

Digital Skills and Digital Transformation Adoption in SMEs: A Moderated Mediation Framework

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Abstract

Digital transformation remains challenging for small and medium-sized enterprises (SMEs), particularly in the developing world where resource and skill limitations hinder technology adoption. This study investigates the connection of digital skills with digital transformation within SMEs sector in Pakistan, with perceived usefulness as a mediator and competitive pressure as a moderator. It integrates the Resource-Based View and Technology Acceptance Model to propose and examine a moderated mediation model using a sample of 439 SME owner-managers. SPSS and SmartPLS software were employed for descriptive analysis and Partial Least Squares Structural Equation Modeling (PLS-SEM) respectively. Findings show that digital skills have a significant effect on digital transformation adoption ($\beta = 0.34, p < 0.001$) and perceived usefulness ($\beta = 0.56, p < 0.001$), and perceived usefulness positively impacts adoption ($\beta = 0.29, p < 0.001$). Mediation results verify a significant indirect impact of digital skills via perceived usefulness ($\beta = 0.16, p < 0.001$), suggesting partial mediation. Furthermore, competitive pressure moderates the effect of digital skills on adoption ($\beta = 0.12, p = 0.004$), enhancing this effect with greater competition. In conclusion, the results reveal that digital transformation in SMEs is influenced by internal skills, cognitive appraisal and competitive pressure, with perceived usefulness playing a pivotal role in translating digital skills into adoption.

Keywords: Digital Transformation, SMEs, Digital Skills, Perceived Usefulness, Competitive Pressure.

Introduction

Digital transformation is a core element of modern business strategies, shaping value creation, competitiveness, and growth in an evolving, volatile environment (Kraus et al., 2021). Rather than merely relying on individual technologies, digital transformation epitomises an organisational change that integrates digital technologies into business processes, organisational structures, and value-creation systems (Sarwar et al., 2023; Tabrizi et al., 2019). For smaller organisations, this transformation is particularly significant, as they face resource constraints and increased competition (Shaukat et al., 2024). Although digital technologies provide opportunities for enhanced productivity, growth, and innovation, their uptake by SMEs remains mixed, particularly in emerging markets like Pakistan.

SMEs are vital in driving Pakistan's economy, contributing to job creation and industrial output. However, despite this, a number of SMEs find it difficult to engage in digital transformation (Azeem et al., 2026). Barriers to development, such as access to financing, infrastructure, and institutional deficiencies, make the digital landscape neither easy to navigate nor equally prioritised (Sarwar et al., 2024). Yet, beyond these constraints, there are internal

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organisational factors, notably digital and managerial skills, which are significant not only in whether, but also in how, SMEs engage in digital transformation (Drydakis, 2022). This implies that the problem is not just about access, but also about preparedness and capability.

Among internal factors, digital skills are a core resource that facilitates the understanding, adoption and use of digital technologies (Beaudry & Francois, 2010). These skills go beyond technical know-how to include assessing the opportunities offered by digital technologies, integrating technologies into firms' business models, and adapting to technological change (Gulzar et al., 2024). For SMEs, where strategic decision-making is often in the hands of the owner-manager, digital skills can play a critical role in shaping strategic priorities (Arif et al., 2026). Companies with high digital skills are more likely to perceive the strategic importance of digital change and to engage in related initiatives. By contrast, the absence of these skills may lead to confusion, risk avoidance, and slow responsiveness, even in an environment conducive to digitalisation.

The strategic relevance of digital skills can be identified through the Resource-Based View (RBV), which emphasises the role of firm-specific resources in gaining competitive advantage (Mahoney & Pandian, 1992). In this view, digital skills are an intangible resource that contributes to a firm's capacity to respond to technological shifts and capture opportunities (Stofkova et al., 2022). Unlike tangible resources that can be bought or copied, skill-based resources are embedded in firms and accumulated over time (Talha et al., 2025). This gives them a special importance in rapidly changing environments where firms need to continuously learn and adapt. While RBV clarifies why digital skills are important, it does not address how they can be applied during the adoption process. This is where it is important to bring in complementary approaches that account for organisational decision-making.

One such perspective can come from the Technology Acceptance Model (TAM), which emphasises the role of individual and managerial perceptions in technology adoption (Davis, 1989). A key component of TAM is perceived usefulness, which reflects the belief in their ability to improve performance (Zafar et al., 2025). Perceived usefulness is particularly important to the SME market because technology adoption is often based on the personal judgements of owner-managers rather than formal analyses (Azeem et al., 2025). While digital skills may play a role in technology adoption, this is likely to occur only if technologies are seen as useful, feasible, and likely to help achieve business goals. This implies that digital skills can indirectly contribute to technology adoption by shaping the assessment of digital technologies.

Based on this logic, perceived usefulness can be conceptualised as a mediator linking digital skills to digital transformation. SMEs with greater digital skills are more likely to appreciate the functional and strategic value of digital technologies, which, in turn, affects their perceived usefulness (Ahmad et al., 2025; Parviainen et al., 2017). This subjective assessment then leads to increased usage. On the other hand, without higher-level skills, technologies might be viewed as more complicated, expensive or irrelevant to their needs and therefore less likely to be adopted. This view enhances our understanding of how capabilities are translated into strategy beyond a direct-effect perspective (Amankwah-Amoah et al., 2021). Although internal resources and perceptions play a key role, they are not unique to the organisation. SMEs operate in competitive environments that influence their strategic decision-making. Specifically, competitive pressure is a key external factor that can both fuel and hinder digital transformation. In highly competitive environments, companies are more likely to embrace digital technologies to improve efficiency, connect with customers, and stay relevant (Skare & Soriano, 2021). The pressure to maintain market share and avoid being left behind by competitors can be a compelling motivator to overcome internal resistance or resource constraints. In less competitive markets, the pressure to adopt digital technologies may be less acute, even with strong internal capabilities.

Competitive pressure is particularly relevant in combination with digital skills. Far from being a stand-alone factor, competitive pressure may moderate the link between digital skills and digital transformation (Su et al., 2023). For example, SMEs with high digital skills may be more reactive to competition, leveraging them to implement digital solutions. Conversely, organisations with low competitive pressure may under-invest in their skills, resulting in a lack of transformation. This interplay emphasises the need for a more contingent view that considers internal and external factors to explain digital adoptions.

Although there has been an increased focus on digital transformation, past research has been limited by certain factors that limit its explanatory ability (Mhlanga & Ndhlovu, 2023). First, most studies offer evidence from Western economies, where institutional, technological, and market structures differ from those in developing economies. This raises questions about its applicability to emerging markets such as Pakistan. Second, existing studies talk about the determinants of digital transformation from a single standpoint, either as resources or perceptions of the technology, but not the intersection of the resources and perceptions (Cuthbertson & Furseth, 2022). This neglects complementarity between resources and perceptions. Third, the determinants of digital transformation, such as competition, are said to be contextual factors that affect what happens within the firm, rather than ingredients that affect the effectiveness of the firm's resources (Drydakis, 2022).

This research seeks to address these gaps by adopting a holistic approach that incorporates RBV and TAM to understand digital transformation in Pakistani SMEs. In particular, the study examines the impact of digital skills on the adoption of digital transformation, both directly and indirectly through perceived usefulness, and accounts for the moderating effect of competitive pressure. The inclusion of both mediation and moderation effects in the model offers a more nuanced view of the processes and factors influencing digital adoption.

The inclusion of Pakistan is also valuable in providing insights from a context that is resource-poor, institutionally diverse and in transition. The unique challenges faced by SMEs in these contexts are not fully explained by models developed in more resource-rich and stable environments (Cuthbertson & Furseth, 2022). By offering empirical insights from this environment, the study adds to existing knowledge on digital transformation by underscoring the role of context in shaping firm behaviour.

In terms of practice, the study is likely to provide valuable insights for managers and policymakers. For SME managers, the findings highlight the importance of digital skills and suggest that learning and skill development should be a priority in a digital transformation strategy. Understanding the role of perceived usefulness can help prioritise technology investments to align with these goals and needs. For policymakers, the findings suggest the need to foster an environment that not only makes digital technologies easily accessible but also maintains a highly dynamic competitive environment to motivate firms to adopt and innovate.

In conclusion, digital transformation in SMEs cannot be explained by a single theory or through considering individual factors in isolation. Instead, it is a product of a combination of firm capabilities, cognitive appraisal and competitive pressure. The integration of perceived usefulness, digital skills, and competitive pressure in this study brings a more comprehensive and contextualised understanding of digital transformation in Pakistani SMEs. The following sections provide further discussion of the theoretical basis, formulation of hypotheses, and empirical evidence for the above discussion.

Literature Review and Hypotheses Development

Digital Transformation in SMEs

SMEs' digital transformation is a strategic change that goes beyond mere technology integration, encompassing changes in business processes, business models, and value creation

(Ebert & Duarte, 2018). SMEs tend to pursue digital transformation incrementally due to resource constraints and limited managerial bandwidth (Melo et al., 2023). This incremental approach results in an adoption process inherently tied to internal capacities and managerial views, rather than formal strategies and institutional pressures. In emerging markets, these issues are compounded by infrastructural deficiencies and market imperfections, leading to additional uncertainties surrounding digital investments (Kapurubandara, 2009). This means that SMEs' decisions on digital transformation are based on internal evaluations and prior experience. This highlights the need to consider the interplay between firm capabilities and cognitive assessments in understanding digital transformation outcomes.

Digital Skills and Digital Transformation Adoption

Digital skills are emerging as a key firm capability that allows firms to leverage digital technologies (Stofkova et al., 2022). They comprise both technical expertise and the capacity to understand digital trends, assess technology opportunities and embed digital technologies into business processes (Sarwar et al., 2025). In the context of SMEs, where owner-managers are central to decision-making, their digital skills are especially important for strategic decision-making.

From an RBV perspective, digital skills can be seen as a valuable and firm-specific asset that supports a firm's dynamic capabilities. Organisations with greater digital skills are better able to recognise opportunities to improve processes, engage customers, and innovate digitally (Drydakis, 2022). This helps alleviate the perceived uncertainty around new technologies and increases the likelihood of adoption. Additionally, digital skills also boost confidence in managing technological risks, which is critical in rapidly evolving environments (Molla et al., 2025). SMEs without these skills may find digital transformation challenging or dangerous, thereby hindering its adoption (Sarwar et al., 2025). On the other hand, SMEs with higher digital skills are more active and strategic in their digitalisation efforts.

The above discussions lead us to hypothesise that digital skills positively affect the adoption of digital transformation.

H1: Digital skills positively impact digital transformation uptake in SMEs.

Perceived Usefulness as a Mediator

Although digital skills enable interaction with technology, the adoption of digital solutions among SMEs is also influenced by decision-makers' assessments of technologies. The Technology Acceptance Model (TAM) acknowledges that perceived usefulness is an important predictor of adoption, and is measured by the belief that using a technology will improve performance (Mohd Amir et al., 2020). In the case of SMEs, perceived usefulness is especially important because decisions to adopt digital technology are often based on owner-managers' perceptions (Waseem et al., 2025). For example, while firms might have the required level of digital skills, they might not adopt unless they perceive digital technologies as being useful (Usman et al., 2026). This suggests that the link between skills and adoption is not merely direct but mediated by cognitive assessments.

Digital skills are likely to improve perceived usefulness by helping decision-makers to better understand the features, utility and value of digital technologies (Suárez & Colmenero, 2024). Managers with digital skills are better able to match digital technologies to business needs, enhancing their perceived usefulness (Beaudry & Francois, 2010). Lack of digital skills, on the other hand, can make it difficult to evaluate the benefits of digital technologies, leading to lower perceptions of usefulness and lower intentions to adopt. This implies that perceived usefulness is an intermediary variable explaining the effects of digital skills on digital transformation. Far from being independent, digital skills shape the interpretation and appreciation of digital technologies within organisations, thereby affecting adoption outcomes.

As such, we propose the hypotheses:

H2: Digital skills have a positive impact on the perceived usefulness of digital technologies.

H3: Perceived usefulness is positively related to digital transformation adoption.

H4: Perceived usefulness has a mediating effect on the relationship between digital skills and digital transformation adoption.

Moderating Role of Competitive Pressure

Beyond internal resources and beliefs, external factors also influence firms' actions. Competitive pressure, which refers to the level of competition in a firm's environment, is a critical factor in decision-making (Knudsen et al., 2021). In a competitive and dynamic environment, firms are more likely to innovate to defend or improve their competitive position (Blichfeldt & Faullant, 2021). Competitive pressure creates a sense of urgency for SMEs, potentially affecting resource use. In a highly competitive environment, firms must draw upon their resources, such as digital skills, to meet market needs and build competitive advantage (Sarwar et al., 2025). In this environment, the effect of digital skills on digital transformation is likely to be greater, as firms actively leverage them.

On the other hand, in a low-competitive-pressure environment, the adoption of digital technologies might not be as important for SMEs (Parviainen et al., 2017). Even if they have digital skills, they may be reluctant to change, fearing they will be left behind (Zhang et al., 2024). This suggests competitive pressure does not dictate adoption, but it does moderate the impact of internal resources (Damert & Baumgartner, 2018). Competitive pressure acts as a moderating variable, affecting the relationship between digital skills and digital transformation. The view is consistent with contingency theories that stress that the effects of a firm's resources are contingent on the environment.

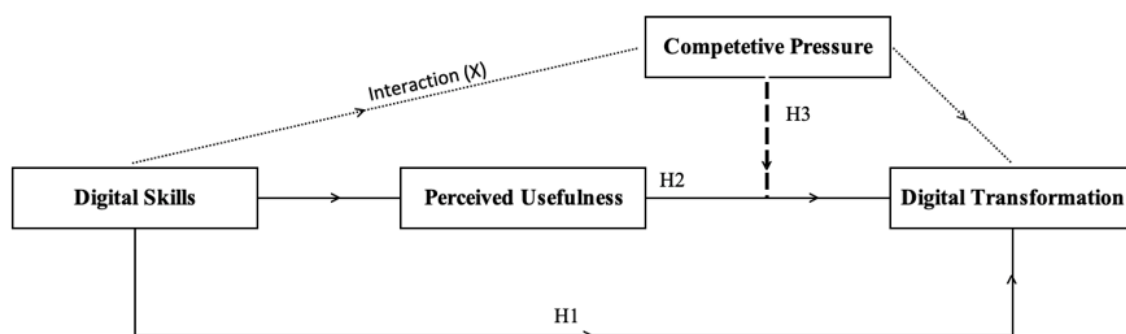
As such, we suggest the following:

H5: Competitive pressure has a positive moderating effect on the relationship between digital skills and digital transformation, such that the relationship is stronger under high competitive pressure.

Conceptual Framework

Drawing on the aforementioned discussion, this research proposes a moderated mediation model in which digital skills directly and indirectly (through perceived usefulness) affect digital transformation adoption, and competitive pressure moderates the direct effect of digital skills on digital transformation adoption. This holistic model examines the relationships among internal skill sets, cognitive assessments, and external factors to understand digital transformation in SMEs.

Figure 1: Theoretical framework guided by RBV and TAM



Methodology

Research Design

This research employs a quantitative approach to investigate the impact of digital skills, usefulness and competitive pressure on the adoption of digital transformation in Pakistan's SMEs. A cross-sectional survey design is adopted, which enables the structured data collection from a large sample using a standardized questionnaire and is ideal for testing theoretical models with mediation and moderation effects (Bates & Grijalva, 2022). A questionnaire-based approach allows the measurement of latent constructs and the use of multivariate statistical methods.

The proposed research model is based on an integrated model guided by RBV and the TAM. This helps to explore both ability-based and perception-based mechanisms in digital transformation (Peñarroya-Farell et al., 2025). In particular, the research examines a moderated mediation model of perceived usefulness as a mediator between digital skills and adoption of digital transformation and competitive pressure as a moderator of the direct link between digital skills and adoption.

Population and Sampling

The population of the study is Pakistan's small and medium-sized enterprises from various industries. SMEs were chosen for their role in the economy and the need to undertake digital transformation initiatives to survive (Nazir et al., 2024). The unit of analysis is the enterprise, and the key informants are the owner-managers, who are usually involved in the decision-making process in SMEs.

The researchers have used a questionnaire to conduct a survey of SME owner-managers. Data from 439 responses were analysed. The sample size is deemed sufficient for Partial Least Squares Structural Equation Modeling (PLS-SEM) as it can handle complex models and does not require stringent assumptions about the distribution of the data (Hair & Alamer, 2022). The data collection method ensured a diverse set of industries were represented, which improved the generalizability within the SME sector.

Measurement of Constructs

Multi-item scales were used to measure all constructs in this study based on prior research for content validity. A five-point Likert scale (1-strongly disagree and 5-strongly agree) was used in the questionnaire, which is commonly used in behavioral and management studies to measure respondents' perceptions and attitudes.

The Digital Skills construct was assessed by items capturing the firm's ability to effectively use, manage and integrate digital technologies based on the work by Vitenic and Peric (Vitezić & Perić, 2024). These items reflect both technical skills and knowledge about the use of digital technologies. Perceived Usefulness was measured as the degree to which SME owner-managers perceive that the use of digital technologies improve business performance, efficiency and effectiveness (Ortiz-López et al., 2024). Competitive Pressure was captured through items capturing the level of competition in the market and the extent to which the actions of competitors affect the firm's strategies (Tran, 2025). Digital Transformation Adoption was operationalized using items that reflected the level of adoption and integration of digital technologies in business operations and processes (Xicang et al., 2024).

The items used for measurement were modified to align with the SME environment in Pakistan while staying in line with previously validated scales. A pretest was performed to check the clarity, relevance, and reliability of the items in the survey questionnaire prior to the actual data collection.

Data Collection Procedure

The study used a questionnaire to survey SME owner-managers. The survey was distributed both electronically and physically to increase the response rate and ensure a varied sample followed by prior work (Shaukat et al., 2024). The survey was voluntary and respondents were guaranteed anonymity to minimise response bias. Common method bias was reduced by maintaining anonymity, using simple terms in the questionnaire, and by logically grouping measurement sections in the questionnaire (Sarwar et al., 2024). Respondents were also assured that there were no correct or incorrect answers to ensure unbiased responses (Hair Jr et al., 2021).

Data Analysis Techniques

The analysis of the data was performed in two steps using SPSS and SmartPLS. The initial data analysis with SPSS involved data screening, descriptive statistics and missing value analysis. This analysis confirmed that the data were fit for multivariate analysis. We used Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS to conduct the main analysis. This technique is suitable for exploratory and predictive studies, especially when dealing with complex models with mediation and moderation effects (Cheah et al., 2024). PLS-SEM is also suitable for smaller sample sizes and does not require assumptions of normality.

Measurement Model Assessment

The measurement model was assessed for reliability and validity of the constructs (Hair & Alamer, 2022). We examined internal consistency reliability through Cronbach's alpha and composite reliability (CR) with values higher than recommended cut-offs indicating reliability (Hair et al., 2021). Convergent validity was assessed by factor loadings and average variance extracted (AVE), confirming that each construct accounts for a significant amount of variance in its corresponding items. Discriminant validity was evaluated using standard criteria to ensure that constructs are significantly different from each other (Hair et al., 2021).

Structural Model Assessment

The structural model was tested to examine the relationships between variables. Standardized path coefficients were calculated to examine the direction and magnitude of the relationships, and bootstrapping was used to test the path coefficient significance. The coefficient of determination (R^2) was used to assess model explanatory power. Indirect effect analysis was conducted to examine the mediating role of perceived usefulness, enabling the evaluation of whether the link between digital skills and adopting digital transformation is mediated by perceived usefulness. The moderating role of competitive pressure was examined by considering the interaction between digital skills and competitive pressure, to determine whether the relationship between variables is stronger at higher levels of competition.

Results

Descriptive Statistics

The findings in tabel 1 show that the respondents reported moderately high levels across all the constructs, with the highest mean value for competitive pressure. This implies that SMEs operate in competitive environments which may impact on strategic decision-making. The standard deviations are acceptable, demonstrating response variability across the firms. Skewness and kurtosis values are acceptable. In summary, the data is statistically suitable for the structural model.

Table 1: Descriptive Statistics

Construct	S	Min	Max	Average	Std. Dev	Skewness	Kurtosis
Digital Skills (DS)	439	1	5	3.62	0.74	-0.42	0.31
Perceived Usefulness (PU)	439	1	5	3.71	0.69	-0.38	0.27
Competitive Pressure (CP)	439	1	5	3.84	0.72	-0.51	0.44
Digital Transformation (DTA)	439	1	5	3.58	0.77	-0.36	0.22

Note(s): Author's work

Measurement Model Assessment

The measurement model was assessed for reliability and validity of constructs prior to hypothesis testing (Hair Jr et al., 2021). In table 2, the measurement model shows all constructs have good internal consistency, with Cronbach's alpha values exceeding the recommended threshold 0.70 (J. Hair & Alamer, 2022). The composite reliability measures for constructs also support the adequacy of scales. All constructs have AVE values above 0.50, suggesting good convergent validity (J. F. Hair et al., 2024). This demonstrates that the constructs account for a significant variance in the indicators. The measurement model is reliable and can be used for structural modelling.

Table 2: Reliability and Convergent Validity

Construct	Item-count	Alpha Value	CR	AVE
Digital Skills	4	0.88	0.91	0.66
Perceived Usefulness	4	0.87	0.9	0.64
Competitive Pressure	4	0.85	0.89	0.62
Digital Transformation	4	0.89	0.92	0.68

Note(s): Authors compilation

Table 3: Factor Loadings

Construct	Item	Code	Loading
Digital Skills	Our business has employees who are proficient in using digital technologies for business operations.	DS1	0.81
	Our management team possesses adequate knowledge of digital tools relevant to our industry.	DS2	0.84
	Our business is capable of adopting new digital technologies without major difficulties.	DS3	0.79
	Employees in our business are skilled in using digital systems for communication and coordination.	DS4	0.83
Perceived Usefulness	Our organization has strong capability to integrate digital tools into business processes.	PU1	0.80
	Using digital technologies improves the efficiency of our business operations.	PU2	0.82
	Digital technologies enhance the overall performance of our firm.	PU3	0.78
	Digital tools help in making better and faster business decisions.	PU4	0.81
Competitive Pressure	Our business faces strong competition in the market.	CP1	0.77
	Competitors in our industry frequently adopt new digital technologies.	CP2	0.80
	Competitive pressure forces our firm to improve its digital capabilities.	CP3	0.79
	Customer expectations increase due to competitors' digital advancements.	CP4	0.78

Digital Transformation	Customer expectations increase due to competitors' digital advancements.	DTA1	0.84
	Our business has integrated digital technologies into core business processes.	DTA2	0.86
	Digital systems are widely used in our daily business operations.	DTA3	0.82
	Our business actively relies on digital tools for strategic decision-making.	DTA4	0.83

Note(s): Authors work

The factor loadings are above 0.70, which shows indicators are reliable. This implies that each item is important in measuring its construct. The loadings' consistency across constructs indicates measurement reliability (J. F. Hair et al., 2024). None of the items were removed, demonstrating the suitability of the modified scales. In summary, the measures well represent their constructs.

Table 4: Discriminant Validity (Fornell–Larcker)

Construct	DS	PU	CP	DTA
DS	0.81			
PU	0.54	0.8		
CP	0.43	0.39	0.79	
DTA	0.58	0.56	0.47	0.82

Note(s): Authors own work

The square root of AVE for each construct is greater than its correlations with other constructs, supporting discriminant validity (J. F. Hair et al., 2024). This suggests each construct is clearly distinguished in the empirical world and measures a different facet of the model. The moderate correlations indicate strong, yet distinct, relationships between variables. This enhances the theory's validity. In summary, the measurement model fulfils all the criteria for discriminant validity.

Structural Model Assessment

The structural relationships are analyzed using SmartPLS with bootstrapping (resamples = 5,000). Direct effects, mediations and moderations are shown in an integrated way below for clarity and consistency of findings from the hypothesis testing.

Table 5: Structural Model Results (Direct, Mediation, Moderation, and Hypothesis)

Hypothesis	Relationship / Effect	β	t-value	p-value	Decision
H1	Digital Skills → Digital Transformation (DTA)	0.3	6.21	<0.001	Supported
H2	Digital Skills → Perceived Usefulness (PU)	0.6	11.03	<0.001	Supported
H3	Perceived Usefulness → DTA	0.3	5.47	<0.001	Supported
H4	Indirect Effect (DS → PU → DTA)	0.2	4.98	<0.001	Supported (Partial Mediation)
H5	DS × Competitive Pressure → DTA	0.1	2.87	0.004	Supported

The findings from the structural model provide strong empirical support for the theoretical model. Digital skills show a significant direct impact on the adoption of digital transformation, suggesting SMEs with high levels of digital skills are more likely to adopt digital technologies (Vitezić & Perić, 2024). Moreover, digital skills have a significant direct effect on perceived

usefulness, implying that digitally skilled managers perceive the usefulness of digital technologies in terms of operational and strategic advantage (Mohd Amir et al., 2020). Perceived usefulness also significantly affects the adoption of digital transformation, so it is an important cognitive factor in the decision-making process. The mediation test also shows a significant indirect impact of digital skills on digital transformation through perceived usefulness, suggesting partial mediation. This reveals that digital skills exert both direct and indirect effects on digital transformation through perceptual evaluation processes.

The moderation analysis reveals that competitive pressure positively moderates the association between digital skills and digital transformation adoption. This confirms that companies in competitive markets are more likely to translate their digital skills into digital transformation initiatives (Damert & Baumgartner, 2018). In summary, the combined findings reveal that both internal and external factors play a role in digital transformation in SMEs.

Discussion

This research explored the role of digital skills in the adoption of digital transformation in Pakistan's SMEs, considering the mediating role of perceived usefulness and the moderating role of competitive pressure. The study offers a more refined view of digital transformation by integrating perspectives on internal capabilities, cognitive appraisal, and environmental conditions into a coherent framework.

This study makes an important contribution by confirming that digital skills act as a foundational organisational capability that drives digital transformation (Beaudry & Francois, 2010). This implies, from a Resource-Based View, that SMEs with greater digital skills are more likely to transform intangible knowledge-based resources into strategic performance (Molla et al., 2025). In contrast to the resource constraints typically highlighted in SME studies, the results indicate that differences in digital skills lead to distinct adoption patterns across firms, even in similar environments (Suárez & Colmenero, 2024). This builds on existing research by reframing digital skills as a key strategic rather than supporting resource in digital transformation.

The findings also show that digital skills positively affect perceptions of usefulness, which in turn leads to adoption. This finding aligns with the Technology Acceptance Model but shifts its focus from individual adoption to decision-making at the SME level. The mediation effect shows that the capability's effect on transformation is not direct but operates through managerial interpretation. That is, digital skills influence the cognitive assessments of SMEs' decision-makers regarding the usefulness of digital technologies. This suggests that perception is an important intermediary step in the transformation process, especially in contexts with low formalised planning.

The partial mediation found in this study is theoretically significant because it implies a two-fold effect. First, digital skills directly facilitate the implementation of digital technologies by overcoming technology-related barriers and enhancing operational readiness (Parviainen et al., 2017). On the other hand, they enable indirect adoption by increasing the perception of usefulness (Ortiz-López et al., 2024). This two-fold effect captures the complementary explanations of technology adoption based on "capability" and "cognition". It also implies that strategies designed to enhance digital transformation should focus on both capabilities and perceptions.

A second contribution is the moderating effect of competition. The results suggest that competitive pressure enhances the positive effect of digital skills on the adoption of digital transformation. This finding is consistent with the contingency view, which holds that resource effectiveness is conditional on the environment. In competitive environments, SMEs are more likely to mobilise their digital skills to remain competitive (Zhang et al., 2024). In contrast, in

less competitive markets, even capable firms may invest less in digital transformation due to a lower sense of urgency.

This cross-term also emphasises the importance of environmental pressure. Competition seems to be a catalyst that turns potential into action in the digital transformation process (Tran, 2025). This insight has broader implications for developing countries like Pakistan, where competition varies across industries and regions. It implies that policies and market structures affect digital transformation indirectly, by moderating the extent to which a firm uses its internal resources. Theoretically, this research contributes to the integration of RBV and TAM by showing how firm resources and cognitive perceptions interact to affect digital transformation. RBV explains resource availability, and TAM explains the meaning of technology. Combining these perspectives offers a better understanding of SME behaviour than single theories. Finally, the addition of competitive pressure expands this integrated perspective by situating it in a broader environmental perspective, thereby providing a more comprehensive view of the digital transformation process. The study also advances the SME literature by refocusing on capability-perception-environment interactions instead of structural barriers. The focus of earlier research has been on external constraints such as financial, infrastructure and policy barriers. But this research reveals that internal cognitive and capability factors are just as important, if not more so, for digital transformation. This focus is especially important in developing countries, where policy measures tend to emphasise infrastructure more than human and organisational capacity building.

Pragmatically, the findings have several implications. First, SMEs must focus on building managers' and workers' digital capabilities, as these capabilities impact the transformation process. Second, efforts to increase perceived usefulness (such as training, awareness-raising, and demonstrating the digital benefits) can increase the use of digital technologies. Third, companies in competitive markets should embrace competition as an opportunity rather than a threat and use it to drive digital transformation.

From a policy perspective, the results indicate that digital transformation strategies should not only address infrastructure development, but also build capability. Digital literacy, industry-specific support and training programs can improve SMEs' capacity to leverage digital technologies. Further, promoting market competition can indirectly encourage digital transformation through pressure to innovate. This study also has some limitations. The cross-sectional nature of the study limits the understanding of the dynamics of digital transformation. Longitudinal studies could help tease out the dynamics of digital transformation. Moreover, the research is conducted with SMEs in Pakistan, which may limit the generalizability of the results. The model could be tested in other countries to improve generalizability.

In conclusion, this study offers a holistic understanding of digital transformation in SMEs by examining the role of digital capabilities, usefulness, and competition. It shows that digital transformation is not just a resource- or technology-driven phenomenon, but a complex interplay of capability, cognition, and context.

Conclusion

Our research examined the factors driving digital transformation adoption in Pakistan's SMEs through an integrated model of digital skills, perceived usefulness, and competitive pressure, informed by the Resource-Based View and the Technology Acceptance Model. The study proposed and tested a moderated-mediation model using a sample of 439 SME owner-managers. Interestingly, the results offer a unified understanding of the influence of internal skills, cognitive perceptions, and the external environment on digital transformation, and the findings support the importance of digital skills in driving it, both directly and through perceived usefulness. The outcome offers the need for capability building in SMEs to support digital adoption. More precisely, the moderating effect of perceived usefulness suggests that

managers' perceptions are vital factors in translating skills into digital transformation. In addition, competitive pressure amplifies the impact of digital skills on digital transformation, underscoring the role of environmental factors in shaping strategy.

On theoretical grounds, this study adds value by linking the RBV and TAM to develop an integrated model of digital transformation from the perspectives of both skills and perceptions, and it further builds on previous research by showing that digital transformation is not shaped solely by resources or perceptions in isolation, but by their interplay. Moreover, by adding competitive pressure as a moderating factor, we introduced a contextual element that enriches the understanding of SMEs in emerging markets. Pragmatically, the study's results imply that SMEs need to invest in digital capabilities to enhance their transformation capacity. We further propose that capability is insufficient until managers invest in boosting the perceived benefits of digital technologies through education, training, and alignment with strategy. Besides, Governments should incentivise SMEs through digital literacy training and by creating competitive markets that promote innovation and the use of digital technologies.

Besides strengths, the research also points to some limitations; for instance, the cross-sectional nature of the study limits causal inferences and prevents the examination of changes in digital transformation over time. Given this, longitudinal studies could be used to explore the dynamics of digital transformation. Second, the research targets only Pakistan's SMEs, thereby posing a potential threat to generalizability. To address it logically, comparative studies may apply this model to other developing and developed countries to test and further refine it. In a nutshell, this research establishes that digital transformation in SMEs is a complex process influenced by skills, perceptions and environmental factors, and these insights are crucial for theoretical and policy development to encourage digital transformation in developing economies.

References

- Ahmad, M. A., Khan, M. B., Zafar, H., & Sarwar, U. (2025). Customer attitude towards car sharing, electric vehicles, and autonomous driving: Evidence from Indonesia. *Journal of Asian Development Studies*, 14(3), 753–766.
- Amankwah-Amoah, J., Khan, Z., Wood, G., & Knight, G. (2021). COVID-19 and digitalization: The great acceleration. *Journal of Business Research*, 136, 602–611.
- Arif, T., Munir, Y., Azeem, S., Khan, M. B., Zafar, H., & Sarwar, U. (2026). Nexus between business incubators, commercialization and innovation: Does absorptive capacity act as a mediator? *Journal of Asian Development Studies*, 15(1), 1–14.
- Azeem, S., Sarwar, U., Khan, M. B., Zafar, H., & Sattar, S. (2026). The nexus between corporate social responsibility, ownership structure, and financial health: An examination of firm-specific predictors of earnings management. *Advance Journal of Econometrics and Finance*, 4(1), 102–112.
- Azeem, S., Shafqat, M. M., Munir, Y., & Sarwar, U. (2025). Impact of ICT diffusion on economic growth: Exploring the moderating role of financial inclusion in E7 countries. *Journal of Asian Development Studies*, 14(3), 1339–1354.
- Bates, B. R., & Grijalva, M. J. (2022). Knowledge, attitudes, and practices towards monkeypox during the 2022 outbreak: An online cross-sectional survey among clinicians in Ohio, USA. *Journal of Infection and Public Health*, 15(12), 1459–1465.
- Beaudry, P., & François, P. (2010). Managerial skills acquisition and the theory of economic development. *The Review of Economic Studies*, 77(1), 90–126.
- Blichfeldt, H., & Faullant, R. (2021). Performance effects of digital technology adoption and product & service innovation: A process-industry perspective. *Technovation*, 105, 102275.
- Cheah, J.-H., Magno, F., & Cassia, F. (2024). Reviewing the SmartPLS 4 software: The latest features and enhancements. *Journal of Marketing Analytics*, 12(1), 97–107. <https://doi.org/10.1057/s41270-023-00266-y>

- Cuthbertson, R. W., & Furseth, P. I. (2022). Digital services and competitive advantage: Strengthening the links between RBV, KBV, and innovation. *Journal of Business Research*, 152, 168–176.
- Damert, M., & Baumgartner, R. J. (2018). External pressures or internal governance—What determines the extent of corporate responses to climate change? *Corporate Social Responsibility and Environmental Management*, 25(4), 473–488. <https://doi.org/10.1002/csr.1473>
- Davis, F. D. (1989). Technology acceptance model: TAM. In M. N. Al-Suqri & A. S. Al-Aufi (Eds.), *Information seeking behavior and technology adoption* (pp. 205–219).
- Drydakakis, N. (2022). Improving entrepreneurs' digital skills and firms' digital competencies through business apps training: A study of small firms. *Sustainability*, 14(8), 4417.
- Ebert, C., & Duarte, C. H. C. (2018). Digital transformation. *IEEE Software*, 35(4), 16–21.
- Gulzar, S., Sarwar, U., Sattar, S., Usman, M., & Quibtia, M. (2024). Tax audit, tax penalty, religiosity and tax compliance. *Journal of Asian Development Studies*, 13(3), 776–791. <https://doi.org/10.62345/jads.2024.13.3.64>
- Hair, J., & Alamer, A. (2022). Partial least squares structural equation modeling (PLS-SEM) in second language and education research. *Research Methods in Applied Linguistics*, 1(3), 100027.
- Hair, J. F., Sharma, P. N., Sarstedt, M., Ringle, C. M., & Liengaard, B. D. (2024). The shortcomings of equal weights estimation and the composite equivalence index in PLS-SEM. *European Journal of Marketing*, 58(13), 30–55.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook*. Springer.
- Kapurubandara, M. (2009). A framework to e-transform SMEs in developing countries. *The Electronic Journal of Information Systems in Developing Countries*, 39(1), 1–24. <https://doi.org/10.1002/j.1681-4835.2009.tb00277.x>
- Knudsen, E. S., Lien, L. B., Timmermans, B., Belik, I., & Pandey, S. (2021). Stability in turbulent times? The effect of digitalization on the sustainability of competitive advantage. *Journal of Business Research*, 128, 360–369.
- 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), 21582440211047576. <https://doi.org/10.1177/21582440211047576>
- Mahoney, J. T., & Pandian, J. R. (1992). The resource-based view within the conversation of strategic management. *Strategic Management Journal*, 13(5), 363–380. <https://doi.org/10.1002/smj.4250130505>
- Melo, I. C., Queiroz, G. A., Junior, P. N. A., de Sousa, T. B., Yushimito, W. F., & Pereira, J. (2023). Sustainable digital transformation in SMEs: A review on performance. *Heliyon*, 9(3).
- Mhlanga, D., & Ndhlovu, E. (2023). Digital technology adoption in the agriculture sector: Challenges and complexities in Africa. *Human Behavior and Emerging Technologies*, 2023, 1–10. <https://doi.org/10.1155/2023/6951879>
- Mohd Amir, R. I., Mohd, I. H., Saad, S., Abu Seman, S. A., & Tuan Besar, T. B. H. (2020). Perceived ease of use, perceived usefulness, and behavioral intention. In N. Kaur & M. Ahmad (Eds.), *Charting a sustainable future of ASEAN in business and social sciences* (pp. 403–410). Springer.
- Molla, A., Gekara, V., Karanasios, S., & Snell, D. (2025). Modeling digital skills beyond the IT workforce. *Information Technology & People*, 38(3), 1461–1504.
- Nazir, M. A., Khan, R. S., & Khan, M. R. (2024). Identifying prosperity characteristics in SMEs of Pakistan. *Journal of Asia Business Studies*, 18(1), 21–43.
- Ortiz-López, A., Sánchez-Prieto, J. C., & Olmos-Migueláñez, S. (2024). Perceived usefulness of mobile devices in assessment. *Journal of New Approaches in Educational Research*, 13(1), 2. <https://doi.org/10.1007/s44322-023-00001-6>
- Parviainen, P., Tihinen, M., Kääriäinen, J., & Teppola, S. (2017). Tackling the digitalization challenge. *International Journal of Information Systems and Project Management*, 5(1), 63–77.
- Peñarroya-Farell, M., Vaziri, M., Soto Rivera, S. K., & Miralles, F. (2025). A complex leadership perspective on generative AI adoption in SMEs. *Administrative Sciences*, 15(12), 494.

- Sarwar, U., Ahmad, M. B., Mubeen, M., Fatima, I., & Rehan, M. (2023). A bibliometric analysis of sustainability disclosure. *Bulletin of Business and Economics*, 12(3), 28–43.
- Sarwar, U., Baig, W., Rahi, S., & Sattar, S. (2025). Fostering green behavior in the workplace. *Sustainability*, 17(9), 4083.
- Sarwar, U., Bint-e-Naeem, N., Fahmeed, L., & Atif, M. (2024). Role of perceived security and financial attitude. *Journal of Asian Development Studies*, 13(3). <https://doi.org/10.62345/jads.2024.13.3.112>
- Sarwar, U., Sattar, S., & Ar, A. Y. (2025). Abusive supervision and employees cyber-loafing. *SAGE Open*, 15(4), 21582440251410815. <https://doi.org/10.1177/21582440251410815>
- Sarwar, U., Sattar, S., & Noor, L. (2025). From campus to startup. *Acta Psychologica*, 261, 105991.
- Shaukat, M. Z., Yousaf, S. U., Sarwar, U., & Sattar, S. (2024). Thriving in turmoil among SMEs. *Bulletin of Business and Economics*, 13(2).
- Skare, M., & Soriano, D. R. (2021). How globalization is changing digital technology adoption. *Journal of Innovation & Knowledge*, 6(4), 222–233.
- Stofkova, J., et al. (2022). Digital skills as a significant factor. *Sustainability*, 14(20), 13117.
- Su, J., Zhang, Y., & Wu, X. (2023). Market pressures and digital marketing adoption. *Technological Forecasting and Social Change*, 193, 122655.
- Tabrizi, B., Lam, E., Girard, K., & Irvin, V. (2019). Digital transformation is not about technology. *Harvard Business Review*, 13, 1–6.
- Talha, M., Saleem, S., Shahbaz, K., Sarwar, U., & Sattar, S. (2025). Financial knowledge and entrepreneurial intentions. *Center for Management Science Research*, 3(3), 450–469.
- Tran, T. A. P. (2025). Customer expectations and innovation decisions. *Cogent Business & Management*, 12(1), 2462272. <https://doi.org/10.1080/23311975.2025.2462272>
- Usman, M., Sarwar, U., & Azeem, S. (2026). Entrepreneurial tax compliance in Pakistan. *Journal of Entrepreneurship and Business Venturing*, 6(1), 43–59. <https://doi.org/10.56536/jebv.v6i1.226>
- Vitezić, V., & Perić, M. (2024). Digital skills and AI acceptance. *Journal of Business & Industrial Marketing*, 39(7), 1546–1566.
- Waseem, F., Sarwar, U., Azeem, S., & Zafar, J. (2025). Corporate climate initiatives. *Journal of Asian Development Studies*, 14(3), 1973–1984.
- Xicang, Z., et al. (2024). Digital transformation and technology adoption. *SAGE Open*, 14(4), 21582440241300189.
- Zafar, H., Khan, M. B., Sarwar, U., Azeem, S., Sattar, S., & Ashraf, A. (2025). Governance and whistleblowing. *Advance Journal of Econometrics and Finance*, 3(1), 151–164.
- Zhang, S., Ren, S., & Tang, G. (2024). Employee green behavior spillover. *Journal of Business Ethics*, 192(1), 57–76. <https://doi.org/10.1007/s10551-023-05494-x>