

From Capabilities to Sustainability: The Mediating Roles of Digital Transformation and Innovation in Project-Based Organizations

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Abstract

The rapid adoption of digital technologies by project-based organizations in emerging economies has not consistently translated into sustainable organizational performance, especially under conditions of resource constraints, institutional uncertainty and skills gaps. Drawing on Dynamic Capabilities Theory, the Resource-Based View and Contingency Theory, this study examines how Digital Capabilities influence Sustainable Organizational Performance in Pakistani project-based organizations through the mediating roles of Digital Transformation and Digital Innovation and the moderating role of Digital Culture. A cross-sectional survey was administered to employees of digitally active project-based organizations in Islamabad and Rawalpindi across construction, IT/software, telecommunications, shared services and banking and financial services, yielding 257 valid responses analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4. The measurement model demonstrated acceptable reliability and validity, and the structural model showed moderate explanatory and predictive power for Digital Innovation, Digital Transformation and Sustainable Organizational Performance. The findings reveal that Digital Capabilities do not directly enhance Sustainable Organizational Performance; instead, their impact is fully transmitted through Digital Transformation and Digital Innovation, which function as parallel mediating mechanisms. In contrast, Digital Culture does not significantly moderate the relationships between Digital Capabilities and Sustainable Organizational Performance, Digital Innovation or Digital Transformation in the sampled organizations. The study contributes to the digital transformation literature by clarifying that, in project-based organizations in Pakistan, digital technologies create value only when capabilities are actively deployed through transformation and innovation processes rather than remaining latent resources. Practically, the results suggest that managers should prioritize coherent transformation programs and digital innovation initiatives over isolated technology investments and view digital culture as an important but empirically under-specified condition requiring more nuanced modeling in future research.

Keywords: *Digital Capabilities, Digital Transformation, Digital Innovation, Digital Culture, Sustainable Organizational Performance, Project-Based Organizations, PLS-SEM, Dynamic Capabilities Theory, Mediation, Moderation*

Introduction

The rapid rate of DI has altered the organizational environment across the world, where digital capabilities are becoming critical in determining project-based organizations competitive advantage. DC refer to the potential of organizations to make use of emerging digital technologies and related competencies to create value (Khin and Ho, 2019). The current empirical studies indicate that digital capabilities have an immense impact on sustainable organizational performance in both emerging and developed marketplaces and the connection is getting more complicated in the context of projects (Van Hoang et al., 2025). Businesses within such environments need versatile digital capabilities which cut across operational, managerial, as well as individual levels so that they can navigate dynamic environments (Belhadi et al., 2022). The difficulty is the translation of these capabilities into the real organizational transformation and innovation results. Digitization transformation is a crucial redesigning of digital technologies and includes radical shifts in transforming business models, processes, and business routine (Belhadi et al., 2022). Designing new services, products, or solutions with the help of the use of digital technology (Khin & Ho, 2019). A more important issue with little empirical investigation is the conditioning effect of organizational culture on digital initiatives. A digital culture allows the existence of flat hierarchies and decentralization of decision-making, which opens up room to creativity and prospects of designing digital products and services (Proksch et al., 2024). The increased degrees of digitalization demand constant re-use of organizational capabilities, which leads to smart, interconnected and decentralized inter-organizational relations (Belhadi et al., 2022).

In recent times, organizations across the globe are experiencing unprecedented levels of digital disruption that fundamentally alter their competitive landscapes and operational paradigms (Vial, 2019; Verhoef et al., 2021). The rapid advancement of digital technologies—including big data analytics, Internet of Things (IoT), cloud computing, artificial intelligence, and cyber-physical systems—has created both opportunities and imperatives for organizations to develop and leverage digital capabilities (Bharadwaj et al., 2013; Nambisan, 2017). Digital capabilities, defined as an organization's ability to mobilize digital resources and competencies to create value, have emerged as critical determinants of sustainable competitive advantage in the digital era (Mikalef et al., 2020; Warner & Wäger, 2019). Organizations possessing robust digital capabilities can sense market opportunities more rapidly, respond to environmental changes with greater agility, and reconfigure their resource bases to maintain alignment with dynamic market conditions (Teece, 2018; Belhadi et al., 2022). The relationship between digital capabilities and organizational performance has attracted considerable scholarly attention, with substantial evidence demonstrating positive associations between digital investment and firm performance outcomes (Khin & Ho, 2019; Van Hoang et al., 2025). However, the mechanisms through which digital capabilities translate into sustainable organizational performance remain incompletely understood. Recent research suggests that the capability-performance link is not direct but rather operates through intermediate organizational processes (Belhadi et al., 2022; Proksch et al., 2024).

Two such intermediate processes that have emerged prominently in literature are digital transformation and digital innovation. Digital transformation refers to the strategic re-orientation of organizational processes, business models, and operational structures enabled by digital technologies (Matt et al., 2015; Vial, 2019). It encompasses radical changes in how organizations

create and capture value, interact with stakeholders, and conduct business activities (Belhadi et al., 2022). Digital innovation, in contrast, focuses specifically on the creation of new products, services, or solutions leveraging emerging digital technologies to differentiate offerings and enhance customer value propositions (Khin & Ho, 2019; Nambisan et al., 2017). Importantly, evidence suggests that digital capabilities may influence performance through both transformation and innovation pathways, potentially operating as parallel rather than sequential mechanisms (Khin & Ho, 2019). Organizations with strong digital capabilities can simultaneously optimize existing processes through digital transformation while exploring new value creation opportunities through digital innovation (March, 1991). This parallel mediation structure represents an important theoretical advancement, as it challenges simplistic linear models of digital capability deployment and highlights the multifaceted nature of digital value creation. Pakistani project-based organizations face distinctive challenges in developing and deploying digital capabilities. These include limited access to capital for digital investments, scarcity of digitally skilled talent, underdeveloped digital infrastructure, and organizational cultures that may be resistant to rapid technological change (OICCI, 2023).

From a theoretical perspective, this study builds primarily upon Dynamic Capabilities Theory (Teece et al., 1997; Teece, 2007, 2018) and the Resource-Based View (Barney, 1991; Wernerfelt, 1984), while also incorporating insights from Contingency Theory (Burns & Stalker, 1961; Lawrence & Lorsch, 1967) to explain moderating effects. Dynamic Capabilities Theory provides the conceptual foundation for understanding how organizations develop, deploy, and reconfigure digital resources in response to changing environments. The theory's tripartite framework of sensing, seizing, and reconfiguring capabilities aligns closely with the processes through which digital capabilities enable both transformation and innovation (Teece, 2018). The Resource-Based View complements this perspective by explaining why digital capabilities constitute strategic resources—they are valuable in enabling differentiation and cost advantages, rare due to the specialized knowledge and infrastructure required, imperfectly imitable given their embeddedness in organizational routines and complementary assets, and non-substitutable given the fundamental importance of digital technologies in contemporary business (Mikalef et al., 2020). However, existing theoretical frameworks require extension and adaptation to fully account for the dual mediation mechanisms (transformation and innovation operating in parallel) and the cultural boundary conditions specific to project-based organizational contexts.

This study therefore aims to advance theoretical understanding by empirically testing an integrated model that specifies these complex relationships, thereby extending dynamic capabilities theory beyond its traditional application in functional organizations to the distinctive context of project-based work. The imperative for sustainable organizational performance adds an additional dimension to this investigation. Sustainable performance encompasses not only economic dimensions (financial performance, market position) but also operational efficiency, client satisfaction, employee retention, and organizational adaptability of which are critical for long-term viability in competitive and volatile markets (Belhadi et al., 2022; Elkington, 1997). For project-based organizations, sustainable performance manifests in the ability to consistently deliver successful projects, maintain and grow client relationships, attract and retain talented project professionals, and adapt to evolving technological and market conditions (Shenhar & Dvir, 2007). Understanding how digital capabilities contribute to this multifaceted performance construct through transformation and innovation pathways, and under what cultural conditions, therefore addresses both theoretical gaps and pressing managerial concerns.

This study contributes to the theoretical understanding and practical application of digital capabilities in enhancing sustainable organizational performance within project-based organizations (PBOs). Theoretically, it extends Dynamic Capabilities Theory by examining digital transformation and digital innovation as parallel mediating mechanisms through which digital capabilities influence organizational performance. It also integrates Contingency Theory by investigating digital culture as a potential moderator, providing insights into the contextual conditions affecting digital capability effectiveness. Furthermore, the study extends existing frameworks to project-based organizational settings and adopts a multidimensional perspective of sustainable performance encompassing economic, operational, and relational outcomes.

Practically, the findings provide strategic guidance for organizational leaders and project managers in developing and deploying digital capabilities effectively. By highlighting the roles of digital transformation and innovation, the study supports balanced investment in process optimization, technological advancement, and innovative service development. It also offers insights into fostering digital cultures that encourage collaboration, experimentation, knowledge sharing, and continuous learning. Human resource professionals can use these findings to design targeted digital training and development programs, while consultants can apply the proposed framework to assess digital maturity and identify organizational capability gaps. Additionally, the study offers useful implications for policymakers seeking to promote digital adoption and organizational sustainability. Overall, the research provides a foundation for improving digital strategy, strengthening organizational learning, enhancing project delivery, and achieving sustainable competitive advantage in increasingly digital business environments.

Literature Review

Digital Capabilities and Organizational Sustainable Performance

One of the resources needed in the innovation processes is technological skills and competence (Khin and Ho, 2019). The efficient application of technology also demands the ability to manage and use it properly in addition to its ownership (Khin & Ho, 2019). The use of Industry 4.0 allows achieving greater sustainable performance in various ways (Belhadi et al., 2022). The industry 4.0 helps managers to embrace modern technological processes in order to accomplish sustainable enhancement in the value chains, and the management of Industry 4.0 technologies is an enhancement of resource utilization effectiveness via end to end transparency in value chains (Belhadi et al., 2022). The performance mechanisms of capabilities have several routes and paths. Digital capabilities can help organizations streamline operations, make improved decisions with the help of data analytics, and react faster to market shifts (Khin and Ho, 2019). The technologies of Industry 4.0, including Big Data Analytics, Internet of Things, and Cyber-Physical Systems, enhance the sustainable performance by providing more visibility, ensuring coordination, and supporting decisions (Belhadi et al., 2022).

Based on above discussion, the following hypotheses is proposed:

H1: Digital Capabilities have a significant positive effect on Sustainable Organizational Performance.

Mediating role of Digital Transformation and Digital Innovation

Digital Business Transformation plays a positive mediating role in the relationship between Industry 4.0. sustainable performance capabilities through the integration of the circular concepts to generate. Business models (Belhadi et al., 2022). The opportunities of operation in terms of technologies and transformation is enhanced through infrastructures because of making more information and data. communicable, memorable, and traceable (Belhadi et al., 2022). This implies that transformation is among the. mechanisms that the potential of capabilities is attained in actual change within an organization. The Industry 4.0 features allow the companies to acquire new managerial and human capabilities in order to be innovative. through technologies with strategies that generate implications of digital transformation and motivating. increased operation performance (Belhadi et al., 2022). Those companies that have been able to redefine. efficiency is achieved in the operations, more coordination and utilization of resources. The mediating role of digital plays the role of digital orientation and ability between the financial and non-financial performance innovation (Khin and Ho, 2019). A highly digitalized company that can is more placed to do so. offer new products that are more acceptable to the clients thereby producing more of them. financial net and sales (Khin and Ho, 2019). The IT digital innovation can be referred to as innovative IT. resolutions to integrate new digital technologies so that the non-tech businesses can be digitalized. (Khin and Ho, 2019).

Based on above discussion, the following hypotheses are proposed:

H2: Digital Transformation mediates the relationship between Digital Capabilities and Sustainable Organizational Performance.

H3: Digital Innovation mediates the relationship between Digital Capabilities and Sustainable Organizational Performance.

Moderating Role of Digital Culture

A digital culture could complement impacts of digital strategy on digitalization through the unfolding strategy potential (Proksch et al., 2024). This means that culture is not the cause of transformation or innovation, but it predisposes the effectiveness with which capabilities are transforming into such results. Digital culture builds a space where team members could utilize digital technologies (Proksch et al., 2024). Digital culture is characterized by the openness of the discussion of failures with the entire team (Proksch et al., 2024). Factors in favor arise when it has been found that organizational flexibility has a positive relationship with perceived organizational change readiness (Veseli et al., 2025). The moderating concept might be understood in the following way: at low levels of digital culture, the organization might have the capabilities but fail to utilize them because of resistance, poor collaboration, or fear of failure. At high levels of digital culture, the same capabilities can be utilized more, due to the fact that employees are empowered, work in teams, and ready to experiment. Culture is, therefore, a boundary condition that defines when and how much the digital capabilities would bring about the results of transformation, and innovation.

Based on above discussion, the following hypotheses are proposed:

H4a: Digital Culture moderates the relationship between Digital Capabilities and Organizational Sustainable Performance, such that the relationship is stronger when Digital Culture is high.

H4b: Digital Culture moderates the relationship between Digital Capabilities and Digital Innovation, such that the relationship is stronger when Digital Culture is high.
H4c: Digital Culture moderates the relationship between Digital Capabilities and Digital Transformation, such that the relationship is stronger when Digital Culture is high.

Research Hypothesis

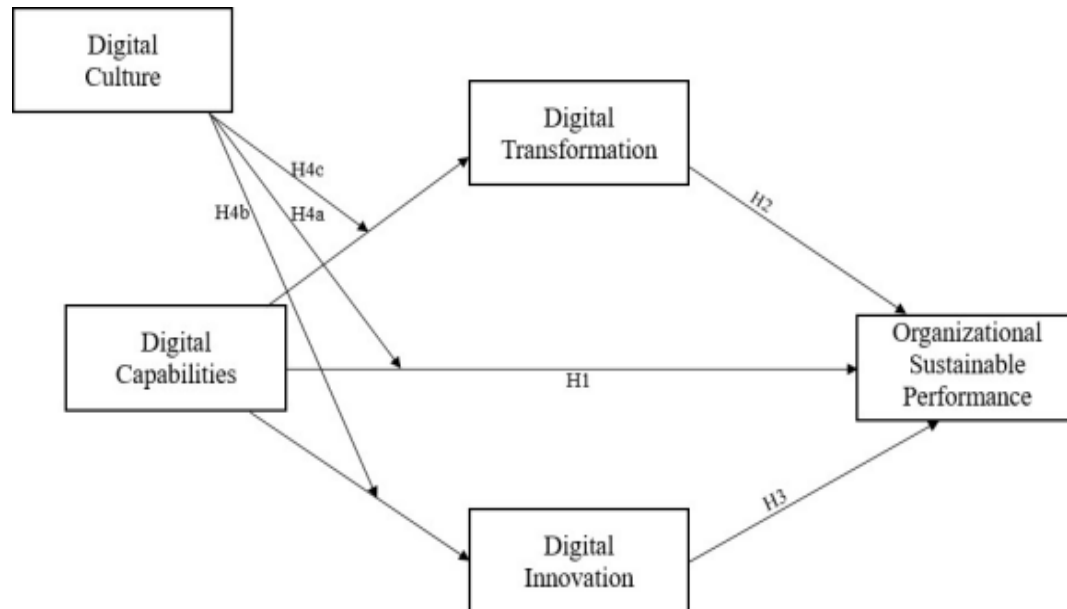


Figure 1: Hypothesized Model

Research Methodology

Data collection technique (survey)

Data are collected through a structured, self-administered questionnaire, distributed primarily online to employees of project-based organizations of Islamabad and Rawalpindi. The questionnaire includes an introductory section explaining the purpose of the study and ethical assurances, followed by demographic items and then sets of statements measuring each construct using five-point Likert scales. Online administration through tools such as web-based forms enables efficient access to respondents across different organizations and locations, which is particularly useful in urban clusters like Islamabad and Rawalpindi. Self-administration reduces interviewer bias and allows participants to complete the survey at a convenient time, which can improve the response rate and encourage more thoughtful answers.

Sample Size

The size of the sample in this research is based on the recommendations for Partial Least Squares Structural Equation Modeling (PLS-SEM). In variance-based structural equation modeling, sample size requirements are typically evaluated using rules of thumb such as the “10-times rule” as well as more recent power-analysis-based guidelines (Hair et al., 2019; Hair et al., 2021). According to the 10-times rule, the minimum sample should be at least ten times the maximum

number of structural paths pointing at any latent variable in the model, which in the present study would already require well above one hundred observations. More rigorous Monte Carlo simulations for PLS-SEM further suggest that, for models with multiple mediating and moderating relationships, a sample of 200 or more cases is generally sufficient to detect medium effect sizes at acceptable levels of statistical power when using bootstrapping procedures (Cohen, 2013; Hair et al., 2019). In line with these recommendations, data were collected from 257 respondents working in project-based and digitally active organizations located in Islamabad and Rawalpindi, with construction companies constituting the largest share of the sample. After applying data screening procedures to remove incomplete and ineligible responses, a final sample of 249 valid cases was retained for analysis. This final sample size exceeds the minimum requirements for PLS-SEM and is adequate for estimating the proposed measurement and structural models, testing direct, mediating, and moderating effects, and conducting bootstrapping-based inference using SmartPLS 4.

Instrument Development/Selection

The basis of any rigorous quantitative study is the choice and construction of valid and reliable measurement instruments (Churchill, 1979). This research will use a quantitative method of choosing instruments as it will use well-known scales that have been validated in previous empirical studies with high psychometric quality. As suggested by Hinkin (1998) and DeVellis (2017), measurement tools to be used in this study are thoroughly chosen according to their theoretical foundation, content and construct validity, reliability, and previous use in the literature. Multi-item scales guided by Likert-type response formats with anchored rating points as found in reputable academic journals were used in measuring all constructs of this study. Multi-item measures improve the measurement reliability and precision because they measure complex constructs in a multidimensional manner, and minimize measurement error (Hair et al., 2010). Every item was measured through five points likert scale with 1-Strongly Agree, 2-Agree, 3-Neutral, 4-Disagree and 5-Strongly disagree (Likert, 1932; Joshi et al., 2015). The Likert scale was adopted due to its universal application in the research of behavioral and management to elicit responses to the respondent in a consistent and measurable way. The questions concerning demographic and organizational profile were measured either on nominal or ordinal scales according to the nature of the information that is needed.

Table 1: Instruments

S.NO	Variables	Sources	Items
1	Digital Capabilities	Khin and Ho (2019); Zhou and Wu (2010)	5
2	Digital Transformation	Proksch et al. (2024)	5
3	Digital Innovation	Khin and Ho (2019); Paladino (2007)	7
4	Digital Culture	Proksch et al. (2024); Lukas et al. (2013); Duerr et al. (2018)	5
5	Sustainable Organizational Performance	Khin and Ho (2019); Belhadi et al. (2022)	6

Data analysis techniques (statistical analysis)

The analysis relies on a series of statistical techniques designed to address the research objectives step by step. Initial procedures include data screening to remove incomplete or low-quality responses and descriptive statistics to summarize the sample and key variables. Reliability and validity of the scales are then evaluated to ensure that each construct is measured consistently and appropriately. After these preliminaries, bivariate correlations are examined to understand basic associations among variables. The main hypothesis tests are conducted using multiple regression and structural equation modeling, which allow the researcher to estimate direct effects of digital capabilities on performance, mediation paths through digital transformation and digital innovation, and moderation effects involving digital culture.

Table 2: Data analysis techniques

Research Question / Objective	Research Hypothesis	Constructs / Variables Involved	Data Analysis Technique / Test (PLS-SEM, SmartPLS 4)
RQ1: To examine the direct impact of digital capabilities on sustainable organizational performance.	H1: Digital Capabilities have a positive and significant effect on Sustainable Organizational Performance.	IV: Digital Capabilities (DC) DV: Sustainable Organizational Performance (SOP)	Descriptive Statistics; PLS-SEM Structural Model Assessment; Path Coefficient Estimation; Bootstrapping (5,000 resamples); t-values and p-values significance testing.
RQ2: To investigate whether digital transformation mediates the relationship between digital capabilities and sustainable organizational performance.	H2: Digital Transformation mediates the relationship between Digital Capabilities and Sustainable Organizational Performance.	IV: DC MV: Digital Transformation (DT) DV: SOP	PLS-SEM Mediation Analysis; Bootstrapping of Specific Indirect Effects; Indirect Effect Significance Testing; Assessment of Full vs Partial Mediation.
RQ3: To investigate whether digital innovation mediates the relationship between digital capabilities and sustainable organizational performance.	H3: Digital Innovation mediates the relationship between Digital Capabilities and Sustainable Organizational Performance.	IV: DC MV: Digital Innovation (DI) DV: SOP	PLS-SEM Mediation Analysis; Bootstrapping of Specific Indirect Effects; Indirect Effect Significance Testing.
RQ4: To examine whether digital culture moderates the relationship between digital capabilities and sustainable organizational performance.	H4a: Digital Culture moderates the relationship between Digital Capabilities and Sustainable Organizational Performance.	IV: DC Moderator: Digital Culture (DCU) DV: SOP	PLS-SEM Moderation Analysis; Creation of Interaction Term (DC × DCU); Bootstrapping for Interaction Significance Testing.
RQ5: To examine whether digital culture moderates the relationship between digital capabilities and digital innovation.	H4b: Digital Culture moderates the relationship between Digital Capabilities and Digital Innovation.	IV: DC Moderator: DCU DV: DI	PLS-SEM Moderation Analysis; Creation of Interaction Term (DC × DCU); Bootstrapping for Interaction Significance Testing.
RQ6: To examine whether digital culture moderates the relationship between digital capabilities and digital transformation.	H4c: Digital Culture moderates the relationship between Digital Capabilities and Digital Transformation.	IV: DC Moderator: DCU DV: DT	PLS-SEM Moderation Analysis; Creation of Interaction Term (DC × DCU); Bootstrapping for Interaction Significance Testing.

Data Analysis and Results

Demographic Analysis

Demographic analysis gives the profile of the respondents in terms of gender, age, current position/role, type of organization/industry and participation in projects. It is important to know the demographic representation of the sample so that the findings can be evaluated regarding representativeness and generalizability.

Table 3: Demographic Profile

Category	Frequency	Percentage (%)
Male	171	66.5
Female	86	33.5
Industry of Organization		
Construction	106	41.2
IT / Software	88	34.2
Other	26	10.1
Engineering / Manufacturing	23	8.9
Banking / Finance	8	3.1
Consulting	6	2.3
Job Role		
Team member / professional staff	176	68.8
Middle management	38	14.8
Top management	23	9.0
Project manager	19	7.4
Years of Experience in Project-Based Work		
2–5 years	165	64.2
Less than 2 years	49	19.1
6–10 years	29	11.3
More than 10 years	14	5.4
Size of Organization		
Medium (50–249)	122	48.2
Small (10–49)	74	29.2
Large (250+)	55	21.7
Micro (1–9 employees)	2	0.8

Measurement Model Assessment

The results indicate that Digital Capabilities demonstrated satisfactory reliability ($\alpha = 0.766$; CR = 0.845), indicating good internal consistency among its measurement items. Digital Culture also exhibited acceptable reliability ($\alpha = 0.710$; CR = 0.811), suggesting that the items consistently represent the construct. Similarly, Digital Innovation showed adequate internal consistency ($\alpha = 0.785$; CR = 0.845). Digital Transformation demonstrated acceptable reliability ($\alpha = 0.716$; CR =

0.816), meeting the recommended threshold for both indicators. Furthermore, Sustainable Organizational Performance exhibited moderate but acceptable reliability ($\alpha = 0.655$; CR = 0.777). Although the Cronbach's alpha value is slightly below 0.70, the composite reliability exceeds the recommended threshold, confirming satisfactory internal consistency in line with PLS-SEM standards.

Table 4: Reliability Analysis of Scales

Variable	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)
Digital Capabilities	0.766	0.778	0.845
Digital Culture	0.710	0.721	0.811
Digital Innovation	0.785	0.804	0.845
Digital Transformation	0.716	0.718	0.816
Sustainable Organization Performance	0.655	0.674	0.777

Discriminant validity was assessed using the Heterotrait–Monotrait Ratio (HTMT) of correlations. According to Henseler et al. (2015), HTMT values below 0.85 indicate strict discriminant validity, while values below 0.90 are considered acceptable in social science research. All HTMT values are below 0.90, discriminant validity is established. Therefore, the constructs are empirically distinct and suitable for structural model evaluation.

Table 5: Discriminant Validity Analysis

Variable	DC	DCul	DI	DT	SOP	DCul x DC
Digital Capabilities (DC)						
Digital Culture (DCul)	0.763					
Digital Innovation (DI)	0.796	0.881				
Digital Transformation (DT)	0.697	0.728	0.779			
Sustainable Organization Perf. (SOP)	0.517	0.655	0.749	0.586		
Digital Culture x Digital Capa.	0.545	0.468	0.329	0.438	0.246	

Correlation Analysis

The correlation results indicate that all variables are positively and significantly associated. The strongest relationship is observed between Digital Capabilities and Digital Innovation ($r = .779$, $p < .001$), while the weakest is between Digital Capabilities and Sustainable Organizational Performance ($r = .549$, $p < .001$). None of the correlation coefficients exceed the threshold of 0.80, indicating that multicollinearity is not a concern. These findings provide preliminary support for the hypothesized relationships and justify proceeding with structural model analysis.

Table 6: Correlation Matrix

	DC	DCul	DI	DT	SOP
DC	1	.722***	.779***	.674***	.549***

DCul	.722***	1	.754***	.644***	.611***
DI	.779***	.754***	1	.724***	.629***
DT	.674***	.644***	.724***	1	.592***
SOP	.549***	.611***	.629***	.592***	1

Structural Model Assessment

Collinearity (VIF)

Variance Inflation Factor (VIF) is used to assess multicollinearity among predictor constructs in the structural model. High VIF values (>5) indicate high collinearity, which can distort regression results. The acceptable threshold for VIF is generally considered to be less than 3.3. The VIF values for all relationships are below the threshold of 3.3, indicating no multicollinearity concerns. Thus, the constructs in the structural model are sufficiently distinct, and multicollinearity does not threaten the model's validity.

Table 7: VIF Analysis

Relationship	VIF	Interpretation
Digital Capabilities → Digital Innovation	1.935	No multicollinearity issue
Digital Capabilities → Digital Transformation	1.734	No multicollinearity issue
Digital Capabilities → Sustainable Organizational Performance	1.806	No multicollinearity issue
Digital Culture → Digital Innovation	1.384	No multicollinearity issue
Digital Culture → Digital Transformation	1.107	No multicollinearity issue
Digital Culture → Sustainable Organizational Performance	1.312	No multicollinearity issue
Digital Culture × Digital Capabilities → Digital Innovation	1.515	No multicollinearity issue
Digital Culture × Digital Capabilities → Digital Transformation	1.468	No multicollinearity issue
Digital Culture × Digital Capabilities → Sustainable Organizational Performance	1.546	No multicollinearity issue
Digital Innovation → Sustainable Organizational Performance	1.720	No multicollinearity issue
Digital Transformation → Sustainable Organizational Performance	1.276	No multicollinearity issue

Effect size (f^2) measures the magnitude of the effect of an exogenous variable on an endogenous variable. According to Cohen (1988), an f^2 value of 0.02 indicates a small effect, 0.15 indicates a medium effect, and 0.35 indicates a large effect.

Table 8: Effect Size (f^2)

Relationship	f^2	Interpretation
Digital Capabilities → Digital Innovation	0.238	Large effect
Digital Capabilities → Digital Transformation	0.129	Medium effect

Digital Capabilities → Sustainable Organizational Performance	0.012	Small effect
Digital Culture → Digital Innovation	0.198	Large effect
Digital Culture → Digital Transformation	0.090	Medium effect
Digital Culture → Sustainable Organizational Performance	0.027	Medium effect
Digital Culture × Digital Capabilities → Digital Innovation	0.009	Small effect
Digital Culture × Digital Capabilities → Digital Transformation	0.001	Small effect
Digital Culture × Digital Capabilities → Sustainable Organizational Performance	0.074	Medium effect
Digital Innovation → Sustainable Organizational Performance	0.030	Medium effect
Digital Transformation → Sustainable Organizational Performance	0.047	Medium effect

Predictive relevance (Q^2) measures the model's ability to predict new, out-of-sample data. A Q^2 value greater than 0 indicates that the model has predictive relevance.

Table 9: Predictive Relevance (Q^2)

Construct	Q^2	Interpretation
Digital Innovation	0.663	Predictive relevance
Digital Transformation	0.450	Predictive relevance
Sustainable Organizational Performance	0.353	Predictive relevance

The structural model demonstrates strong explanatory power for Digital Innovation, with an R^2 value of 0.686, indicating that approximately 68.6% of the variance in Digital Innovation is explained by its predictors. This suggests that Digital Capabilities and Digital Culture substantially contribute to innovation outcomes within organizations.

Table 10: Coefficient of Determination (R^2)

Endogenous Construct	R^2	R^2 Adjusted	Interpretation
Digital Innovation	0.686	0.682	Moderate to Strong
Digital Transformation	0.492	0.486	Moderate
Sustainable Organizational Performance	0.501	0.491	Moderate

Hypothesis Testing and Corresponding Analysis

H1: Digital Capabilities have a significant positive effect on Sustainable Organizational Performance

The results indicate that the direct effect of Digital Capabilities on Sustainable Organizational Performance is statistically significant, with a path coefficient ($\beta = 0.375$), t-value = 2.487, and a p-value = 0.013. Since the p-value is below the threshold of 0.05, and the t-value is above 1.96, the relationship is statistically significant. This suggests that Digital Capabilities positively contribute to Sustainable Organizational Performance.

These findings suggest that Digital Capabilities alone positively impact the Sustainable Organizational Performance. Therefore, H1 is supported.

Table 11: H1 Direct Effect

Interaction Path	β	t-value	P-value	Decision
DC → SOP	0.375	2.487	0.013	Supported

H2: Digital Transformation mediates the relationship between Digital Capabilities and Sustainable Organizational Performance.

Importantly, the direct effect (Digital Capabilities to Sustainable Organizational Performance) was insignificant, while the indirect effect through Digital Transformation was significant. This pattern indicates full mediation (also referred to as indirect-only mediation). This suggests that Digital Capabilities contribute to Sustainable Organizational Performance only when they are translated into organizational transformation initiatives.

Accordingly, H2 is supported, confirming that Digital Transformation acts as a crucial mechanism linking Digital Capabilities to performance outcomes.

Table 12: H2 Indirect Effect (Mediation via DT)

Interaction Path	β	t-value	P-value	Decision
DC → DT → SOP	0.112	2.414	0.016	Supported (Full Mediation)

H3: Digital Innovation mediates the relationship between Digital Capabilities and Sustainable Organizational Performance.

The indirect effect through Digital Innovation is statistically significant ($\beta = 0.084$, $t = 2.523$, $p = 0.012$). Both component paths—Digital Capabilities → Digital Innovation and Digital Innovation to Sustainable Organizational Performance are significant, indicating that Digital Capabilities enhance innovation activities, which subsequently improve sustainable performance. Similar to H2, the direct path from Digital Capabilities to Sustainable Organizational Performance remains insignificant, while the indirect path through Digital Innovation is significant. This confirms full mediation. These results demonstrate that Digital Capabilities improve Sustainable Organizational Performance primarily through innovation-driven mechanisms rather than through a direct pathway. Therefore, H3 is supported.

Table 13: H3 Indirect Effect (Mediation via DI)

Interaction Path	β	t-value	P-value	Decision
DC → DI → SOP	0.084	2.523	0.012	Supported (Full Mediation)

H4a: Digital Culture moderates the relationship between Digital Capabilities and Sustainable Organizational Performance, such that the relationship would be stronger when Digital Culture is high.

Moderation was tested using the interaction term between Digital Capabilities and Digital Culture. The interaction effect is statistically insignificant ($\beta = -0.088$, $t = 1.492$, $p = 0.136$). Since the p-value exceeds 0.05 and the t-value is below the critical value of 1.96, the moderating effect is not supported.

This suggests that the strength of the relationship between Digital Capabilities and Sustainable Organizational Performance does not significantly vary based on the level of Digital Culture. Therefore, H4a is rejected.

Table 14: H4a Moderation Effect

Interaction Path	B	t-value	P-value	Decision
DC×DCU → SOP	-0.088	1.492	0.136	Not Supported

H4b: Digital Culture moderates the relationship between Digital Capabilities and Digital Innovation, such that the relationship is stronger when Digital Culture is high.

H4b proposed that Digital Culture moderates the relationship between Digital Capabilities and Digital Innovation. The interaction effect was examined through the bootstrapped structural path.

The results reveal that the interaction term is statistically insignificant ($\beta = -0.025$, $t = 0.966$, $p = 0.334$). The p-value substantially exceeds the significance threshold, indicating that Digital Culture does not significantly strengthen or weaken the relationship between Digital Capabilities and Digital Innovation. Accordingly, H4b is not supported

Table 15: H4b Moderation Effect

Interaction Path	β	t-value	P-value	Decision
DC×DCU → DI	-0.025	0.966	0.334	Not Supported

H4c: Digital Culture moderates the relationship between Digital Capabilities and Digital Transformation, such that the relationship is stronger when Digital Culture is high.

The results indicate that the moderating effect is statistically insignificant ($\beta = -0.031$, $t = 0.752$, $p = 0.452$). Since the effect is not significant, Digital Culture does not significantly influence the strength of the relationship between Digital Capabilities and Digital Transformation. Therefore, H4c is rejected

Table 16: H4c Moderation Effect

Interaction Path	B	t-value	P-value	Decision
DC×DCU → DT	-0.031	0.752	0.452	Not Supported

Conclusion

This study investigated the impact of Digital Capabilities on Sustainable Organizational Performance in project-based organizations in Pakistan, examining the parallel mediating roles of Digital Transformation and Digital Innovation and the moderating role of Digital Culture. Drawing on Dynamic Capabilities Theory, the Resource-Based View, and Contingency Theory, the study proposed and tested an integrated model using PLS-SEM with data from 257 respondents across PBOs in Islamabad and Rawalpindi. The empirical findings reveal that Digital Capabilities do not directly enhance Sustainable Organizational Performance in project-based organizations. This counterintuitive finding challenges the often-assumed direct link between capability possession and performance outcomes. Instead, the study demonstrates that

the capability–performance relationship is fully mediated through two parallel pathways: Digital Transformation and Digital Innovation. Digital Capabilities significantly predict both Digital Transformation (representing the reconfiguration of organizational processes and structures) and Digital Innovation (representing the creation of new digital products, services, and solutions), which in turn significantly enhance Sustainable Organizational Performance. The parallel mediation finding is a key contribution of this study. It demonstrates that organizations must not only invest in building digital capabilities but must also actively pursue both transformation and innovation agendas to realize performance benefits. The simultaneous significance of both mediation pathways supports the exploration–exploitation framework (March, 1991), confirming that project-based organizations benefit from concurrently optimizing existing processes (exploitation through transformation) and developing new value propositions (exploration through innovation). This dual pathway model provides a more comprehensive and realistic account of digital value creation than single-mediator models prevalent in prior research. The non-significant moderation effects of Digital Culture across all three hypothesized pathways suggest that, in the Pakistani PBO context, digital culture functions as a direct contributor to digital outcomes rather than as a boundary condition that amplifies or attenuates the effectiveness of digital capabilities. The strong bivariate correlations between Digital Culture and all other study variables suggest that culture plays an important role in the digital ecosystem, but its influence appears to operate additively rather than interactively. This finding refines the theoretical understanding of culture's role in digital contexts, suggesting that Contingency Theory's interaction-based predictions may need to be qualified by considerations of shared variance, contextual homogeneity, and the relative strength of main effects.

The study's model demonstrated substantial explanatory power, with R^2 values indicating that the proposed framework explains 68.6% of variance in Digital Innovation, 49.2% in Digital Transformation, and 50.1% in Sustainable Organizational Performance. All endogenous constructs exhibited strong predictive relevance ($Q^2 > 0$), confirming that the model is not merely explanatory but also possesses meaningful predictive capability. These metrics collectively validate the theoretical framework and confirm its applicability to the project-based organizational context in emerging economies. In conclusion, this research contributes to the digital capabilities literature by providing empirical evidence from an underexplored context—project-based organizations in Pakistan. It advances theoretical understanding by demonstrating the full mediation mechanism through parallel pathways and by challenging the assumed moderating role of digital culture. The findings underscore that digital capabilities are necessary but not sufficient for sustainable performance; their value is realized only when organizations actively transform their processes and innovate their offerings. For Pakistani project-based organizations seeking to thrive in the digital era, the message is clear: build capabilities, but invest equally in transformation and innovation to translate potential into performance.

Recommendations

Theoretical and practical recommendations are proposed based on the study's findings. Theoretically, Dynamic Capabilities Theory (DCT) should incorporate parallel mediation pathways, recognizing that digital transformation and digital innovation simultaneously translate digital capabilities into organizational performance. Future research should examine digital culture as an antecedent, mediator, or configurational element rather than solely as a moderator. Digital capability frameworks should also be adapted to project-based organizations (PBOs),

considering temporary structures, inter-project knowledge transfer, and project-level execution. Integrating the Resource-Based View with DCT can further explain how digital resources generate competitive advantage. Practically, PBOs should pursue digital transformation and innovation alongside capability development. A dual-pathway strategy combining process optimization with innovative service development can maximize performance outcomes. Organizations should foster digital cultures that encourage experimentation, collaboration, knowledge sharing, and continuous learning. Digital strategies should be tailored to sector-specific requirements, particularly in construction and information technology, considering differences in digital maturity and operational needs. Investment in digital talent development should encompass strategic thinking, innovation management, change leadership, and data-driven decision-making. Finally, organizations should establish cross-project knowledge management systems and communities of practice to facilitate knowledge transfer and disseminate successful digital practices. Collectively, these recommendations emphasize that organizational performance depends not only on possessing digital capabilities but also on effectively deploying them through complementary transformation and innovation mechanisms to improve project delivery, strengthen organizational learning, and achieve sustainable competitive advantage.

Limitations of Study & Future Directions

This study has several limitations that provide opportunities for future research. First, its cross-sectional design limits causal inference and does not capture the temporal dynamics of digital transformation and innovation. Future studies should employ longitudinal designs to examine relationships over time. Second, reliance on self-reported questionnaire data may introduce common method bias. Researchers should incorporate objective performance indicators and data from multiple sources. Third, the study focused on project-based organizations in Islamabad and Rawalpindi, Pakistan, particularly construction and IT sectors, limiting generalizability. Comparative studies across countries, regions, and industries are recommended. Fourth, the sample predominantly represented operational-level employees, suggesting the need to include senior managers and strategic decision-makers. Fifth, the five-item digital culture scale may not fully capture its multidimensional nature. Future research should explore alternative cultural dimensions and examine culture as an antecedent, mediator, or configurational factor. Sixth, the model considered only digital transformation and digital innovation as mediators. Additional mechanisms, including digital agility, organizational learning, and knowledge management, should be investigated alongside moderators such as leadership, environmental dynamism, and digital maturity. Furthermore, multilevel research could examine interactions among individual, project, and organizational capabilities. Qualitative and mixed-methods approaches would provide deeper insights into capability development and deployment. Finally, examining individual digital capability dimensions and specific performance outcomes could generate more precise theoretical explanations and actionable managerial recommendations.

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