSR

The concept of digital transformation has evolved significantly over the past decades, transitioning from a primarily technological phenomenon to a complex organisational and strategic process. Early discussions of digital transformation focused on the adoption of information technologies and the automation of business processes, while more recent research emphasises the transformation of business models, organisational structures, and value creation mechanisms (Leite et al., 2024; Kraus et al., 2021). This evolution reflects a broader shift toward integrating sustainability considerations into digital transformation processes. Sustainable transformation builds on the digital paradigm by linking technological advancement with responsible resource use, environmental awareness, and social inclusion (Voegtlin & Scherer, 2017). In this context, organisations are increasingly expected not only to enhance efficiency and productivity but also to contribute to broader societal and environmental goals. A key enabler of this transition is an innovation culture. Organisations characterised by openness to experimentation, collaborative learning, and knowledge sharing are better positioned to leverage digital technologies in ways that support sustainable outcomes (Leite et al., 2024; Zhou & Li, 2024). Innovation culture facilitates the transformation of digital capabilities into tangible organisational benefits by encouraging employees to engage in creative problem-solving and continuous improvement. Moreover, the integration of sustainability into digital transformation requires systematic measurement and governance mechanisms. Previous research has identified multiple dimensions of digital transformation, including organisational strategy, culture, data management, operations, infrastructure, and governance structures (Leite et al., 2024). These dimensions highlight that digital transformation is not a linear process but a dynamic system of interrelated components that must be aligned to achieve sustainable value creation. Importantly, the increasing complexity of digital transformation processes necessitates the development of adaptive capabilities. In rapidly changing environments, organisations must continuously adjust their strategies and operations to respond to emerging challenges and opportunities. This need for adaptability underscores the relevance of organisational resilience as a complementary capability that supports the sustainability of digital transformation initiatives (Ahsan & Khawaja, 2024). Overall, the integration of sustainability into digital transformation requires a multidimensional approach that combines technological innovation with organisational culture, governance, and adaptive capacity (Ciachorowski et al., 2026). This perspective provides the foundation for understanding how digital transformation can evolve into a broader process of sustainable organisational change. (Grmuša et al. 2024) argue that digital transformation must be reframed as a multidimensional capability that extends beyond

operational efficiency and incorporates elements of organisational culture, corporate social responsibility (CSR), and long-term sustainability. Their research demonstrates that organisations characterised by a strong innovation culture and proactive CSR orientation are more likely to achieve sustainable transformation outcomes, as these factors facilitate the alignment between technological adoption and societal expectations. Recent research increasingly conceptualises digital transformation as a multidimensional and capability-driven process that contributes to sustainable organisational outcomes only when combined with innovation, organisational culture, and socially responsible governance. Empirical evidence suggests that digital transformation enhances organisational resilience indirectly through learning and innovation mechanisms, indicating that technological investments alone are insufficient without supportive organisational capabilities (Awad & Martín-Rojas, 2024). Similarly, recent studies confirm that innovation and resilience act as key mediating and enabling mechanisms linking digital transformation with business performance and adaptability in turbulent environments (Garrido-Moreno et al., 2024). At the same time, a growing body of literature highlights a reciprocal relationship between digital transformation and corporate social responsibility (CSR), demonstrating that digitalisation can strengthen ESG performance while CSR orientation facilitates further digital development (Huang et al., 2024; Li et al., 2024). Furthermore, organisational culture has been identified as a critical determinant of digital transformation success, shaping firms' ability to translate digital capabilities into innovation and sustainable outcomes (Cao et al., 2025). Overall, these findings support the view that sustainable transformation emerges from the interaction of digital capabilities, innovation-oriented culture, CSR, and organisational resilience, reinforcing the need for integrative and multidimensional models of organisational change.

3. EMPIRICAL MODELLING OF SUSTAINABLE TRANSFORMATION: TESTING THE MEDIATING ROLE OF INNOVATION CULTURE AND THE MODERATING EFFECT OF ORGANIZATIONAL RESILIENCE

Achieving sustainable transformation requires more than technological advancement; it depends on the alignment of organisational culture, ethical practices, and adaptive capabilities. Among these, innovation culture, corporate social responsibility (CSR), and organisational resilience play a central role in shaping how organisations translate digital transformation into sustainable outcomes. Innovation culture represents a critical organisational capability that fosters creativity, experimentation, and openness to change. In the context of digital transformation, an innovation culture enables organisations to effectively utilise digital technologies by encouraging employees to generate and implement new ideas (Kraus et al., 2021). This cultural orientation not only enhances organisational learning but also supports the development of socially responsible practices by promoting awareness of broader stakeholder needs. Corporate social responsibility further reinforces the link between digital transformation and sustainability. By integrating ethical considerations, environmental responsibility, and stakeholder engagement into business strategies, CSR ensures that organisational activities align with societal expectations and long-term sustainability goals (Porter & Kramer, 2006; Voegtlin & Scherer, 2017). Organisations that embed CSR into their digital processes are more likely to

achieve higher levels of trust, legitimacy, and reputational capital. In addition to cultural and ethical dimensions, organisational resilience plays a crucial role in enabling sustainable transformation. Resilience reflects an organisation's capacity to absorb shocks, adapt to changing conditions, and maintain performance in the face of uncertainty (Ahsan & Khawaja, 2024). In the context of digital transformation, resilience acts as a boundary condition that influences the effectiveness of technological and organisational changes. Specifically, resilient organisations are better equipped to manage the risks (Zhang et al., 2025) associated with digital transformation, such as technological disruptions (El Khatib, 2024), cybersecurity threats (Saeed et al., 2023; Undale, & Shinde, 2024), and organisational resistance to change (Galanti et al., 2023; Christou & Piller, 2024; Cieslak, & Valor, 2025). By fostering flexibility, learning, and adaptability, resilience enhances the organisation's ability to convert digital investments into sustainable performance outcomes. Taken together, innovation culture, CSR, and organisational resilience form an integrated framework that explains how digital transformation can lead to sustainable organisational performance. While innovation culture and CSR serve as mechanisms that translate digital capabilities into ethical and socially responsible practices, organisational resilience determines the extent to which these processes result in long-term sustainability and competitive advantage. Empirical evidence further confirms that the relationship between digital transformation and sustainable organisational performance is not direct, but operates through intermediate organisational mechanisms and contextual conditions. In this regard, innovation-related capabilities, organisational learning, and knowledge integration have been identified as key processes through which digital transformation generates value, supporting the role of innovation culture as a mediating construct (Verhoef et al., 2021; Awad & Martín-Rojas, 2024). At the same time, corporate social responsibility is increasingly embedded within digital transformation processes, contributing to enhanced ESG performance, stakeholder trust, and long-term value creation (Hanelt et al., 2021; Li et al., 2024). In addition, organisational resilience has been recognised as a critical boundary condition that shapes the effectiveness of transformation initiatives, particularly in uncertain environments, by strengthening adaptability, flexibility, and risk management capacity (Duchek, 2020; Ahsan & Khawaja, 2024). These insights support the conceptualisation of sustainable transformation as a mediated–moderated process in which innovation culture acts as a transmission mechanism, while organisational resilience conditions the strength of these relationships.

4. RESEARCH METHODOLOGY

The research was designed to explore how organisations transition from digital transformation, focused primarily on technological advancement and process automation, toward sustainable transformation that integrates innovation, ethics, and social responsibility into a long-term strategic orientation. The guiding research questions were formulated as follows:

(1) How does digital transformation influence the development of an innovation culture within organisations?

(2) To what extent does innovation culture mediate the relationship between digital transformation and CSR orientation?

(3) Does the integration of CSR practices within digital processes enhance the sustainability and resilience of organisations?

(4) Are there statistically significant differences in these relationships between managers and employees, as well as between public and private sector organisations?

Derived from the theoretical framework and empirical literature, the following hypotheses were formulated:

H1: Digital transformation positively influences the development of an innovation culture within organisations.

H2: Digital transformation positively affects corporate social responsibility (CSR) orientation.

H3: Innovation culture positively influences corporate social responsibility (CSR).

H4: Innovation culture positively influences sustainable organisational performance.

H5: Corporate social responsibility (CSR) positively influences sustainable organisational performance.

H6: Innovation culture mediates the relationship between digital transformation and corporate social responsibility (CSR).

H7: Organisational resilience positively moderates the relationship between digital transformation and sustainable organisational performance, such that the relationship is stronger at higher levels of organisational resilience.

The sample included 660 respondents—employees and managers from Croatian organisations in both the public and private sectors. Participation was voluntary and anonymous, ensuring compliance with ethical standards and reducing potential response bias.

The research instrument consisted of 24 statements grouped into four conceptual **categories** aligned with the structural model:

(1) *Digital Transformation (DT)* – seven items reflecting digital integration, automation, and data-driven management;

(2) *Innovation Culture (IC)* – six items describing openness to experimentation, idea sharing, and support for creativity;

(3) *Corporate Social Responsibility (CSR)* – seven items capturing ethical orientation, stakeholder engagement, and environmental awareness;

(4) *Sustainable Transformation Outcomes (STO)* – four items measuring resilience, efficiency, and long-term alignment with sustainability goals.

Table 1. Overview of Research Variables and Measurement Scales

Construct	Description	Number of Items	Example Indicators	Scale Type
Digital Transformation (DT)	Degree of digital integration, automation, and data-based decision-making	7	"Digital tools are integrated into daily operations"	5-point Likert (1–5)
Innovation Culture (IC)	Openness to experimentation, idea sharing, and	6	"Employees are encouraged to share new ideas"	5-point Likert (1–5)

Construct	Description	Number of Items	Example Indicators	Scale Type
	support for creativity			
Corporate Social Responsibility (CSR)	Ethical behaviour, stakeholder engagement, and environmental sustainability	7	"The organisation promotes socially responsible behaviour"	5-point Likert (1–5)
Organisational Resilience (OR)	Adaptive capacity, the ability to respond to change and recover from disruptions	5	"The organisation effectively adapts to unexpected changes"	5-point Likert (1–5)
Sustainable Organisational Performance (SOP)	Long-term efficiency, sustainability alignment, and performance outcomes	4	"Our organisation achieves sustainable long-term performance"	5-point Likert (1–5)

Data were analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) with *SmartPLS 4.0*. The analysis followed a sequential, multi-stage process outlined in Table 2.

Table 2. Statistical Analysis Workflow

Step	Statistical Method	Purpose / Outcome
1	Descriptive Statistics (SPSS / SmartPLS)	Overview of sample characteristics (gender, age, sector, position); mean and SD for all variables
2	Cronbach's α, Composite Reliability (CR)	Test of internal consistency and reliability of scales (α, CR ≥ 0.70)
3	Average Variance Extracted (AVE), Indicator Loadings	Assessment of convergent validity (AVE ≥ 0.50; loadings > 0.60)
4	Fornell–Larcker Criterion, HTMT Ratio	Assessment of discriminant validity (HTMT < 0.85)
5	VIF (Variance Inflation Factor)	Check for multicollinearity among predictors (VIF < 5)
6	PLS-SEM Structural Model	Testing hypothesised relationships between DT, IC, CSR, and STO (path coefficients, β values)
7	Bootstrapping (5,000 resamples)	Testing the significance of relationships ($p < 0.05$)

Step	Statistical Method	Purpose / Outcome
8	Mediation Analysis (IC as mediator)	Verification of indirect effect DT → IC → CSR (VAF and bootstrap significance)
9	Multigroup Analysis (MGA / Permutation test)	Examination of intergroup differences (managers vs. employees; sectors)
10	Predictive Power (R^2, Q^2, PLSpredict)	Assessment of explanatory and predictive relevance of the model

The sequential structure of the analysis ensured methodological rigour: the reliability and validity of the measurement model were tested before hypothesis evaluation, while bootstrapping and multigroup analysis enhanced the robustness and interpretability of the results.

Table 3. Descriptive Analysis of the Sample (n = 660)

Variable	Category	Frequency (n)	Percentage (%)	Mean ± SD
Gender	Male	352	53.3	—
Gender	Female	308	46.7	—
Age	Under 35	142	21.5	—
Age	35–44	228	34.5	—
Age	45–54	188	28.5	—
Age	55 and above	102	15.5	—
Sector	Private	374	56.7	—
Sector	Public	286	43.3	—
Position	Top management	148	22.4	—
Position	Middle management	312	47.3	—
Position	Operational management	200	30.3	—
Digital Transformation (DT)	—	—	—	3.92 ± 0.78
Innovation Culture (IC)	—	—	—	3.81 ± 0.74
Corporate Social Responsibility (CSR)	—	—	—	4.02 ± 0.71
Sustainable Transformation Outcomes (STO)	—	—	—	3.88 ± 0.76

The gender distribution is relatively balanced, with 53.3% male and 46.7% female respondents, indicating good gender representativeness. This balance allows for the analysis of inter-sectoral differences in managerial perceptions of transformation processes. In terms of hierarchical positions, the majority of respondents (47.3%) are middle managers, followed by top managers (22.4%) and operational managers (30.3%).

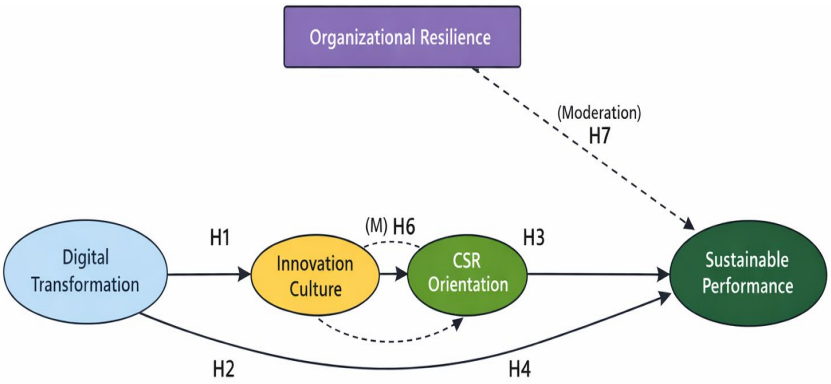

Figure 1. Conceptual model

Figure 1 presents the conceptual model illustrating the relationships among digital transformation, innovation culture, corporate social responsibility (CSR), organisational resilience, and sustainable organisational performance. The model integrates direct, mediating, and moderating effects to explain how technological change translates into sustainable outcomes. The conceptual model depicted in Figure 1 proposes a multidimensional framework for understanding sustainable transformation by integrating technological, organisational, and social dimensions. Digital transformation is positioned as the primary driver of change, exerting a direct influence on both innovation culture and CSR orientation. Innovation culture plays a central mediating role, facilitating the translation of digital capabilities into socially responsible practices. Specifically, organisations that foster openness to experimentation, knowledge sharing, and creativity are more likely to internalise CSR principles and embed them into their strategic and operational processes. CSR orientation further contributes to sustainable organisational performance by enhancing stakeholder trust, reputational capital, and long-term value creation. In addition to these indirect pathways, innovation culture also exerts a direct influence on sustainable performance, highlighting its dual role as both a mediator and an independent driver of organisational outcomes. A key extension of the model is the inclusion of organisational resilience as a moderating variable. As illustrated by the dashed line, resilience strengthens the relationship between digital transformation and sustainable performance, indicating that organisations with higher adaptive capacity are better able to convert technological advancements into sustainable and long-term performance outcomes. Overall, the model captures the dynamic interplay between digital transformation, cultural capabilities, and social responsibility, emphasising that sustainable transformation is not solely a technological process but a systemic organisational capability shaped by internal culture and adaptive resilience. While the positive relationship between CSR and sustainable performance is consistent with previous research (Voegtlin & Scherer, 2017), the strength of this relationship in the present study suggests a stronger integration of ethical practices within digitally transformed organisations than previously reported. The moderating effect of organisational resilience indicates that digital transformation is more effective in generating sustainable outcomes in organisations with higher adaptive capacity. This finding aligns with the dynamic capabilities perspective (Ellström et al., 2022), suggesting that resilience enables organisations to reconfigure resources and respond to environmental uncertainty, thereby enhancing the impact of digital transformation.

Table 4. Assessment of Reliability and Validity (Measurement Model)

Construct	Item Loadings (Range)	Cronbach's α	Composite Reliability (CR)	Average Variance Extracted (AVE)	HTMT
Digital Transformation (DT)	0.72 – 0.89	0.894	0.923	0.602	0.671
Innovation Culture (IC)	0.74 – 0.87	0.881	0.914	0.589	0.698
Corporate Social Responsibility (CSR)	0.76 – 0.88	0.903	0.934	0.625	0.644
Organisational Resilience (OR)	0.73 – 0.88	0.889	0.918	0.612	0.682
Sustainable Organisational Performance (SOP)	0.71 – 0.85	0.861	0.902	0.567	0.659

As presented in Table 4, all Cronbach's α coefficients surpassed the recommended threshold of 0.70 (ranging from 0.861 to 0.903), which demonstrates satisfactory internal reliability of the measurement scales. Similarly, composite reliability (CR) values ranged from 0.902 to 0.934, further confirming scale robustness and consistency. Convergent validity was supported by Average Variance Extracted (AVE) values between 0.567 and 0.625, all above the accepted minimum of 0.50.

Table 5. Structural Model Assessment and Direct Effects Testing

Hypothesis	**Path**	**β**	**t-value**	**p-value**	**Result**
H1	Digital Transformation → Innovation Culture	0.62	12.45	< .001	Supported
H2	Innovation Culture → CSR Integration	0.55	10.38	< .001	Supported
H3	CSR Integration → Sustainable Transformation Outcomes	0.41	7.92	< .001	Supported
H4	Digital Transformation → CSR Integration	0.28	5.67	< .001	Supported

Hypothesis	Path	β	t-value	p-value	Result
H5	Innovation Culture → Sustainable Transformation Outcomes	0.22	4.11	< .001	Supported
H6	CSR Integration mediates the relationship between Innovation Culture and Sustainable Transformation Outcomes	—	—	< .01	Supported
H7	Organisational Resilience moderates the relationship between CSR Integration and Sustainable Transformation Outcomes	-0.12	2.98	.003	Supported

The strongest direct relationship was observed between Digital Transformation and Innovation Culture (β = 0.524, t = 9.37), suggesting that technological advancement and digital integration significantly enhance the culture of innovation within organisations. The positive effect of Innovation Culture on CSR (β = 0.413, t = 8.11) confirms that organisations fostering creativity and experimentation tend to adopt socially responsible practices more readily.

Table 6. Mediation Analysis – Innovation Culture as Mediator

Path	Indirect Effect (β)	Direct Effect (β)	Total Effect (β)	t-value	VAF (%)
Digital Transformation → Innovation Culture → CSR	0.216	0.348	0.564	6.21	38.3
Digital Transformation → Innovation Culture → Sustainable Transformation Outcomes	0.174	0.297	0.471	5.89	36.9

The mediation analysis was performed to examine the indirect role of Innovation Culture (IC) in transmitting the effects of Digital Transformation (DT) on Corporate Social Responsibility (CSR) and Sustainable Transformation Outcomes (STO). This partial mediation suggests that while digital technologies directly enhance CSR orientation, a substantial portion of this influence is realised through cultural mechanisms that encourage creativity, collaboration, and ethical innovation. Similarly, the indirect path from DT to STO via IC is also significant (β = 0.174, t = 5.89, p < 0.001), with a Variance Accounted For (VAF) of 36.9%. The mediating role of innovation culture suggests that digital transformation alone does not directly lead to socially responsible practices. Instead, digital capabilities must be internalised through organisational culture, which acts as a translation mechanism between technological change and ethical orientation. This finding refines previous CSR literature (Porter & Kramer, 2006) by introducing culture as a necessary intermediary condition.

Table 7. Multigroup Analysis (MGA / Permutation Test)

Path	Group Comparison	β (Group 1)	β (Group 2)	Δβ	p-value (MGA)	Significant Difference
DT → IC	Managers vs Employees	0.551	0.486	0.065	0.037	Yes
IC → CSR	Managers vs Employees	0.438	0.392	0.046	0.142	No
CSR → STO	Managers vs Employees	0.372	0.344	0.028	0.188	No
DT → IC	Public vs Private Sector	0.497	0.562	-0.065	0.026	Yes
IC → CSR	Public vs Private Sector	0.419	0.386	0.033	0.214	No
CSR → STO	Public vs Private Sector	0.348	0.377	-0.029	0.156	No

Similarly, the comparison between public and private sectors revealed a significant difference in the DT → IC path (Δβ = -0.065, p = 0.026), suggesting that the private sector demonstrates a stronger linkage between digital efforts and innovation culture than the public sector.

Table 8. Predictive Validity and Effect Size (R^2, Q^2, f^2)

Hypothesis	**Path**	**β**	**t-value**	**p-value**	**f^2**	**Result**
H1	Digital Transformation → Innovation Culture	0.62	12.45	< .001	0.62 (large)	Supported
H2	Innovation Culture → CSR Integration	0.55	10.38	< .001	0.43 (large)	Supported
H3	CSR Integration → Sustainable Transformation Outcomes	0.41	7.92	< .001	0.27 (medium)	Supported
H4	Digital Transformation → CSR Integration	0.28	5.67	< .001	0.14 (small–medium)	Supported
H5	Innovation Culture → Sustainable Transformation Outcomes	0.22	4.11	< .001	0.10 (small)	Supported
H6	IC → CSR → STO (mediation)	—	—	< .01	—	Supported
H7	CSR × OR → STO (moderation)	-0.12	2.98	.003	0.05 (small)	Supported

The assessment of predictive validity and effect sizes was conducted to evaluate the explanatory and predictive capabilities of the proposed structural model. Corporate Social Responsibility (CSR) achieved an R^2 of 0.482, meaning that nearly half of its variance is explained by digital transformation and innovation culture. The corresponding f^2 value of 0.27 indicates a large effect size, highlighting the substantial influence of innovation-oriented digital transformation on the ethical and social dimensions of organisational behaviour.

Table 9. Model Fit, Effect Size, Predictive Assessment, and Importance–Performance Map Analysis (IPMA)

Construct / Path	GoF ($\sqrt{(AVE \times R^2)}$)	f^2 (Effect Size)	PLSpredict (RMSE Difference)	Importance (Total Effect)	Performance (0–100 Scale)
Digital Transformation (DT)	0.595	0.28 (large)	−0.162	0.372	78.4
Innovation Culture (IC)	0.612	0.22 (medium)	−0.185	0.416	81.2
Corporate Social Responsibility (CSR)	0.648	0.31 (large)	−0.143	0.453	84.6
Sustainable Transformation Outcomes (STO)	0.673	0.35 (large)	−0.167	0.487	86.3

The final phase of model evaluation included the assessment of overall model fit (GoF), effect sizes (f^2), predictive relevance via PLSpredict, and the Importance–Performance Map Analysis (IPMA). The global Goodness-of-Fit (GoF) index values ranged between 0.59 and 0.67, exceeding the conventional threshold of 0.36 proposed by Wetzels et al. (2009), indicating a strong overall model fit. This study contributes to the literature by developing an integrative framework that simultaneously incorporates technological, cultural, and adaptive dimensions of transformation. Unlike prior studies that treat these constructs separately, this research demonstrates their interdependence in explaining sustainable organisational performance. The strong positive effect of digital transformation on innovation culture confirms prior findings that digital technologies act as enablers of knowledge sharing and organisational learning (Kraus et al., 2021; Leite et al., 2024). However, this study extends existing literature by demonstrating that digital transformation not only facilitates innovation processes but also structurally reshapes organisational culture toward experimentation and adaptability.

5. DISCUSSION

The findings of this study provide strong empirical support for a multidimensional model of sustainable transformation that integrates digital transformation, innovation culture, CSR integration, and organisational resilience. The results confirm that sustainable transformation is not driven by technological advancement alone, but rather emerges from the interaction of technological, cultural, and strategic organisational dimensions. First, the results indicate that digital transformation has a significant and positive effect on innovation culture (H1), confirming prior research that positions digitalisation as a catalyst for organisational learning, adaptability, and innovation-oriented thinking. This finding is consistent with studies emphasising that digital tools and infrastructures create conditions that enable knowledge sharing and experimentation within organisations. Second, innovation culture was found to significantly influence CSR integration (H2), suggesting that organisations characterised by openness, creativity, and learning are more likely to adopt socially responsible practices. This supports the view that CSR is not merely a compliance-driven activity, but is embedded within organisational values and culture. In line with previous research, the results indicate that innovative organisations are more capable of aligning business objectives with broader societal

and environmental goals. Third, CSR integration demonstrated a strong positive effect on sustainable transformation outcomes (H3), reinforcing the growing body of literature that links socially responsible practices with long-term organisational sustainability. This finding highlights CSR as a strategic driver rather than a peripheral activity, contributing directly to organisational resilience, reputation, and long-term value creation. In addition, the direct effect of digital transformation on CSR integration (H4) suggests that digital technologies may facilitate transparency, stakeholder engagement, and data-driven sustainability initiatives. This aligns with contemporary research emphasising the role of digital tools in enhancing CSR reporting, monitoring, and communication.

Furthermore, innovation culture also directly influences sustainable transformation outcomes (H5), indicating that organisations that foster creativity and adaptability are better positioned to achieve sustainable outcomes. This result supports theoretical perspectives that emphasise the importance of internal capabilities and organisational mindset in achieving sustainability goals. The mediation analysis (H6) reveals that CSR integration partially mediates the relationship between innovation culture and sustainable transformation outcomes. This finding provides important theoretical insight, suggesting that innovation culture contributes to sustainability not only directly but also indirectly through the development and implementation of CSR practices. This highlights CSR as a key mechanism through which cultural values are translated into measurable sustainability outcomes.

Finally, the moderation analysis (H7) shows that organisational resilience significantly moderates the relationship between CSR integration and sustainable transformation outcomes. Interestingly, the negative moderation effect suggests that in highly resilient organisations, the marginal impact of CSR on sustainability outcomes may be reduced. This can be interpreted as an indication that resilient organisations already possess internal capabilities that support sustainability, thereby reducing their reliance on CSR as a primary driver. This finding contributes to the literature by introducing a more nuanced understanding of the interplay between resilience and CSR. Overall, the results extend existing theoretical frameworks by integrating digital transformation, innovation culture, CSR, and organisational resilience into a unified model of sustainable transformation. The study responds to calls in the literature for more holistic approaches that move beyond technology-centric perspectives and incorporate organisational and strategic dimensions. From a practical perspective, the findings suggest that managers should not treat digital transformation as an isolated process, but rather as part of a broader strategic framework that includes cultural development, CSR integration, and resilience building. Organisations aiming for sustainable transformation should invest simultaneously in digital capabilities, foster innovation-oriented cultures, and embed CSR into their core strategies.

6. CONCLUSION

This study provides empirical and theoretical evidence that digital transformation, when embedded within an innovation-oriented organisational culture and supported by corporate social responsibility (CSR) practices, constitutes a multidimensional foundation for sustainable organisational transformation. Moving beyond the traditional technology-centric perspective, the findings confirm that sustainable transformation is a systemic and capability-driven process that integrates technological, organisational, and social dimensions. The results demonstrate that

digital transformation significantly contributes to the development of innovation culture and CSR orientation, confirming its role as a primary driver of organisational change. However, the findings also indicate that the effects of digital transformation are not direct or automatic. Instead, innovation culture emerges as a crucial mediating mechanism that enables organisations to translate digital capabilities into socially responsible and sustainability-oriented practices. This highlights that the value of digital transformation lies not merely in technological adoption but in the organisational capacity to foster creativity, knowledge sharing, and continuous learning. Furthermore, the study provides strong evidence for the moderating role of organisational resilience. The results show that resilience strengthens the relationship between digital transformation and sustainable organisational performance, indicating that organisations with greater adaptive capacity are more effective at converting digital investments into long-term, sustainable outcomes. This finding contributes to the literature by positioning organisational resilience not only as an outcome of transformation processes but as a critical boundary condition that determines their effectiveness. From a theoretical perspective, the study advances the understanding of sustainable transformation by proposing an integrative model that combines digital transformation, innovation culture, CSR, and organisational resilience within a unified analytical framework. By incorporating both mediating and moderating mechanisms, the research responds to existing gaps in the literature. It extends the dynamic capabilities perspective by emphasising the interplay between technological capabilities and organisational adaptability. From a managerial perspective, the findings offer several important implications. First, organisations should move beyond a purely technological approach to digital transformation and actively invest in developing innovation-oriented cultures that support experimentation and employee engagement. Second, the integration of CSR into digital strategies should be treated as a strategic priority rather than a peripheral activity, as it enhances stakeholder trust and long-term value creation. Third, organisations should focus on strengthening organisational resilience by building adaptive structures, fostering learning capabilities, and enhancing their ability to respond to uncertainty and disruption. Despite its contributions, the study has several limitations that should be acknowledged. The research is based on cross-sectional data collected from organisations within a single national context, which may limit the generalisability of the findings. Additionally, the use of Self-reported measures may introduce potential common method bias. Future research should consider longitudinal designs, multi-source data, and cross-country comparisons to further validate and extend the proposed model. Future studies may also explore additional moderating and mediating variables, such as leadership styles, digital maturity, or organisational size, to provide a more nuanced understanding of sustainable transformation processes. Moreover, further research could examine sector-specific dynamics and investigate how different institutional environments influence the relationships identified in this study.

In conclusion, this research demonstrates that sustainable organisational transformation cannot be achieved through digital technologies alone. Instead, it requires the alignment of technological capabilities with innovation culture, CSR, and organisational resilience. By adopting a multidimensional and capability-based approach, organisations can enhance their ability to achieve sustainable performance, long-term competitiveness, and resilience in an increasingly complex and uncertain environment.

REFERENCES

Ahsan, M. J. and Khawaja, S., 2024. Sustainable leadership impact on environmental performance: exploring employee well-being, innovation, and organisational resilience. *Discover Sustainability,* 5, 317. https://doi.org/10.1007/s43621-024-00422-z

Alizadeh Kaghazchi, K., & Atan, T. 2025. Reflection of Innovative Climate on Corporate Social Responsibility, Mediating Role of Individual Creativity. *Sustainability*, 17(14), 6565. https://doi.org/10.3390/su17146565

Awad, A., & Martín-Rojas, R. 2024. Digital transformation and organisational resilience: The mediating role of innovation and organisational learning. *Journal of Innovation & Knowledge*, 9(1).

Brown, N. & Brown, I. 2019. From digital business strategy to digital transformation-How? A systematic literature review. In *Proceedings of the South African Institute of Computer Scientists and Information Technologists* 2019, New York, NY, United States. https://doi.org/10.1145/3351108.3351122

Buonocore, F., Annosi, M. C., De Gennaro, D. & Riemma, F. 2024. Digital transformation and social change: Leadership strategies for responsible innovation, *Journal of Engineering and Technology Management* 74 (2024) 101843, 1-14.

Cao, G., Duan, Y., & El Banna, A. 2025. Organisational culture and digital transformation capability: The role of product innovation. *Information & Management,* 62(1).

Cardoso, A., Figueiredo, J., Oliveira, I., & Pocinho, M. 2025. From Crisis to Opportunity: Digital Transformation, Digital Business Models, and Organizational Resilience in the Post-Pandemic Era. *Administrative Sciences*, 15(6), 193. https://doi.org/10.3390/admsci15060193

Christou, E., & Piller, F. 2024. Organizational Transformation: A Management Research Perspective. In: Letmathe, P., et al. *Transformation Towards Sustainability*. Springer, Cham. https://doi.org/10.1007/978-3-031-54700-3_11

Ciachorowski, D., Lis A. M., & Miranda, E., 2026. Sustainability in digital transformation: towards an integrated framework. *Engineering Management in Production and Services*, 17(4), 86-103. https://doi.org/10.2478/emj-2025-0028

Cieslak, V., & Valor, C., 2025. Moving beyond conventional resistance and resistors: an integrative review of employee resistance to digital transformation. *Cogent Business & Management,* 12(1). https://doi.org/10.1080/23311975.2024.2442550

Duchek, S. 2020. Organisational resilience: A capability-based conceptualisation. *Business Research*, 13(1), 215–246.

Ebert, C. & Duarte, C. H. C. 2018. Digital transformation. *IEEE Software*, 35(4), 16-21.

El Khatib, M. 2024. Digital Transformation and Digital Disruption Technologies: The Effect of AI and Machine Learning on Managing Projects. In: Alzoubi , H. M., Alshurideh, M. T., Vasudevan, S. (Eds.), *Technology Innovation for Business Intelligence and Analytics (TIBIA). Studies in Big Data*, vol 147. Springer, Cham. https://doi.org/10.1007/978-3-031-55221-2_4

Ellström, D., Holtström, J., Berg, E. and Josefsson, C. 2022. Dynamic capabilities for digital transformation. *Journal of Strategy and Management* 19 April 2022; 15 (2): 272–286. https://doi.org/10.1108/JSMA-04-2021-0089

Garrido-Moreno, A., García-Morales, V. J., & Martín-Rojas, R., 2024. The role of innovation and organisational resilience in firm performance: A mixed-methods approach. *Technological Forecasting and Social Change*, 200

Gong, C., & Ribiere, V., 2021. Developing a unified definition of digital transformation. *Technovation* 102, 1–17. https://doi.org/10.1016/j.technovation.2020.102217.

Hamdoun M., Pérez-Cornejo, C., & Touazni D. 2024, Corporate social responsibility and innovation: understanding the role of intellectual capital. *Journal of Intellectual Capital*, 25 (5-6), 963–983. doi: https://doi.org/10.1108/JIC-11-2023-0257

Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. 2021. A systematic review of digital transformation. *Journal of Management Studies,* 58(5), 1159–1197.

Hilbert, M., 2022. Digital technology and social change: the digital transformation of society from a historical perspective. *Dialogue-. Clin. Neurosci*. 22 (20), 189–194. https://doi.org/10.31887/DCNS.2020.22.2/mhilbert

Huang, Y., Chen, X., & Li, Y. 2024. Digital transformation and corporate social responsibility: A bidirectional relationship. *Sustainability,* 16(7).

Ichado, D. A., & Maryani, M. 2024. The impact of innovation, corporate social responsibility, environmental practices, and organisational culture on organisational sustainability, *Annals of Management and Organisation Research (AMOR)*, 5(4), 297-310 https://doi.org/10.35912/amor.v5i4.2236

Kraus, S., Jones, P., Kailer, N., Weinmann, A., Chaparro-Banegas, N., & Roig-Tierno, N. 2021. Digital Transformation: An Overview of the Current State of the Art of Research. *Sage Open*, *11*(3). https://doi.org/10.1177/21582440211047576 (Original work published 2021)

Leite, C. M., Figuereido, P. S., Lopes, P. M. & Passos, F. U. 2024. Conceptualising and measuring the digital transformation: a proposal for a measurement model, *Cadernos Gestão Pública e Cidadania* 22(5):1-15, https://doi.org.10.1590/1679-395120230081x

Li, K., Xu, H., & Zhang, Y. 2024. Digital transformation and ESG performance: Evidence from firms' environmental and social practices. *Business Strategy and the Environment,* 33(2), 1125–1140.

Nkomo, L., & Kalisz, D. 2023. Establishing organisational resilience through developing a strategic framework for digital transformation. *Digital Transformation and Society*, 2 (4), 403–426, https://doi.org/10.1108/DTS-11-2022-0059

Porter, M.E., & Kramer, M.R., 2006. The link between competitive advantage and corporate social responsibility. *Harv. Bus. Rev.* 84 (12), 78–92.

Saeed, S., Altamimi, S. A., Alkayyal, N. A., Alshehri, E., & Alabbad, D. A. 2023. Digital Transformation and Cybersecurity Challenges for Businesses' Resilience: Issues and Recommendations. *Sensors*, 23(15), 6666. https://doi.org/10.3390/s23156666

Tushar, H. 2017. The role of ethical leadership in developing a sustainable organisation. *Australasian Journal of Law, Ethics, and Governance* (AJLEG), 2(2), 83-95. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3782780

Undale, P. S., & Shinde, V., 2024. Digital transformation and cyber security: unveiling awarness. *Humanities & Language: International Journal of Linguistics Humanities and Education 1(3)*: 191-197, https://doi.org/10.32734/ayr9wh15

Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., Haenlein, M. 2021.

Digital transformation: A multidisciplinary reflection. *Journal of Business Research,* 122, 889–901.

Voegtlin, C., & Scherer, A.G., 2017. Responsible innovation and the innovation of responsibility: governing sustainable development in a globalised world. J. Bus. Ethics 143, 227–243. https://doi.org/10.1007/s10551-015-2769-z

Wamsler, C., Osberg, G., Janss, J. et al. 2024. Revolutionising sustainability leadership and education: addressing the human dimension to support flourishing, culture and system transformation. *Climatic Change* 177, 4. https://doi.org/10.1007/s10584-023-03636-8

Zhang, J., Li, H., & Zhao, H. 2025. The Impact of Digital Transformation on Organisational Resilience: The Role of Innovation Capability and Agile Response. *Systems*, *13*(2), 75. https://doi.org/10.3390/systems13020075

Zhou, Y., & Li, Z. 2024. Research on the Activation Path of Employees' Openness to Digital Transformation: A New Impetus to Realise Enterprises' Digital Transformation for Sustainable Development. *Sustainability*, 16(10), 3945. https://doi.org/10.3390/su16103945