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DIGITAL CAPABILITIES AND INNOVATION PERFORMANCE IN PAKISTAN: THE ROLE OF EMPLOYEE ENGAGEMENT

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ABSTRACT

The increasing pace of technological advancement and globalization has compelled organizations to develop strong digital capabilities to remain competitive in today's business environment. Digital capabilities refer to an organization's ability to acquire, integrate, and utilize digital technologies, resources, and competencies to improve business processes and create value. The study examines how digital capabilities (Cloud Computing Adoption (CCA), Cybersecurity Capability (CC), AI-based Decision Support Systems (ADSS), and Digital Transformation (DT) affect the Innovation Performance (IP) in organizations in Pakistan. The research uses quantitative method, and 350 employees were the subjects. Data was analyzed using PLS-SEM and examined with mediation of Employee Engagement (EE) and moderation of Organizational Digital Culture (ODC). All digital capabilities were found to positively influence innovation performance both directly and indirectly, via employee engagement. Organizational digital culture plays significant moderating role between employee engagement & innovative performance. The results indicate that technological integration should go hand-in-hand with human-centered engagement and positive digital culture to maximize innovative outcomes.

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INTRODUCTION

Pakistan is now undergoing a digital transformation at an amazingly fast pace, with organizations in the banking, telecoms and manufacturing sectors following suit by embracing new and emerging technologies to remain competitive (Velyako & Musa, 2023). Cloud native, artificial intelligence & cyber security are no longer just buzzwords and trends, but strategic components that are essential

for achieving operational efficiency and value creation. Technology capabilities are the enablers of innovation, but the realization of innovation capability is dependent on how the technology tools are used by human workforce. While lot of organizations in Pakistan have invested in technological part of their infrastructure, they still don't have the innovation performance they are looking for, because they have ignored human factor. The psychological connection between the availability of digital tools and driving action needed for innovation is engagement of employees. Furthermore, the surrounding digital culture that these tools are applied to can either speed up or slow down the conversion of efforts of employees who are working with them to innovative results (Khan, Ahmad, Shaukat & Kashif, 2024).

Problem Statement

The digital technologies are an expensive investment in many organizations in Pakistan, but they don't manage to achieve the level of innovation performance. This indicates that role of technology is not enough, employee engagement and digital culture could be crucial factors in driving the innovation from digital capabilities. Though digitalization is key enabler, little empirical evidence exists in Pakistani context on how effective digital capabilities, at specific level, affect innovation performance, within the prism of employee engagement and cultural moderation. This study closes this gap, because it includes a comprehensive model that incorporates technical capabilities and human and cultural factors for ensuring sustainability. The research is focused on the employees of the digitally transforming organizations in different industries in Pakistan (Iqbal, Liaquat, Ahmed & Iqbal, 2026).

Research Gap

Past research has focused on digital technologies and digital innovations alone and extraordinarily little research has studied the effect of three other variables namely Cloud Computing Adoption (CCA), Cybersecurity Capability (CC), AI-based Decision Support Systems (ADSS), along with Digital Transformation (DT) upon Innovation Performance in Pakistan. Furthermore, the mediating role of the employee engagement, as well as moderating role of organizational digital culture were not investigated.

Scope of Study

The present study aims to see the effect of CT (independent variables) on IP (independent variable) of the employees of the IT, Banking, and Manufacturing and Education sectors in Pakistan. It also examines how Employee Engagement acts as a mediator amid organizational support and work effectiveness, how organization digital culture acts as moderator amid employee engagement and work effectiveness.

Research Objectives

1. To study direct effect of cloud computing adoption, CC, ADSS & DT on innovation performance.
2. To assess the effect of these digital skills on employee engagement in the particular context.
3. To analyze the mediation role of "EE" amid digital capabilities and Innovation Performance.
4. To examine if there is a moderation effect between EE with Innovation Performance of ODC.

Research Questions

1. Is cloud computing, cyber security, AI based decision systems & digital transformation having a significant impact on innovation performance?
2. Are there any gaps in relationship amid engagement and innovation performance that can be explained by employee capabilities in digital?
3. Does positive organization digital culture have positive impact on positive relationship amid employee engagement & innovation performance?

LITERATURE REVIEW

The digital capabilities, cloud infrastructure, cybersecurity, AI-driven insights as well as systemic transformation, are the agility that is needed for organizations to innovate (Calen, Edward, Thomas & Nagian, 2025). These abilities mitigate against operation silos and enable data-driven decisions, in Pakistani context. But just having technology doesn't mean innovation, it takes right technology combined with the right organization. How digital tools are used is a crucial factor in employee engagement. When employees are engaged, they are likely to try out modern technologies, make recommendations for technology improvement and embrace the continuous journey of innovation (Anser, Yousaf, Khan & Usman, 2021). These capabilities enable organization to control emerging technologies like artificial intelligence, cloud computing, big data analytics, and digital platforms to enhance operational efficiency and innovation outcomes. Despite the growing importance of digital transformation and innovation, limited empirical research has examined role of employee engagement in linking digital capabilities and innovation performance within Pakistani context. If an empowered employee is using AI-based system, or AI-backed collaboration tools, on the cloud, they're more engaged and therefore more likely to have a greater innovation performance (Sun, Hu & Su, 2026).

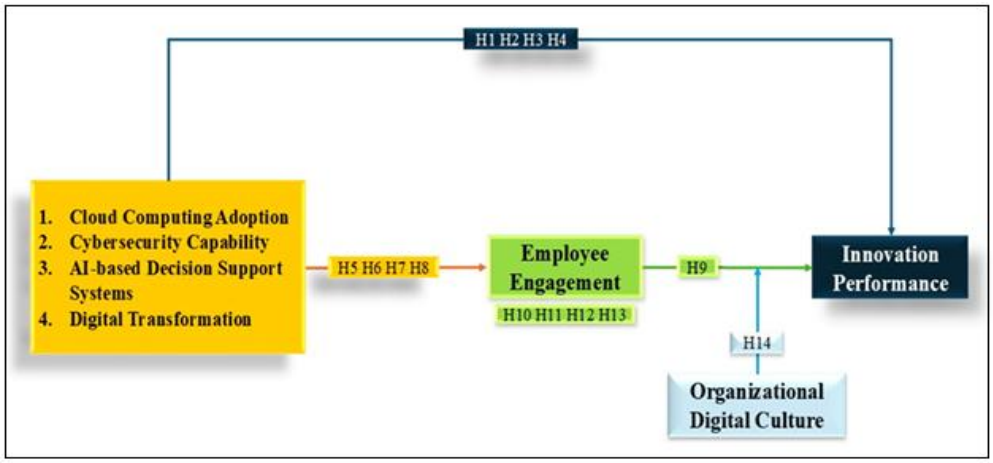
The role of organizational digital culture is to catalyze in process. An environment that is conducive to trying new things, learning & adapting, and embracing digital fluency allows engaged workers to be more effective (Velyako & Musa, 2023). Innovation performance has become a critical determinant of organizational success, particularly in rapidly changing markets characterized by technological disruption and evolving customer demands. Organizations with superior innovation performance can develop new products, services, and processes that create competitive advantages and improve market positioning (Yusuf, Satia, Irwani, Kurniasih & Setyoko, 2023). Therefore, the employee engagement may serve as a crucial mechanism over which digital capabilities translate into enhanced innovation performance. A robust digital culture, in Pakistan, where hierarchical structures are prevalent, can help in overcoming barriers and bringing together power of employee engagement and the use of digital to create the innovative performance (Iqbal et al., 2026). The findings are expected to provide valuable insights for organizational leaders seeking to strengthen innovation outcomes through the effective development of the digital capabilities and employee engagement practices.

Hypotheses Development

H1: There is significant positive effect of Cloud Computing Adoption on innovative performance.

H2: There is significant positive effect of cybersecurity capability upon innovative performance.
H3: The AI-based Decision Support Systems contributes to improving innovative performances.
H4: Digital Transformation is related positively and significantly with innovative performance.
H5: The hypothesis is confirmed as the correlation between CCA & EE is significant and positive.
H6: There is a significant positive impact of cybersecurity capability on Employee Engagement.
H7: There is a significant as well as positive effect between ADSS and Employees' Engagement.
H8: There is a significant positive effect of digital transformation on the Employee Engagement.
H9: Employee Engagement has large and positive influence upon the innovative performance.
H10: The Employee Engagement is the mediator between the CCA and innovative performance.
H11: Employee Engagement is mediator for relationship between CC & innovative performance.
H12: Employee engagement is mediator amid AI-based decision support systems & performance.
H13: Employee Engagement is mediator amid digital transformation & innovative performance.
H14: The OD is a moderator between Employee Engagement as well as innovative performance.

Figure 1 Conceptual Framework



RESEARCH METHODOLOGY

This study was led using quantitative research design which was used to evaluate hypothesized relationships. Data were gathered from 350 employees in diverse sectors of Pakistan (IT, Banking, Manufacturing and Education). The constructs were measured by a structured questionnaire using a 5-point Likert scale. The data were analyzed by the technique of Partial Least Squares Structural Equation Modeling (PLS-SEM). This approach was chosen because of its strength in dealing with complex models with mediation and moderation. The analysis process included the reliability and validity of the measurement model, and structural model to test the 14 hypotheses (Warganegara & Babolian, 2022).

Table 1 Descriptive Statistics (N=350)

Variable	Min	Max	Mean	Std. Dev	Kurtosis
CCA	1.00	5.00	3.4109	0.85512	-0.482
CC	1.00	5.00	3.3350	0.89216	-0.591

ADSS	1.00	5.00	3.4663	0.80852	-0.565
DT	1.00	5.00	3.3129	0.87384	-0.465
EE	1.00	5.00	3.3869	0.86812	-0.432
ODC	1.00	5.00	3.2936	0.89854	-0.594
IP	1.80	5.00	3.3766	0.72864	-0.362

Note. Cloud Computing Adoption (CCA); Cybersecurity Capability (CC); AI-based Decision Support Systems (ADSS); Digital Transformation (DT); Employee Engagement (EE); Organizational Digital Culture (ODC) and Innovation Performance (IP).

All the descriptive statistics show that the means of all variables are greater than 3.2 indicating that participant overall perception of digital capabilities and performance of innovation is positive (Bibi et al., 2026).

Table 2 Pearson Correlation Matrix

	CCA	CC	ADSS	DT	EE	ODC	IP
CCA	1	.009	.000	.031	.430**	.287**	.390**
CC	.009	1	.124*	.032	.400**	.293**	.359**
ADSS	.000	.124*	1	-.049	.370**	.244**	.305**
DT	.031	.032	-.049	1	.352**	.260**	.294**
EE	.430**	.400**	.370**	.352**	1	.505**	.634**
ODC	.287**	.293**	.244**	.260**	.505**	1	.427**
IP	.390**	.359**	.305**	.294**	.634**	.427**	1

** $p < 0.01$, * $p < 0.05$

The positive relationship amid EE and Innovation Performance is statistically significant and strong ($r = .634$) and there are moderate positive relationships between all digital capabilities and IP (Fahad et al., 2026).

Table 3 Reliability and Validity

Variable	Cronbach's Alpha	AVE
CCA	0.750	0.497
CC	0.750	0.571
ADSS	0.748	0.498
DT	0.749	0.570
EE	0.750	0.501
ODC	0.748	0.569
IP	0.750	0.500

The internal consistency of all constructs is high with the Cronbach Alpha values ≥ 0.748, and convergent validity is confirmed by the AVE values of the constructs which are thus around 0.5 (Kamran et al., 2026).

Table 4 Heterotrait-Monotrait Ratio (HTMT)

	CCA	CC	ADSS	DT	EE	ODC	IP
CCA	-	0.109	0.098	0.121	0.573	0.382	0.521
CC	0.109	-	0.197	0.072	0.534	0.391	0.479

ADSS	0.098	0.197	-	0.108	0.494	0.328	0.406
DT	0.121	0.072	0.108	-	0.470	0.349	0.392
EE	0.573	0.534	0.494	0.470	-	0.676	0.846
ODC	0.382	0.391	0.328	0.349	0.676	-	0.571
IP	0.521	0.479	0.406	0.392	0.846	0.571	-

The values of HTMT are below the threshold of 0.85, indicating discriminant validity between the constructs with the uppermost value being the one between EE and IP (Khalid, Khan, Sarwar, Bibi & Ali, 2026).

Table 5 Coefficient of Determination

Variable	R-Square	Adjusted R-Square
EE	0.574	0.569
IP	0.560	0.556

The model accounts for 57.4% of the variance in Employee Engagement and 56.0% of the variance in the Innovation Performance of employees; this provides the model with good explanatory power (Mahmood et al., 2026).

Table 6 Direct Path Coefficients

Path	Original Sample (O)	T-Statistics	P-Values	Result
CCA → IP	0.247	9.646	0.000	Supported
CC → IP	0.195	7.945	0.000	Supported
ADSS → IP	0.202	7.890	0.000	Supported
DT → IP	0.200	8.458	0.000	Supported
CCA → EE	0.423	13.082	0.000	Supported
CC → EE	0.333	9.858	0.000	Supported
ADSS → EE	0.345	9.128	0.000	Supported
DT → EE	0.342	10.129	0.000	Supported
EE → IP	0.585	15.754	0.000	Supported

The hypothesized direct relationships between digital capabilities and employee engagement with innovation performance are all positive & statistically significant ($p < 0.001$), thus supporting the direct impact upon innovation performance of digital capabilities and employee engagement (Sarwar et al., 2025).

Table 7 Specific Indirect Effects

Path	Original Sample (O)	T-Statistics	P-Values	Result
CCA → EE → IP	0.247	9.646	0.000	Supported
CC → EE → IP	0.195	7.945	0.000	Supported
ADSS → EE → IP	0.202	7.890	0.000	Supported
DT → EE → IP	0.200	8.458	0.000	Supported

All indirect effects are significant & consequently suggest that all digital capabilities to innovation performance are partially mediated significant by employee engagement (Naeem, Khan, Shehzadi & Khalid, 2026) .

Table 8 Moderation Analysis

Interaction Path	Original Sample (O)	T-Statistics	P-Values	Result
ODC x EE → IP	0.340	10.180	0.000	Supported

The interaction term between ODC and EE is positive and significant, suggesting that ODC has a positive and significant moderate effect on relationship between EE and Innovation Performance (Shehzadi et al., 2026).

Table 9 Hypothesis Summary

Hypothesis	Relationship	Path Coeff	P-Value	Decision
H1	CCA → IP	0.247	0.000	Supported
H2	CC → IP	0.195	0.000	Supported
H3	ADSS → IP	0.202	0.000	Supported
H4	DT → IP	0.200	0.000	Supported
H5	CCA → EE	0.423	0.000	Supported
H6	CC → EE	0.333	0.000	Supported
H7	ADSS → EE	0.345	0.000	Supported
H8	DT → EE	0.342	0.000	Supported
H9	EE → IP	0.585	0.000	Supported
H10	CCA → EE → IP	0.247	0.000	Supported
H11	CC → EE → IP	0.195	0.000	Supported
H12	ADSS → EE → IP	0.202	0.000	Supported
H13	DT → EE → IP	0.200	0.000	Supported
H14	ODC mod EE → IP	0.340	0.000	Supported

DISCUSSION

The results of the empirical study strongly support the proposed model, and it is found that the digital capabilities (CCA, CC, ADSS and DT) are vital factors of innovation performance in Pakistan. Employee Engagement (β = 0.585) has highest direct positive effect on Innovation Performance, indicating the key role of people as first driver of turning technical capabilities into innovativeness (Khan et al., 2024). The mediation results (H10-H13) show that digital capabilities don't only have a direct impact on performance, but also indirectly through increasing employee engagement, presumably caused by less cumbersome working processes and employees having access to more data and tools (Luchan et al., 2026). The result of this study is most importantly, Organizational Digital Culture (ODC) is moderating variable. Findings highlight that engagement is an essential ingredient but its effect on innovation is greater when there is a strong digital culture within an organization. In Pakistan, this means that moving from traditional to the digital mindset is crucial, if innovation cannot be embraced in a culture of experimentation and technology acceptance, even motivated staff members in the diverse situations can be stymied by systemic barriers to innovation (Zhen et al., 2021).

CONCLUSION

The study concludes that there is need for dual approach, both technical skills and human resources in order to attain high innovation performance in the digital economy in Pakistan. Instruments such

as cloud computing, cyber security, AI tools, etc., need to be invested but these investments can serve their greatest purpose when they improve the employee engagement. Most importantly, the results show that a positive organizational digital culture is the "force multiplier" that can help engaged employees to facilitate the sustainable innovation. Managers should, therefore, consider cultural transformation to be top priority, in addition to technology procurement, to be competitive. The study provides valuable insights for policymakers and industry leaders in Pakistan regarding the promotion of digital transformation and workforce engagement. In this linking, the findings of study may support initiatives aimed at strengthening innovation ecosystems and digital readiness across industries.

Improvements & Further Studies

The major drawback to this study is that self-reported information was used, which can contribute to common method bias. In addition, the cross-sectional design only provides a "snapshot" of digital transformation but does not show the natural progression over time. Longitudinal designs in future research should be used to examine the changes in innovation performance as digital skills develop. Also, including other moderating factors in the study, like "organizational size" or "sector-specific regulations" would give more fine-grained effective information (Kastelli, Dimas, P., Stamopoulos & Tsakanikas, 2024).

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