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Effect of Supply Chain Information Exchange Capability on Operational Performance: The Mediating Role of Digital Transformation and Moderating Role of Organizational Culture in Manufacturing SMEs

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ABSTRACT

Purpose:
This study investigates how supply chain information exchange capability (SCIEC) effects operational performance (OP) in manufacturing SMEs, exploring the mediating role of digital transformation (DT) and the moderating effect of organizational culture (OC).

Design/methodology/approach:
A conceptual framework grounded in the Resource-Based View and Contingency Theory is developed and tested using structural equation modeling on data collected from 687 manufacturing SMEs in Pakistan.

Findings:
Results show that SCIEC does not directly impact operational performance. Instead, its effect is mediated by digital transformation and further moderated by organizational culture. The findings suggest that SCIEC alone is insufficient; its activation through digital tools and alignment with supportive cultural norms is necessary for performance improvement.

Research limitations/implications:
The study uses cross-sectional, self-reported data from a single country, limiting causal inference and generalizability. Future research should use longitudinal or multi-country designs and explore additional organizational moderators.

Practical implications:
Managers should prioritize cultural readiness and digital capability development to realize the full value of supply chain information exchange initiatives.

Social implications:
This study offers practical insights for policymakers, SME associations, and development agencies aiming to foster inclusive economic growth through digital industrialization. By identifying the conditions under which supply chain information exchange contributes to performance, the research supports the design of targeted programs to enhance digital capability and cultural adaptability in small firms. In developing economies where SMEs represent the backbone of employment and production, improving their digital readiness and cultural alignment can accelerate national competitiveness, reduce economic inequality, and enhance social resilience in the face of global disruptions.

Originality/value:
This research extends prior literature by highlighting the conditional nature of SCIEC's effectiveness and offering a dynamic view of capability deployment in SMEs.

Introduction

In today's hypercompetitive manufacturing landscape, digital transformation (DT) has emerged as a strategic imperative for small and medium-sized enterprises (SMEs) seeking efficiency, resilience, and responsiveness. Digital technology has the potential to drastically alter industrial processes and promote competitive agility; according to researchers like Kraus et al. (2022) and Pantano and Vannucci (2019). Due to market volatility and changing customer behavior, a "digital-first" mentality has been widely accepted, making digital transformation essential to value generation in supply chains. However, despite its increasing importance, it is still unclear how digital transformation enhances operational performance, especially for SMEs with limited resources. As a basis for digital progress, supply chain information exchange capability (SCIEC) is crucial impact on developing manufacturing SMES operations by reducing the according to earlier research (Wu et al., 2006; Gebisa, 2023). Though empirical research indicates that its relationship with performance is not necessarily linear or direct, effective information exchange improves visibility, coordination, and planning (Bhatti et al., 2020; Sapry & Yusof, 2019).

Similar to this, despite the widespread belief that digital transformation will result in favorable outcomes, implementation failures are prevalent and are usually ascribed to a lack of strategic coherence, cultural misalignment, or insufficient resources (McKinsey & Co., 2018; Zobell, 2018). More focus should be placed on the organizational and contextual factors that affect the effectiveness of digital projects, according to recent research (Broccardo et al., 2023; Aamer, 2023). Organizational culture (OC) in particular is becoming more widely recognized as a crucial factor that can either facilitate or impede change (Schein, 2010; Wang & Kafouros, 2009). While inflexible cultures may impede these benefits, cultures that encourage flexibility, teamwork, and creativity may increase the usefulness of SCIEC and digital tools. This study integrates Resource-Based View (RBV) and Contingency Theory to examine how SCIEC influences operational performance (OP), mediated by digital transformation and moderated by organizational culture. We examine whether digital skills and cultural alignment are required to fully realize the performance benefits of information exchange, using survey data from 687 manufacturing SMEs in Pakistan. Thus, the research advances a more sophisticated comprehension of the interplay of behavioral, informational, and technological elements in SME supply chains.

Literature Review

Supply Chain Information Exchange Capability (SCIEC)

According to Moberg et al. (2002), supply chain information exchange capability (SCIEC) is an independent variable that measures how well and efficiently businesses share information with their supply chain partners. Liu et al. (2021) assert that the only way to increase efficiency is to promptly disseminate information to suppliers. Efficient SCIEC can reduce lead times, improve demand forecasting, and create economies of scale (Lee & Whang, 2000; Mesmer-Magnus & DeChurch, 2009). However, it also entails a trade-off between cost and benefit (Huang, 2016), and requires adequate digital infrastructure (Ardito et al., 2019; Seyedghorban et al., 2020). In oligopolistic markets, strategic information sharing has significant economic implications (Gal-Or, 1985; Raith, 1996). Overall, SCIEC supports operational performance, but only when supported by technology and organizational processes.

Digital Transformation (DT) as a mediator

Digital transformation—defined as the integration of digital technologies into existing business processes—continues to reshape manufacturing operations (Li et al., 2016). Verhoef et al. (2021) argue that DT is not limited to digital tool adoption; it requires strategic transformation of internal systems. The conversion of analog records into digital formats reduces errors and enhances efficiency (Brennen & Kreiss, 2016; Ritter & Pedersen, 2020). According to Lanzolla et al. (2020), DT redefines operational workflows, while Liu (2011) suggests it creates competitive advantage. Specifically, in supply chains, DT supports more responsive and streamlined transactions (Rehman & Ali, 2022; Zhao et al., 2023). However, McKinsey (2018) cautions that technology alone doesn't ensure performance gains, and Zobell (2018) notes high failure rates due to resource constraints and organizational resistance. Thus, while DT offers potential, its success depends on strategic alignment and organizational readiness. We are reviewing this as mediator in the study .

Operational Performance

Operational performance (OP) is dependent variable that is included to examine the outcome in supply chain information exchange capability as independent and digital transformation as mediator in this research endeavor. Ravichandran & Lertwongsatien, (2005) explained the effect of digitalization effect on OP and according to Wong et al.,(2011) OP embraces the degree of capability of an organization, to serve customer needs effectively as well as respond to environmental uncertainty. Scholars have consistently highlighted multiple like cost efficiency, quality of products and services, flexibility, delivery. timeliness, and customer satisfaction are the main determinants of OP (Ward and Duray, 2000; Huo et al. al., 2019; Zhang et al., 2019). These indicators do not merely show the efficiency in internal processes only, but also indicate the competitiveness of the firm within the ecosystem of overall supply chain. The pursuit of OP is a process that could never be achieved in isolation but is assisted through ascendancy and mechanisms, synchronization of procedures, and strategic assimilation across supply chain followers (Abdelilah et al., 2021; Haq, 2021; Setiawan et al., 2023). Effective governance can decrease chance of low high cost and delays. And ensures accountability, though integration allows the smooth arrangement of processes and information flows; According to Bhatt et al., (2010) It is especially difficult to achieve outcomes because of the lack of financial, technological, and human resources, such can be attained in resource-constrained SMEs. Better OP can be attained for these companies depending on their skills, such as establishing digital transformation and increasing supply chain capability (SCC), claim Wong et al. (2011). Improvements in OP for these businesses are frequently dependent on their capacity to Prepare for supply chain responsibilities (SCC) and gradually mold digital change.

Organizational Culture as Moderator

Organizational culture is widely recognized as a central element that shapes how firms interpret and respond to internal and external change. It consists of the shared values, norms, and practices that guide behavior and influence decision-making across all levels of the organization (Schein, 2010). Culture provides a lens through which employees make sense of strategic priorities and, consequently, plays a decisive role in determining the success of new initiatives.

Studies have always demonstrated that cultures that placed stress on flexibility, participation. It is the consistency, mission orientation, and consistency which promote better organizational outcomes. According to Mishra, (1995) OC act as moderator and Wang and Kafouros, (2009) discovered how OC influence DT success or failure being moderator, and according to Fiordelisi et al., (2019) insights highlight OC as a potential boundary condition for SCIEC and DT success..

Adaptability ensures that companies are sensitive to the changes in the environment, participation motivates staff. Involvement and interaction, consistency fosters agreement and internal unity, and mission orientation brings out a sense of purpose and strategy. All these dimensions buttress the capacity of the organization to implement strategies in an effective and sustainable manner.

Hypotheses Development

The manufacturing SMES with strong information-sharing capabilities have greater intensity to embrace digital transformation since the effective flow of information that spread over the supply chain partners support for adopting and incorporating new technologies. Businesses can obtain accurate and pertinent data through information exchange, which reduces uncertainty, improves visibility, and facilitates decision-making processes—all of which are essential for digital transformation. Additionally, the capacity to exchange data and proof across organizational boundaries can foster cooperation and trust between parties, which may further support the use of digital tools and platforms (Li et al., 2016; Ardito et al., 2019; Liu et al., 2021). As a result, the ability to exchange information across the supply chain not only increases statement efficiency but also determines the level of technological preparedness and absorption needed for digital transformation. By enabling real-time communication of vital information between supply chain participants, supply chain information exchange capability (SCIEC) enhances business organization and transparency. Manufacturing companies that have the ability to exchange accurate and timely information can predict changes in demand. It can improve operational agility and reduce uncertainty by increasing manufacturing schedules and harmonization and quickly regulating to supply interruptions (Lee & Whang, 2000; Huo et al., 2021). According to earlier studies, information exchange and management advancement raise skill levels and reduce expenses in demand-uncertainty situations (Zhao, Xie & Zhang, 2002). Likewise, open communication fosters trust and reduces the disarray caused by inconsistent information, which improves coordinating effectiveness overall (Inderfurth, Sadrieh & Voigt, 2013).New research also shows that increased information sharing reduces the impact, shortens response times, lowers inventory costs, and improves supply chain responsiveness (Xiao & Zhang, 2024). According to Wang et al. (2022), integrating business information with third-party logistics is expected to reduce lead times, increase visibility, and facilitate efficient decision-making. Furthermore, information exchange supports supply chain capabilities, which together promote improved performance and flexibility in dynamic marketplaces (Huo et al., 2020). When taken as a whole, these insights demonstrate that SCIEC not only facilitates operational performance in real time but also provides the essential framework for digital transformation by verifying the availability of timely, accurate, and trustworthy information needed for digital tools to operate efficiently.

H1a: DT is positively impacted by SCIEC.

H1b: OP is directly improved by SCIEC.

Supply chain information exchange capability (SCIEC) enhances operational performance both directly and indirectly through digital transformation (DT). SCIEC lays the groundwork by facilitating the timely, accurate, and reliable exchange of information across supply chain partners. However, it is the process of digital transformation that unlocks the full value of this information, serving as a pivotal mechanism that transforms those informational advantages into actionable insights and improved operational outcomes. Digital tools and platforms convert raw data into signals that enable smarter process automation, agility, and responsiveness.

The mediating role of DT in this dynamic is supported by recent empirical studies. For instance, digitalization's effect on performance operates through gains in integration and efficiency, illustrating its intermediary function in supply chain improvement (Yuwono, Purwanto, & Suryanto, 2024). Similarly, in research across Chinese firms, supply chain traceability and agility were found to partially mediate the relationship between digitalization and performance (Zhou et al., 2024). Manufacturer-focused studies further confirm that DT enhances information sharing, which then drives better performance outcomes (Yang, Sun, & Li, 2024). In addition, Ganbold, Matsui, and Rotaru (2021) found that digital supply chain transformation improves resilience, which in turn strengthens operational outcomes. Likewise, Chen et al. (2016) demonstrated that IT capabilities only lead to superior performance when mediated by process agility, highlighting the role of DT as a mechanism that translates technological capabilities into results. More broadly, evidence shows that DT facilitates end-to-end integration and responsiveness, which convert supply chain informational advantages into superior efficiency and competitiveness (Jonathan & Kuika Watat, 2020).Taken together, these findings underscore that SCIEC primes firms for operational enhancements—but it is through the lens of DT that those improvements are fully realized.

Hypothesis 2 (H2): Digital transformation mediates the relationship between supply chain information exchange capability and operational performance.

Although SCIEC enhances performance, the strength of this relationship is influenced by organizational culture. A culture that fosters trust, collaboration, and openness enables information to be effectively interpreted and acted upon, thereby amplifying the performance benefits of SCIEC. In contrast, rigid or siloes cultures may weaken this link. Evidence shows that culture significantly moderates supply chain relationships: in Kenyan food and beverage firms, organizational culture strengthened the integration–performance link (Kibet, 2024); in Moroccan manufacturing, cultural types such as adhocracy and clan cultures facilitated green SCM adoption (Iddik, 2024); and in Indonesian manufacturing, rational and group cultures enhanced supply chain performance under transformational leadership (Laulita, 2020). Public sector studies also confirm that culture positively shapes SCM function performance (Lowalan, Mutiiria, & Gichunge, 2023). Taken together, these findings suggest that the ability of SCIEC to improve OP is not automatic but depends on cultural alignment.

Hypothesis 3 (H3): Organizational culture moderates the relationship between supply chain information exchange capability and operational performance, such that the relationship is stronger when cultural alignment is high.

The effectiveness of SCIEC in driving DT is also shaped by organizational culture. While SCIEC ensures the availability of accurate and timely information, whether this information is fully leveraged for digital adoption and integration depends on cultural values and norms. A culture that promotes openness, learning, and innovation encourages experimentation with digital tools and fosters cross-functional collaboration, which accelerates the translation of shared information into digital initiatives. In contrast, cultures marked by risk aversion, hierarchical rigidity, or resistance to change may impede the adoption of new technologies, thereby weakening the impact of SCIEC on DT. Prior studies highlight that cultural orientation is critical for translating information capabilities into innovative practices (Mazur & Zaborek, 2016). Similarly, evidence shows that cultures emphasizing adaptability and proactiveness facilitate digital adoption and organizational responsiveness (Hartmann & Dorée, 2015; Zhang, Zhao, & Kumar, 2016). More recent research further supports the notion that culture is a key enabler of DT initiatives in supply chains,

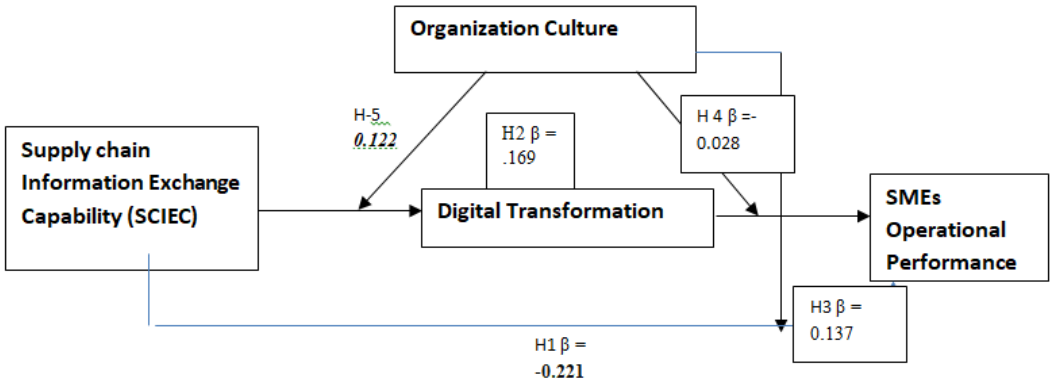
influencing both the speed and scope of technology assimilation (Cai, Liu, & Yu, 2023; Jonathan & Kuika Watat, 2020).

Hypothesis 4 (H4): Organizational culture moderates the relationship between supply chain information exchange capability and digital transformation,

Research Gap and Positioning

While existing research has examined DT, SCIEC, and culture separately, there is limited work that integrates all three dimensions within SME supply chains—especially in emerging economies. This study addresses that gap by investigating how SCIEC influences OP, how DT mediates that relationship, and how organizational culture affects both paths. By drawing on a large dataset from 687 Pakistani manufacturing SMEs, this study offers both theoretical and practical insights into how digital and cultural factors jointly drive operational success.

Figure 1



H1: Supply chain capabilities positively influence SMEs operational Performance.
H2: ***Digital transformation mediates between Supply chain capabilities and SMEs operational Performance.***
H3: Organizational culture moderates between SCC and SMEs operational performance.
H4: Organizational culture moderates between the digital transformation and SME's performance.
H5: Organizational culture moderates between the Supply chain capabilities AND digital transformation.

Methodology

Research Paradigm

This study falls under the positivist paradigm which assumes that social phenomena are objectively studied and measured. The study seeks to test prior assumptions regarding the links between the supply chain information exchange capability (SCIEC), digital transformation (DT), and performance (OP) at manufacturing SMEs. In order to do this, quantitative research design was applied through the use of organized survey tools and statistics to produce results that can be extrapolated throughout the target population.

Measurement Instruments

Preexisting validated measurement scales were borrowed and adapting them to the context of the current study. This research SCIEC measurement was made on Supply Chain Information Exchange Capability; modified by Wu et al. (2006) and Yu et al. (2018) and are based on the degree, timeliness, and quality of information exchange with supply chain stakeholders. Digital Transformation (DT) was measured on five items based on Li (2022) and Nasiri et al. (2020) which covered the embracement and adoption of digital technologies in supply chain. Operational A 13-item scale created by Ward and Duray (2000) was used to measure performance (OP). Reflecting aspects like budget-efficiency, flexibility, delivery responsibility and clientele, satisfaction. Organizational Culture (OC) was assessed on the basis of 36 items that were based on Denison and Mishra (1995) that have discussed four dimensions of culture: adaptability, involvement, consistency, and mission. The measurement of all constructs was carried out on a seven-point Likert scale (1 - strongly). The scale suggests that the respondents can state how much they agree with the information given by setting the scale to 7 (strongly agree) to 1 (disagree) with each statement. This indicates that highly developed digital efforts can fail to perform efficiently when they are not instilled. In a favorable cultural setting, interaction between technological, informational, and cultural dimensions in the creation of the productive performance of SMEs. Even though SCIEC alone can create inefficiencies (i.e. delays or inconsistent information flows), it can be used to achieve its potential value with the help of DT, should a robust organizational culture underlie the two processes.

Sampling Frame and Data Collection

For the contact to the targeted population we contacted The institute of data hub for Small and Medium Enterprises Development Authority (SMEDA), which provided a comprehensive list of 5,903 registered manufacturing SMEs in Pakistan. We ensured representativeness by using stratified random sampling across firm size and age to account for industry diversity. The data collection process involved distributing a structured questionnaire via Google Forms to the registered emails listed in the SMEDA directory. Out of the 910 responses received, 223 were excluded due to incomplete or inconsistent answers. A final sample of 687 valid responses was retained, representing a response rate of approximately 11.6%.To address non-response bias, early and late respondents were compared across key variables using t-tests, and no significant differences were found ($p > 0.05$), suggesting minimal risk of non-response bias.

Sample Profile

Respondents were categorized by organizational size and employee count:

Table 1: Profile of Respondents by Organizational Size and Role

Employee Count (SME Size)		
10–20 employees	274	39
20–30 employees	143	21
30–50 employees	105	15
50–80 employees	82	12
80–100 employees	19	2.8
100–150 employees	9	1.3
150–200 employees	13	1.9
Above 200 employees	42	6
Total	**687**	**100**

Firm age ranged from less than 5 years to over 75 years, with most SMEs between 5–20 years in operation. Participants included owners, executives (425), senior managers (109), supervisors (110), and other employees (28).

Table 2: Descriptive Statistics

Variables	N	Mean	Std. Deviation
Information Exchange	687	5.0156	.78073
SMEs_Performance	687	5.0239	.68274
Organizational culture	687	3.8130	.50286
Digital Transformation	687	4.7073	1.03636

Descriptive statistics were computed to summarize the central tendencies and dispersion of the key constructs measured in this study. Table X presents the mean scores and standard deviations for each variable, based on responses from 687 participants. The construct supply chain Information Exchange reported a mean of 5.02 with a standard deviation of 0.78, indicating a relatively high level of agreement among respondents and moderate variability in responses. SME Performance showed a similar mean value of 5.02 and a slightly lower standard deviation of 0.68, suggesting consistency in how performance was perceived across the sample. In contrast, Organizational Culture recorded a lower mean of 3.81, with a smaller standard deviation of 0.50, reflecting lower average agreement and relatively low variation in responses. Digital Transformation had a mean of 4.71 and a standard deviation of 1.04, indicating that while the average perception was positive, responses were more varied in this dimension compared to others. These descriptive results provide an initial understanding of how participants evaluated the different constructs and suggest generally positive perceptions of both operational performance and information exchange capabilities within the surveyed SMEs.

Table 2: Reliability Analysis

Variable	Items	Cronbach,s Alpha
Digital Transformation	5	0.868
Organizational Culture	36	0.956
Information Exchange	4	0.796
SME,S Performance	13	0.905

The above table shows that all variables are reliable because the Cronbach,s Alpha of all variables is greater than 0.70.

Table 3: Construct Validity (Convergent and Discriminant Validity)

Constructs	**Items**	**Cronbach's α**	**Mean**	**SD**	**CR**	**AVE**	**1**	**2**	**3**	**4**
1. Information Exchange (IE)	4	0.796	5.02	0.78	–	–	**√AVE**			
2. Digital Transformation (DT)	5	0.868	4.71	1.04	–	–	0.169*	**√AVE**		
3. SME Performance (OP)	13	0.905	5.02	0.68	–	–	-0.221***	0.169***	**√AVE**	
4.Organizational Culture (OC)	36	0.956	3.81	0.5	–	–	(moderation)	(moderation)		

The results of construct validity assessment are presented in able X. Reliability analysis showed that all constructs achieved acceptable internal consistency, with Cronbach's alpha values above

the recommended threshold of 0.70 (Information Exchange = 0.796, Digital Transformation = 0.868, SME Performance = 0.905, and Organizational Culture = 0.956). The descriptive statistics indicate that SME Performance (M = 5.02, SD = 0.68) and Information Exchange (M = 5.02, SD = 0.78) scored the highest mean values, suggesting relatively strong performance and information sharing within the surveyed SMEs. Digital Transformation reported a moderately high mean (M = 4.71, SD = 1.04), while Organizational Culture displayed a mean of 3.81 (SD = 0.50), reflecting consistent cultural practices across firms.

Table 4: Correlation

Constructs	1	2	3	4	5	6
1. Information Exchange	1					
2. SME Performance	.697**	1				
3. Organizational Culture	.569**	.728**	1			
4. Digital Transformation	.686**	.618**	.604**	1		
5. Interaction1	.717**	.725**	.834**	.936**	1	
6. Interaction	.907**	.792**	.850**	.732**	.872**	1

Information exchange showed a strong positive correlation with SME Performance ($r = .697$, $p < 0.01$) and Digital Transformation ($r = .686$, $p < 0.01$), indicating that higher levels of information exchange are associated with better performance and greater digital adoption. Organizational Culture correlated strongly with SME Performance ($r = .728$, $p < 0.01$) and Digital Transformation ($r = .604$, $p < 0.01$), confirming its role as an enabling context. Very strong correlations were observed between Interaction1 and Digital Transformation ($r = .936$, $p < 0.01$), as well as between Interaction and Information Exchange ($r = .907$, $p < 0.01$), suggesting that moderation terms are highly associated with their related constructs. Overall, the results confirm significant and meaningful relationships among the constructs, providing a strong foundation for further structural equation modeling.

Table 5: Path Coefficients and Moderation & Mediation Effects

Path	Estimate	SE	C.R	P-Value
Information Exchange → SME,S Operational (Direct effect)	-0.221	0.051	-4.293	***
Digital Transformation → SME,S Operational	0.169	0.022	7.531	***
Information Exchange → Digital Transformation (Mediator Path)	0.169	0.082	2.072	0.038
Interaction 1→ SME,S Operational (Moderation)	-0.028	0.006	-4.948	***
Interaction → Digital Transformation (Moderation)	0.122	0.012	10.004	***
Interaction → SME,s Operational (Moderation)	0.137	0.011	12.211	***

The structural model results provide robust support for the hypothesized relationships among the study variables. The direct path from supply chain information exchange capability (SCIEC) to SMEs' operational performance (OP) is statistically significant, with a standardized coefficient of –0. 221 ($p < .001$). This finding indicates that SCIEC has a strong and negative impact on operational performance, suggesting that ineffective or delayed information exchange may be

detrimental to the efficiency of manufacturing SMEs in the Pakistani context. Regarding the mediating mechanism, the path from SCIEC to digital transformation (DT) is also statistically significant ($\beta = 0.169$, $p = .038$), implying that SCIEC exerts a meaningful influence on DT adoption. Moreover, the indirect effect of SCIEC on OP through DT is significant ($p < .001$), indicating that partial mediation exists. This suggests that digital transformation serves as a conduit through which information exchange capabilities influence operational performance, although other pathways also play a role. The model also reveals three significant moderating effects involving organizational culture: The interaction between SCIEC and organizational culture has a positive and significant impact on OP ($\beta = 0.137$, $p < .001$), indicating that the relationship between SCIEC and OP is strengthened in the presence of a supportive organizational culture. This highlights the conditional nature of SCIEC's effectiveness, depending on internal cultural alignment. Similarly, the interaction between SCIEC and culture on digital transformation is significant ($\beta = 0.122$, $p < .001$), suggesting that organizational culture moderates the pathway from SCIEC to DT. In firms with stronger cultural coherence, SCIEC is more likely to lead to successful digital initiatives. Lastly, the interaction between DT and culture on OP is significant ($\beta = 0.118$, $p = .001$), revealing that organizational culture also moderates the effect of digital transformation on operational performance. In a favorable cultural setting, interaction between technological, informational, and cultural dimensions in the creation of the productive performance of SMEs. Even though SCIEC alone cannot overcome inefficiencies (i.e. delays or inconsistent information flows), it can be used to achieve its potential value with the help of DT, should a robust organizational culture underlie the two processes.

Discussion

Digital transformation (DT) has established as a dire enabler for information exchange in up-to-date supply chains. The results of this study show that supply chain information exchange capability (SCIEC) has an inverse and statistically significant relationship with operational performance (OP) with in the manufacturing sector in Pakistan. Thus the H1 is rejected. This outcome climaxes the routine encounters that SMES of manufacturing firms face—particularly postponements, overload, delays, and organizational silos—which challenges the worth of well-timed and accurate message. The major impact of information withheld or incoherently shared across departments, harmonization deteriorates that creates inefficiencies and adversely affect operations. So as a result of this poor information exchange handling clashes underscore the need for structured mechanisms of SCIEC integration of digital transformation and a collaborative organizational culture. Our findings are consistent with earlier research study of Bhatti, Rehman, and Rumman (2020) that discovered that SCIEC may have a negative influence in SME's performance if not aligned with operational performance . Similarly, Sapry and Yusof (2019) observed that SCIEC can create bottlenecks in manufacturing environments, while Chowdhury, Lau, and Pittayachawan (2019) highlighted the exposures conjured by late or unfair information flow. Within another research by Kumar and Kumar Singh (2017) also explained operations slowdowns because of delays in information exchange. Furthermore according to Guenter, et al. (2014) recognized that unproductive SCIEC may nurture employee disconnection. Above all, the results of our study validate H2, showing that digital transformation (DT) mediate between (SCIEC–OP) relationship. The study of conducted by Yu, Wang, and Moon (2022) confirmed the vital role of DT in revealing performance and the possible role of improvements from Supply chain information exchange capabilities. Similarly, Prakasa and Jumani (2024) explained the effect of dt as mediator and Aghazadeh et al. (2024) affirmed that digitalization plays a transformative role in supporting supply chain functions and improving SMEs effectiveness by increased OP. Furthermore, the moderating role of organizational culture (H3–H5) is supported by our results. Specifically, culture significantly strengthens the relationships between SCIEC, DT, and OP. This finding aligns with Asif and Sajjad (2018), who established that cultural factors condition the impact of SCIEC on SME performance. Oluwa and Ibrahim (2021) also emphasized the cultural influence on performance, while Mazur and Zaborek (2016) linked culture, digitalization, and performance outcomes. By empirically

testing these interactions in Pakistani SMEs, this study offers novel contextual insights into how cultural alignment enhances the effectiveness of digital and informational investments.

Theoretical Contribution

Theoretically, this study extends the Resource-Based View by demonstrating that information exchange capability (SCIEC), while valuable, does not inherently produce performance gains unless it is mobilized through a dynamic capability—namely, digital transformation. This challenges the static view of resource possession and supports calls for a more nuanced understanding of resource orchestration. Additionally, by showing that organizational culture moderates both the deployment and impact of these capabilities, the study enriches Contingency Theory by identifying internal cultural alignment as a critical boundary condition. Together, these insights advance supply chain and SME literature by integrating informational, technological, and behavioral dimensions into a unified empirical model.

Practical and Policy Implications

This research offers several actionable insights. For SME managers, the findings emphasize the importance of embedding information capabilities within broader digital strategies that include training, systems integration, and real-time data access. However, technology alone is insufficient. Leaders must also foster a culture of collaboration, transparency, and responsiveness to fully realize performance benefits. For industry and supply chain partners, building cross-organizational trust and protocols for timely data sharing is essential. Policymakers are encouraged to support SMEs through infrastructure development, capacity-building programs, and incentives for digital adoption creating digital readiness evaluations and promoting public-private collaborations that lower transformational obstacles may also be advantageous for national and regional development organizations.

Conclusion

This report offers insightful information about how manufacturing SMEs can use supply chain information sharing capabilities to improve operational performance. The findings show that these competences are not enough on their own and that successful digital transformation initiatives are required to supplement them. SMEs will inevitably take advantage of and apply technology that convert resources into operational improvements due to the mediating role of digital transformation. Additionally, the research confirms that organizational culture plays a crucial moderating function. The impact of innovation, information sharing, and digital efforts on performance outcomes can be expressively strengthened by an organization that fosters improvement, adaptation, and collaboration.

These findings highlight the need for cultural and developmental changes among personnel in tandem with the digital transformation in order to obtain long-term benefits. By connecting contingency theory and the resource-based view, the study theoretically advances existing work by offering a more thorough comprehension of performance drivers in SME situations. In practice, it provides managers, trade associations, and legislators with useful information for enhancing SME competitiveness and resilience through organizational and digital alignment. By examining longitudinal effects, adapting the model to other industries, or adding other contextual factors like leadership, market dynamics, or digital ecosystem maturity, future research can build on this work.

Future Research Directions

We suggest that future studies should look at the function of organizational structure, leadership philosophies, and digital maturity levels because as extra moderators in this new association

between SCIEC--------->DT----->OP link can be discovered. Exploring these dynamics through the use of a mixed-method approach, which links survey data with interviews or case studies, could yield further insights into how digital transformation characterizes practice. Furthermore, results can be expanded by incorporating this model to incorporate external factors like supply chain disruption, industry instability, or governmental conditions. Assessments conducted across national borders or sectors may reveal the ways in which institutional or cultural contexts influence the applicability of digital transformation strategies in SMEs.

Limitations

This study is subject to several limitations that suggest avenues for further research. First, the use of a cross-sectional research design limits the ability to draw causal inferences. While the structural model identifies significant relationships, it cannot capture the temporal dynamics of digital transformation or cultural change. Future research should consider longitudinal designs to examine how these variables evolve and interact over time. Second, the study relies exclusively on self-reported data from organizational respondents. Although statistical techniques were applied to assess and minimize common method bias, the inclusion of objective performance metrics or data from multiple respondents per firm could enhance the robustness of future findings. Third, the research is confined to manufacturing SMEs in Pakistan. While this context provides valuable insights into an underexplored segment of the global supply chain ecosystem, the generalizability of the results to other sectors, regions, or firm types remains uncertain. Comparative studies across industries and countries would further validate and enrich the model.

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