

Building Adaptive Supply Chains Through Digital Social Capital: Implications for Supply Chain Performance in Emerging Economies

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ABSTRACT

The current technological evolution, geopolitical turbulence and customer's preferences have created a situation of volatility, uncertainty, complexity and ambiguity (VUCA) in global value chains. The increased challenges have made supply chains more adaptive and resilient, which is crucial for companies to survive in volatile contexts. Especially, companies in emerging economies are under greater pressure to improve their adaptability and performance of their supply chains. In this context, digital transformation has revolutionized the way firms construct and use relational networks within and outside the boundaries of the firm. Through the use of Digital technologies like enterprise systems, cloud platforms and collaborative communication software, companies can build Digital Social Capital (DSC) and share information, coordinate and collaborate in real time. While there is increasing interest in digital supply chains, previous research has tended to focus more on the technological enablers and overlooked the digitally enabled relationship resource. Furthermore, the links between the digital social capital and the performance of the supply chain are not well understood. The study follows the Social Capital Theory (SCT) and the Dynamic Capabilities View (DCV) that emphasizes the knowledge, trust, and coordination benefits from internal and external relational networks enabled by digital technology. SCT explains how digital interactions within and outside the firm facilitate resource access and knowledge sharing, while DCV explains how these relational resources are transformed into adaptive capabilities that enable firms to respond to environmental uncertainty. Using a quantitative, cross-sectional survey design, data are collected from supply chain and operations managers in Pakistani manufacturing firms. The proposed relationships are tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). The model posits that both Internal Digital Social Capital (IDSC) and External Digital Social Capital (EDSC) positively influence SCA, which in turn enhances SCP. In addition, SCA is expected to mediate the relationships between digital social capital dimensions and supply chain performance. The study contributes by integrating SCT and DCV to explain the resource–capability–performance link in an emerging economy context and highlights supply chain adaptability as a key mechanism for improving performance in digitally transforming manufacturing firms in Pakistan.

1. Introduction

This current business landscape is not only volatile, but unpredictable, as a result of a chain of events that have hit the world, such as global pandemics, geopolitical conflicts, trade restrictions, climate-related events and economic uncertainties. The disruptions have revealed critical weaknesses in global value chains, resulting in product shortages, transportation bottlenecks, production disruptions, and operational instability (Ivanov & Dolgui, 2020; Queiroz et al., 2020; Chowdhury et al., 2021). As a result, firms are increasingly demanded to build up skills and prepare to cope with and be competitive in the face of disruption and volatility.

In this context, supply chains are no longer a support function or tool, but are actually a strategic asset that can greatly affect organization competitiveness (Christopher, 2016; Mentzer et al., 2001). The use of intricate supplier networks, manufacturing, distributor networks and customers to produce and provide value has become an important part of firms. This has made supply chain performance (SCP) one of the key factors of organizational success (Li et al., 2006; Flynn et al., 2010; Gligor et al., 2019), measured by certain dimensions including responsiveness, reliability, flexibility, cost efficiency and customers' satisfaction.

But maintaining high performance in the supply chain in dynamic and uncertain environments is tougher than ever. However, the use of traditional resources alone may be inadequate to meet the ever-evolving needs of the market and the unexpected changes that occur (Teece et al., 1997; Eisenhardt & Martin, 2000). The advent of digital technologies has revolutionized the way firms engage, work together and share information with their supply chain partners, as firms look for new sources of competitive advantage (Dubey et al., 2021; Bag et al., 2021). The evolution of these has helped give rise to networks of digitally connected firms that help to improve collaboration and information exchange between firms.

In the era of digitization of interorganizational relations, the term digital social capital has emerged. Social Capital is the resources that are actually and potentially available within the networks of relationships through which people coordinate their actions and create value as described in Social Capital Theory (Bourdieu, 1986; Coleman, 1988; Nahapiet & Ghoshal, 1998). In a digital environment, these relational resources are reinforced by online platforms, digital communication channels and collaborative technologies that foster trust, knowledge sharing and network connectivity, including the use of digital tools, such as social media (Chiu et al., 2006; Ellison et al., 2007; Huynh et al., 2022). Digital social capital unlocks a wide range of knowledge sources, allows firms to get real-time information, improves collaboration, and boosts the group's ability to solve problems together, providing strategic value in supply chain operations.

Digital social capital can help access the relational resources, but how these resources affect organizational outcomes may be contingent on the capabilities of the firms to leverage these resources. According to the Dynamic Capabilities View (DCV), firms can sustain competitive advantage by being able to integrate, build and reconfigure internal and external resources to address environmental changes (Teece et al., 1997; Teece, 2007). One of these capabilities is supply chain adaptability, which helps firms to be responsive to market changes and supply chain disruptions (Lee, 2004; Eckstein et al., 2015).

Supply chain adaptability is defined as the ability of a supply chain to adjust its strategies and processes, structures and relationships to environmental uncertainties and emerging opportunities (Lee, 2004; Stevenson & Spring, 2007). Flexible supply chains can respond to changing conditions by modifying sourcing, production, logistics and collaboration. For the DCV, the adaptability is an important dynamic capability, which enables firms to adjust resources and capabilities to environmental requirements on an ongoing basis (Teece, 2007; Wilden et al., 2013).

Digital social capital might be a crucial predecessor of adaptability in supply chain. The strong relationships based on digital media enable the rapid dissemination of information, greater transparency within the chain, trust between partners and collaborative decision-making (Nahapiet & Ghoshal, 1998; Inkpen & Tsang, 2005). Access to quality information and knowledge-sharing systems allows firms to better detect environmental change; coordinate a response; and create adaptive solutions to new challenges. Therefore, it can be said that digital social capital will be expected to enhance the adaptability of a firm to its supply chain operations in unpredictable environments.

Moreover, adaptability of the supply chain is expected to boost the performance of the supply chain by making them responsive, flexible, resilient, and efficient (Eckstein et al., 2015; Gligor et al., 2019; Aslam et al., 2021). Companies that are more adaptable will be better positioned to adjust when things go wrong, customers' needs evolve, and technology advances, ensuring they can keep their businesses running and services up to standard. Thus, chain responsiveness can be a potential pathway of digital social capital's contribution to improving supply chain performance.

These linkages are especially important in Pakistan's manufacturing industry, which is considered as one of the most important sectors for national economic growth, job creation and export. The sector is not only crucial for the economy but also grapples with various issues such as infrastructure limitations, energy scarcity, supply disruptions, market volatility, and competition from around the world (Khan et al., 2019; Hussain et al., 2023). Understanding the conditions that necessitate the creation of more robust collaborative networks and how adaptability can bring competitiveness to the manufacturers become crucial. Empirical evidence on how digital social capital improves supply chain adaptability and performance in the Pakistani context is limited, though digital technologies have been increasingly embraced in manufacturing supply chains.

In view of this, the present study uses the Social Capital Theory (Nahapiet & Ghoshal, 1998) and Dynamic Capabilities View (Teece et al., 1997) to investigate the relationship between digital social capital, SC adaptability and supply chain performance in manufacturing industry of Pakistan. In this study, the authors examine first if digital social capital has a direct positive effect on supply chain performance and second if supply chain adaptability acts as a mediator between digital social capital and supply chain performance. The study adds to the growing body of literature on digitally transformable interorganizational resources and dynamic capabilities, and helps managers gain insightful lessons about how to enhance supply chain effectiveness in the current turbulent business scenario.

2.0 Theoretical Background

2.1 Social Capital:

Social capital, also termed as relational capital, encompasses embedded knowledge acquired through interactions with stakeholders, including customers, suppliers, and both internal and external partners (Marr & Roos, 2012).

2.1.1 Dimensions of Social Capital:

Researchers have branded social capital into diverse dimensions, for this study, we use two dimensions of Social Capital:

1. Employee Internal Collaboration

2. Employee external collaboration (Subramaniam & Youndt, 2005)

Employee internal collaboration refers to a dynamic process involving the interaction and cooperation of employees within an organization to achieve shared goals. It encompasses a broad spectrum of activities, from informal knowledge sharing to structured teamwork.

Employee external collaboration refers to the interaction and cooperation between employees of an organization and external stakeholders to achieve mutual goals. This involves building relationships and working together with individuals or groups outside the company's boundaries (Zhong et al., 2023).

In the age of global hyper connection, innovation, a fundamental pillar of company competitiveness, although investigated often and with different approaches, needs to be considered in the social process perspective (de Melo et al., 2020).

Since digital technologies, digital platforms and digital infrastructures extended to macro, meso and micro levels, business innovation processes changed in significant ways, favouring collaboration and knowledge sharing among individuals, firms, other agents and the context (Malhotra and Majchrzak, 2019). The shape of social capital is changed from Social capital to digital Social capital

Hence, collaboration represents a way to overcome this physiological lack of resources. Accordingly, as theoretical and practical evidence showed, the concept of innovation has been redefined, going beyond the boundaries of technology (i.e. new products/processes), since changes originate from all the elements comprising a firm's business model.

The social capital perspective suggests that digital platforms strengthen structural, relational, and cognitive ties among organizational members by facilitating communication, trust development, shared understanding, and knowledge exchange (Nahapiet & Ghoshal, 1998). Digital tools such as intranets, workflow systems, email platforms, enterprise resource planning (ERP) systems, and collaborative software enable employees to coordinate tasks efficiently and access collective knowledge resources (Zwass, 2003). Hardwig and Weißmann (2021) argue that digital collaboration enhances employee cooperation and collective problem-solving, although it may simultaneously increase the need for self-organization.

2.2 Digital Social Capital

DSC are resources embedded within digitally enabled relationships and networks that facilitate information sharing, knowledge exchange, collaboration, and coordinated action among organizational members and external stakeholders. Building upon Social Capital Theory (Nahapiet & Ghoshal, 1998; Adler & Kwon, 2002), Digital Social Capital extends traditional social capital into digitally mediated environments where interactions occur through communication technologies, collaborative platforms, cloud-based systems, and other digital infrastructures.

The concept of digital collaboration can be understood by adopting the perspective of the Social Capital Theory, which considers digital collaboration as a multidimensional phenomenon with internal and external dimensions. Internal digital collaboration involves digitally enabled interactions between organizational units and/or between employees that foster the sharing of knowledge and coordination of activities, while external digital collaboration occurs when the focal firm collaborates with its supply chain partners in a digitally enabled way, to share information, make decisions together, or create value together. These dimensions together show

the firm's digitally enhanced social capital, which strengthens the firm's capabilities and adaptability of the supply chain.

Digital Collaboration can be thought of to be an expression of social capital that works in two ways:

Internal Digital Collaboration (Intra-organizational social capital)

The first of the intra-organizational social capital is represented by Internal Digital Collaboration.

External Digital Collaboration (Inter-organizational Social Capital):

The external collaboration between two or more firms through digital channels.

2.2.1 Internal Digital Collaboration (Intra-organizational Social Capital)

Internal digital collaboration depends on how employees and organizational units interact, share knowledge, coordinate activities and work together to achieve organizational goals and tasks through digital technologies.

This Internal digital collaboration is the degree to which members of firms, its' departments and its functional units use digital technologies and communication platforms to share knowledge, coordinate activities, resolve problems and reach firm' goals.

Enhanced communication and knowledge sharing helps to foster organizational learning, innovation and operational efficiency via internal digital collaboration (Tsai et al., 2014). It also enhances collective intelligence by enabling employees from different disciplines to connect and collaborate to find solutions in virtual space (Malone et al., 2010).

Internal digital collaboration is the application of digital technologies for communication, coordination of action and exchange of knowledge within the firms by employees and organizational units themselves (Hardwig & Weißmann, 2021). As far as social capital is concerned, the interactions build structural, relational and cognitive social capital, which supports the sharing of knowledge and collective learning among employees (Tsai et al., 2014).

Therefore, Internal Digital Social Capital is the social resources that are contained within digitally mediated relationships between employees and firm units. Employees build more solid structures, gain a shared understanding, and trust each other through enterprise systems, intranets, collaborative platforms and digital communication tools, which enable knowledge sharing and collective problem-solving (Hardwig & Weißmann, 2021). Social Capital Theory proposes that such internal networks improve the firm's ability to mobilize and connect and integrate distributed knowledge resources (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998) which promotes organizational adaptability and performance.

2.2.2 External Digital Collaboration (Inter-organizational Social Capital)

External digital collaboration: Degree of use of digital technologies to communicate, share information, coordinate activities and cooperate with suppliers, customers and other external actors to reach mutual goals.

Thus, external digital collaboration is defined as the application of digital technologies to support cooperation, the sharing of information and the co-production of value with external partners such as suppliers, customers, distributors and other actors in the value chain.

Inter-organizational relationships are considered as valuable resources that can facilitate firms to access external knowledge, technologies, and capabilities from a social capital point of view

(Adler & Kwon, 2002). Digital technologies include extranets, cloud-based systems, supplier portals, and web-enabled communication systems that enable supply chain partners to share knowledge, information and coordinate decision-making (Zwass, 2003).

Greasley et al. (2008) note that such collaboration supports the exchange of knowledge, technology, assets, and business processes, generating outcomes that individual firms could not achieve independently.

Digital collaboration across organizational boundaries enhances responsiveness to environmental changes, improves access to distant markets, strengthens supply chain integration, and supports innovation through collective problem-solving (Gursoy et al., 2015). By enabling continuous interaction among supply chain partners, digital collaboration strengthens inter-organizational social capital and facilitates the development of shared goals and mutual understanding.

Thus, External Digital Social Capital refers to the resources embedded in digitally enabled relationships between the focal firm and its external stakeholders. Digital platforms facilitate continuous communication, information exchange, joint planning, and collaborative decision-making across organizational boundaries (Zwass, 2003). These digitally connected networks enable firms to access valuable external knowledge, develop mutual trust, and coordinate responses to environmental changes (Adler & Kwon, 2002; Carey et al., 2011). Consequently, External Digital Social Capital enhances inter-organizational learning and collaborative adaptation throughout the supply chain.

Table 1: Proposed Conceptualization

Social Capital Dimension	Digital Collaboration Dimension	Key Actors	Main Purpose
Internal Social Capital	Internal Digital Collaboration	Employees, departments, functional units	Knowledge sharing, coordination, learning
External Social Capital	External Digital Collaboration	Suppliers, customers, logistics providers, partners	Information exchange, supply chain integration, joint problem solving

2.3 Supply Chain Adaptability

It is important to mention that supply chain flexibility (SCF), also called adaptability, is a strategic-level capability (Mak & Max Shen, 2021). It was developed to help companies tailor their Supply Chain around fundamental shifts inside the business environment. According to Phadnis & Schoemaker, (2022), a critical indicator of the success of firms is the pace and ease with which customer services can be obtained in the new context. This adaptability implies that an organization can refine its processes to focus on particular circumstances by using various technologies, saving material providing time, and learning from the past (Zomorodi et al., 2019); Rameshwar et al. 2021).

SCA is an essential requirement in complex and changing market environments for organizational success in terms of profitability and business making risks compared to competitors (Tuominen et al., 2004). SCA is becoming manifestly valued as a dynamic capability. This demonstrates the adaptive intelligence of an organization, allowing it to quickly detect and respond to business-related incidents. The resulting higher resilience in firms that have developed an Adaptive SC has been proven. Excerpts from the Covid-19 pandemic demonstrate strategies that are effective in reducing adverse effects (Dohale et al., 2023).

2.4 Supply Chain Performance

Supply chain performance can be perceived as the ability to deliver quality products and services on a sustained basis, at the right quantity and amount based on the set time lines, at a competitive price.

SCOR is a comprehensive framework for evaluating supply chain performance, encompassing multiple dimensions such as reliability, responsiveness, agility, cost efficiency, and asset management efficiency.

Unlike single-metric assessments, score 13 provides a structured approach that allows firms to measure both operational and strategic outcomes, offering insights into strengths and areas for improvement across supply chain functions.

2.5 Grounded Theories:

A robust theoretical substance can be established by integrating **Social Capital Theory (SCT)** and the **Dynamic Capabilities View (DCV)**. Social Capital Theory elucidates how digitally embedded relationships and networks deliver access to vital information and resources, while DCV enlightens how firms convert these resources into adaptive capabilities that augment performance. Here, **Internal Digital Social Capital (IDSC)** and **External Digital Social Capital (EDSC)** signify strategic relational resources, whereas **Supply Chain Adaptability (SCA)** embodies a dynamic capability that allows firms to reconfigure resources in response to environmental variations. Together, these theories provide a coherent clarification for in what way digital social relationships decipher into superior supply chain results.

2.5.1 Social Capital Theory

According to Social Capital Theory, valuable resources are contained in relationships and social networks which enables information, trust, cooperation and collective action (Nahapiet & Ghoshal, 1998). There are three forms of social capital: structural, relational, and cognitive. Structural capital involves network structure and interaction patterns between actors, relational capital involves the trust, norms, and obligations generated in the network, and cognitive capital involves the shared understanding, goals, and interpretations of the network members (Nahapiet & Ghoshal, 1998).

In the modern supply chains, the digital technologies have brought about a change in the understanding of social capital by making communication, collaboration and knowledge sharing possible through digital platforms and technologies, namely Digital Social Capital (DSC). The use of digital tools, like enterprise resource planning (ERP) systems, cloud-based platforms, collaborative software and social networking technologies helps firms build and sustain social capital both internally and externally. Internal Digital Social Capital is formed by the digitally mediated interaction between people and departments and by External Digital Social Capital, people and digitally mediated relationships with suppliers, customers and other partners in the supply chain.

According to the Social Capital Theory, the higher the digital social capital a company has, the more likely it is to obtain timely information, coordinate activities, decrease uncertainty, and create collaborative problem-solving. These benefits are especially significant in dynamic and uncertain scenarios where speed in information flow and collaboration is key to managing the supply chain effectively.

2.5.2 Dynamic Capabilities View

The Dynamic Capabilities View builds on the RBV by focusing on the ability to manage a firm's internal and external competencies in the face of dynamic changes in the environment (Teece, Pisano, & Shuen, 1997). Dynamic capabilities are the ability to recognize and react to changes in the environment, to exploit new opportunities, and to transform resources within the organization to maintain competitive advantage (Teece, 2007).

Supply Chain Adaptability is one of the dynamic capabilities mentioned in literature, which enables companies to change the configuration, processes and strategies of their supply chains in response to variations in market conditions, technological innovations, and unforeseen events (Lee, 2004). Flexible supply chains have the ability to redefine their sourcing strategy, resources, form new partnerships, and be able to react to demand and supply variations.

According to DCV, it takes more than valuable resources to outperform. In fact, companies need to build the skills necessary to use and redeploy those resources. So social capital can't be seen as a factor that directly contributes to performance unless the firms have the power to convert social relations into operational results.

Digital Social Capital isn't directly related to the performance itself. Instead, it gives access to information, knowledge, trust and collaborative relationship that can help the firm restructure the supply chain arrangements, processes and relationship to meet varying market demands. This greater flexibility then results in greater supply chain effectiveness.

Social Capital Theory is a theory that explains why digital relationships are significant assets that can be utilized within an organization.

Dynamic Capabilities View is an explanation of how these resources are converted into adaptive capabilities.

Supply Chain Adaptability is the key dynamic capability that connects digital social capital to supply chain performance.

This holistic view provides greater theoretical support for the mediation of Supply Chain Adaptability and is consistent with the existing supply chain literature that focuses on the significance of relational resources and dynamic capabilities in responding to uncertainty and enable superior performance.

2.5.3 Integrating Social Capital Theory and Dynamic Capabilities View

The integration of Social Capital Theory and DCV provides a compelling framework for understanding how digital relationships contribute to supply chain success. Social Capital Theory explains the origin of valuable relational resources embedded in digital networks, while DCV explains how firms leverage these resources through dynamic capabilities to improve performance.

In this study, Internal Digital Social Capital and External Digital Social Capital are conceptualized as strategic relational resources that facilitate access to information, knowledge, trust, and collaborative opportunities. These resources enhance an organization's ability to sense environmental changes and coordinate responses across the supply chain. However, the performance benefits of these resources are realized only when firms possess the capability to adapt supply chain operations effectively.

Accordingly, Supply Chain Adaptability serves as the mechanism through which digital social capital is converted into enhanced supply chain performance. Internal digital social capital improves cross-functional coordination, knowledge sharing, and collective decision-making,

enabling firms to adapt internal supply chain processes more effectively. Similarly, external digital social capital facilitates collaboration with suppliers and customers, improving visibility, responsiveness, and access to external resources needed for adaptation.

Consistent with DCV, supply chain adaptability represents the firm's capacity to reconfigure resources and operational processes in response to environmental changes. Consequently, firms with stronger digital social capital are expected to develop greater adaptability, which in turn enhances supply chain performance through improved responsiveness, flexibility, reliability, and efficiency.

Therefore, this study integrates SCT and DCV to explain how digital relational resources translate into performance outcomes.

- SCT explains **resource formation** (IDSC and EDSC).
- DCV explains **resource transformation** into capability (SCA).
- SCP represents **performance outcomes** of dynamic capability deployment.

Table 2: Summary of Hypothesis & Role of Theory

Hypothesis	Primary Theory	Role of Theory
H1	Social Capital Theory Social Capital Theory	IDSC provides relational and knowledge resources EDSC provides external relational and knowledge resources
H2	Dynamic Capabilities View	Adaptability is a dynamic capability driving performance
H3	SCT + DCV Integration SCT + DCV Integration	Resources (IDSC) → Capability (SCA) → Performance Resources (EDSC) → Capability (SCA) → Performance

This explicit resource → capability → performance logic is exactly what many reviewers expect when evaluating studies grounded in Dynamic Capabilities View. It also aligns fit with context of this paper i.e. manufacturing sector in Pakistan, where digital relationships themselves are unlikely to produce performance outcome until and unless firms can translate them into adaptive supply chains.

2.6 Adaptability as a Mediator:

Digital technologies create and strengthen social relationships both within the firm and across supply chain partners. These digitally enabled relationships constitute Digital Social Capital, which provides access to information, knowledge, trust, and collaborative resources. Such resources enhance the firm's ability to sense, respond, and reconfigure supply chain activities in response to environmental changes (Supply Chain Adaptability), which ultimately improves Supply Chain Performance.

Digital Social Capital itself does not directly generate performance. Rather, it provides access to information, knowledge, trust, and collaborative relationships that enable firms to adapt supply chain structures, processes, and partnerships in response to changing market conditions. This enhanced adaptability subsequently leads to superior supply chain performance.

Thus, digital social capital is not directly sufficient for performance improvement unless it is transformed through supply chain adaptability.

2.7 Proposed Conceptual Model

The proposed model therefore follows the logic:

Digital Social Capital (Internal and External) → Supply Chain Adaptability → Supply Chain Performance

Under this framework:

- **Social Capital Theory** explains why digital relationships constitute valuable organizational resources.
- **Dynamic Capabilities View** explains how these resources are transformed into adaptive capabilities.
- **Supply Chain Adaptability** acts as the key dynamic capability linking digital social capital to supply chain performance.

This integrated perspective offers a stronger theoretical justification for the mediating role of Supply Chain Adaptability and aligns well with current supply chain literature emphasizing the importance of relational resources and dynamic capabilities in managing uncertainty and achieving superior performance.

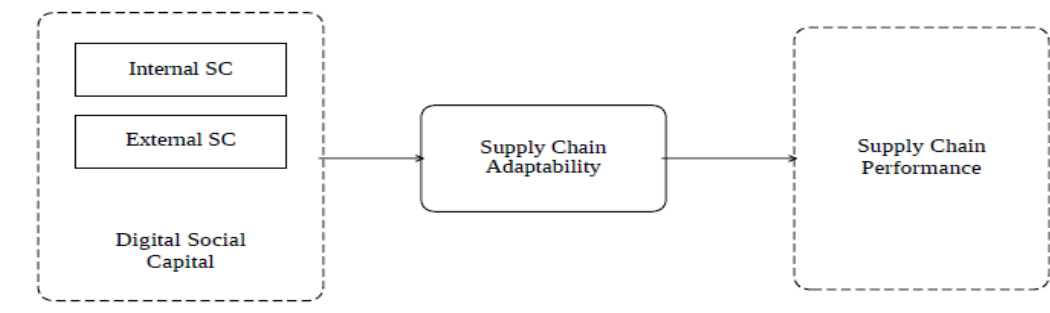


Figure 1: Conceptual Model:

2.8 Hypothesis

Internal Digital Social Capital and Supply Chain Adaptability

The adaptability of internal Digital Social Capital and Supply Chain.

Social Capital Theory (SCT) suggests that valuable resources are located in social relationships and networks, which enable the sharing of information, knowledge, trust and collective action (Nahapiet & Ghoshal, 1998). In the workplace, digital technologies like internal communication networks, collaborative tools and enterprise systems enhance communication between employees and departments, fostering Internal Digital Social Capital (IDSC). These digitally mediated relationships facilitate the sharing of knowledge in more efficient ways, the coordination of activities in more effective ways, and the creation of shared understanding about the goals of the supply chain.

Access to information and knowledge resources improves a firm's sensing and reconfiguration capabilities from a Dynamic Capabilities View (DCV) point of view, by making it more able to detect environmental changes and to be able to reconfigure operational resources to solve new problems (Teece, 2007). Digital social capital inside the organization enables cross-functional collaboration and organizational learning, and this is important to adaptability. Recent research has indicated that digitally connected internal networks have a positive impact on organizational responsiveness and adaptive capability in dynamic business environments (Queiroz et al., 2024).

Thus, companies with a stronger internal digital social capital are in a more advantageous position to create supply chain adaptability.

External Digital Social Capital and Supply Chain Adaptability

Social capital theory suggests that relationships outside the organization can also be a source of external resources, information, and opportunities that facilitate organization effectiveness (Adler & Kwon, 2002). External Digital Social Capital (EDSC) is an indicator of the trust, communication and collaboration that can be facilitated digitally between firms and their supply chain partners such as suppliers, customers and logistics providers.

Digital platforms enable information sharing in real-time and collaborative problem-solving, helping companies stay informed about market trends, customer preferences, and supplier capacities. These knowledge resources placed in the external environment assist firms in predicting changes in the environment and preparing for adaptive action. The DCV view sees these relational resources as strengthening a firm's sensing and reconfiguration functions and thus its adaptability. Over the last few years, there has been growing evidence that digital collaboration in supply chain networks can make companies significantly more effective in adjusting operations and react to uncertainty (Bag et al., 2024; Wamba et al., 2023). Thus, a higher level of external digital social capital should lead to higher social capital adaptability in the supply chain.

H1: there is a positive relationship between DSC and SC Adaptability

Supply Chain Adaptability and Supply Chain Performance

Dynamic Capabilities View states that sustainable performance results not only from the possession of resources but also from the capacity of integrating, building and reconfiguring resources in new environments (Teece et al., 1997). The ability to change supply chain structures, processes, and resource configurations in response to uncertainty in the environment is such a dynamic capability and is what Supply Chain Adaptability (SCA) is.

More adaptable supply chains can more readily change sourcing, production plans, inventory management and distribution paths when compared to less adaptable competitors. Such adaptive actions promote responsiveness, operational efficiency, delivery reliability, and customer satisfaction, and these all lead to better supply chain performance. Adaptability as a key factor for the effectiveness and competitive advantage of supply chains in turbulent contexts is still being demonstrated in recent studies (Gligor et al., 2023; Eckstein et al., 2024). Thus, it is expected that supply chain adaptability will have a positive influence on supply chain performance.

H2: Supply Chain Adaptability has a positive effect on Supply Chain Performance.

The Mediating Role of Supply Chain Adaptability between Digital Social Capital and Supply Chain Performance

The internal digital social capital is seen by SCT as a means of acquiring useful resources of information and relations, while DCV points out that resources are not enough to ensure better performance results (Teece 2007). Instead, companies need to build a set of dynamic capabilities to convert available resources into operational capabilities.

Internal social capital provides opportunities for knowledge sharing, trust and coordination within the organization, thereby establishing a resource base to inform adaptive decision making. These are the relational resources that allow companies to detect changes, react quickly and reconfigure supply chain activities as needed. The benefits of internal digital social capital are therefore expected to be realized due to increased adaptability of the supply chain, which will in turn lead to

increased supply chain performance. A recent study of the digital supply chain further indicates that collaborative digital resources have indirect effects on performance via capability building mechanisms (Dubey et al., 2023; Srinivasan & Swink, 2025). Hence, the path of integration of SCT and DCV implies that the internal digital social capital is a means of achieving the supply chain's performance.

Social Capital Theory posits that social ties outside the digital firm can be a source of firms' valuable knowledge and market intelligence, as well as collaborative resources, that lie within the networks of supply chain. Social Capital Theory states that external digital relationships can be a source of a firm's valuable knowledge and market intelligence, and resources for collaborative work, located in the networks of supply chain (Adler & Kwon, 2002). But the benefits that firms can reap from such resources depends on their ability to deploy and reconfigure them effectively to deal with changing environmental conditions.

External digital social capital can enable companies to work closely with suppliers and customers, providing better visibility, information quality and responsiveness through the supply chain. These relational resources enable adaptive actions like changing sourcing strategies, reallocating resources, or redesigning supply chain processes. Higher adaptability levels enable companies to better sustain their efficiency and responsiveness to fluctuations, resulting in better supply chain performance. A recent study shows that the performance impact of digital collaboration is often mediated by adaptive capabilities like agility, resilience, and adaptability (Wamba et al., 2023; Bag et al., 2024).

So, the supply chain adaptability is expected to be the dynamic capability that transforms the external digital social capital into the improved supply chain performance.

H3: Digital Social Capital positively affects Supply Chain Performance through Supply Chain Adaptability.

3.0 Research Methodology

3.1 Research Design

This study uses a quantitative method with cross sectional and explanatory research design to understand the relationship between Internal Digital Social Capital (IDSC) and External Digital Social Capital (EDSC), Supply Chain Adaptability (SCA) and Supply Chain Performance (SCP). The design is appropriate because the study wants to test the theoretically grounded hypotheses of social capital theory (SCT) and dynamic capabilities view (DCV).

The survey method is used to collect the perceptions of the managers that are associated in the working of the supply chain in the manufacturing sector of Pakistan. The unit of analysis is the firm, and the respondents are key informants, including those involved in supply chain management, operations management, logistics management and procurement.

3.2 Population and Sample

The population for this study consists of manufacturing firms in Pakistan, especially those that are connected with their supply chain and customers. These companies are an appropriate setting as digitalization and uncertainty are becoming a growing issue in the supply chain of these companies.

The sample is selected via a purposive and judgmental sampling approach to ensure that respondents have knowledge of the processes of supply chain and digital collaboration. Key

informants are chosen based on their managerial functions and decision-making roles after conducting preliminary research in the supply chain, such as that of Flynn et al., 2010 and Li et al., 2006.

The number of valid responses is 221, considered sufficient for Structural Equation Modeling (SEM) and mediation analysis, especially when using Partial Least Squares (PLS-SEM).

3.3 Data Collection Procedure

Data is gathered via a structured questionnaire filled out online (Google Forms, email and LinkedIn) and offline (where possible) Using more than one method of distribution helps minimize non-response rate and increase representative data.

A pilot study is carried out with 30-50 respondents prior to full-scale data collection to achieve clarity, reliability, and contextual relevance of the measurement scale. Minor wording changes are made in response to feedback.

The respondents are assured of their confidentiality and anonymity to minimize biases such as social desirability bias and motivate them to provide accurate answers.

3.4 Measurement of Variables

All constructs are measured using **multi-item Likert scales (5-point scale: 1 = strongly disagree to 5 = strongly agree)** adapted from established literature.

Internal Digital Social Capital (IDSC)

Measured through dimensions of internal digital communication, trust, knowledge sharing, and collaboration among employees.

- Adapted from Nahapiet & Ghoshal (1998), Tsai & Ghoshal (1998), Chiu et al. (2006)

External Digital Social Capital (EDSC)

Measured through digital collaboration, trust, and information sharing with suppliers, customers, and supply chain partners.

- Adapted from Adler & Kwon (2002), Inkpen & Tsang (2005), Villena et al. (2011)

Supply Chain Adaptability (SCA)

Measured as the ability of the supply chain to reconfigure processes, resources, and strategies in response to environmental changes.

- Adapted from Lee (2004), Braunscheidel & Suresh (2009), Gligor et al. (2019)

Supply Chain Performance (SCP)

Measured in terms of delivery reliability, responsiveness, cost efficiency, and overall performance relative to competitors.

- Adapted from Li et al. (2006), Flynn et al. (2010)

4.0 Analysis

4.1 Data Analysis Technique

The study employs **Partial Least Squares Structural Equation Modeling (PLS-SEM)** using software such as **SmartPLS** due to its suitability for:

- Complex mediation models
- Prediction-oriented research
- Non-normal data distributions
- Formative and reflective constructs (if required)

The analysis is conducted in two stages:

1. Measurement Model Assessment

- Reliability: Cronbach's Alpha, Composite Reliability (CR)
- Convergent validity: Average Variance Extracted (AVE)

Cronbach's alpha, Composite Reliability (rho_a), and AVE are used to check the reliability and convergent validity of constructs.

Table 3: Psychometric Indicators:

	Cronbach's alpha	Composite reliability (rho_a)	Average variance extracted (AVE)
DSC	0.896	0.896	0.905
SCP	0.942	0.943	0.814

Table 3(a) Results of Psychometric indicators:

Construct	Result	Interpretation
DSC	Alpha = 0.896	Very good internal consistency
DSC	rho_a = 0.896 , rho_c = 0.950	Strong composite reliability
DSC	AVE = 0.905	Excellent convergent validity
SCP	Alpha = 0.942	Excellent internal consistency
SCP	rho_a = 0.943 , rho_c = 0.956	Excellent composite reliability
SCP	AVE = 0.814	Strong convergent validity

The measurement model results indicate satisfactory reliability and convergent validity. Cronbach's alpha values for DSC and SCP are 0.896 and 0.942, respectively, which are above the recommended threshold of 0.70, confirming strong internal consistency. Similarly, the composite reliability values, including rho_a is also above 0.70, indicating that the constructs are reliable. Furthermore, the AVE values for DSC and SCP are 0.905 and 0.814, respectively, exceeding the recommended threshold of 0.50. This confirms that both constructs have adequate convergent validity.

Discriminant validity: HTMT2 ratios:

Table 4 :Correlation

Constructs	Agility	CP	EDSC	FP	IDSC	OP	Resilience	SCA
Agility	1.000							
CP	0.387	1.000						
EDSC	0.013	0.269	1.000					
FP	0.262	0.422	0.427	1.000				
IDSC	0.013	0.269	0.160	0.427	1.000			
OP	0.298	0.068	0.124	0.322	0.124	1.000		
Resilience	0.287	0.058	0.167	0.276	0.167	0.156	1.000	
SCA	0.314	0.166	0.031	0.036	0.031	0.108	0.091	1.000

Interpretation

All HTMT2 values are **below 0.85** and **below 0.90**, which means **discriminant validity is established** among all constructs.

The highest values are:

Relationship	HTMT2
EDSC ↔ FP	0.427
IDSC ↔ FP	0.427
CP ↔ FP	0.422
Agility ↔ CP	0.387

Even these highest values are well below the recommended threshold, so there is **no** discriminant validity issue.

The HTMT2 results show that all construct values are below the recommended threshold of 0.85/0.90. The highest HTMT2 values are found between EDSC and FP, and IDSC and FP, both at 0.427, which are still within the acceptable range. Therefore, the results confirm that discriminant validity has been established among all constructs.

2. Structural Model Assessment

- Path coefficients (H1–H5)
- Significance testing via bootstrapping (5000 resamples)
- Coefficient of determination (R^2)
- Effect size (f^2)

4.2. Hypothesis testing

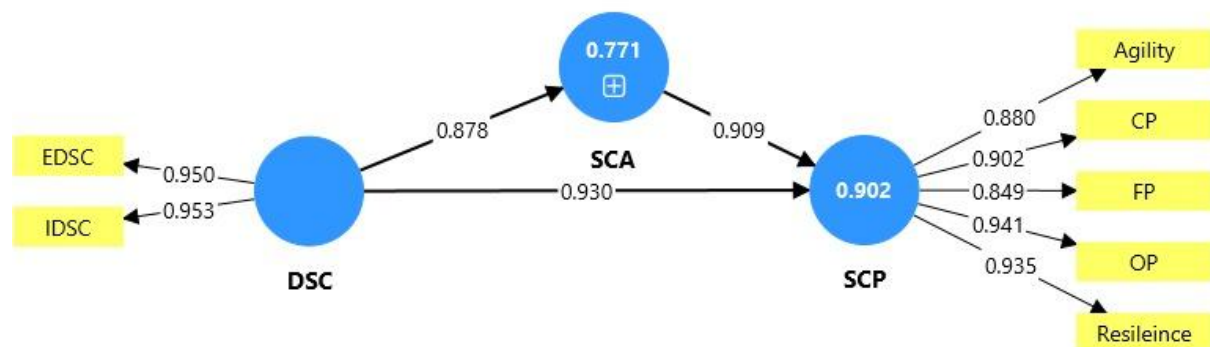


Table 5: Hypothesis testing

	Original (O)	sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
DSC -> SCA	0.878	0.879	0.019	45.945	0.000
DSC -> SCP	0.574	0.571	0.060	9.507	0.000
SCA -> SCP	0.405	0.409	0.059	6.895	0.000

Table 5(a) Interpretation summary

This table shows the path coefficients / direct effects in the structural model.

Path	Beta / Original Sample	T-value	P-value	Interpretation
DSC → SCA	0.878	45.945	0.000	Strong positive and significant effect
DSC → SCP	0.574	9.507	0.000	Positive and significant effect
SCA → SCP	0.405	6.895	0.000	Positive and significant effect

Interpretation

DSC → SCA:

The path coefficient is **0.878**, which means DSC has a **very strong positive effect** on SCA. The t-value is **45.945**, and the p-value is **0.000**, meaning this relationship is statistically significant.

DSC → SCP:

The path coefficient is **0.574**, showing that DSC has a **moderate to strong positive effect** on SCP. The t-value is **9.507**, and the p-value is **0.000**, so this effect is also statistically significant.

SCA → SCP:

The path coefficient is **0.405**, meaning SCA has a **moderate positive effect** on SCP. The t-value is **6.895**, and the p-value is **0.000**, confirming a significant relationship.

The **sample mean values are very close to the original sample values**, which shows that the results are stable and reliable.

The structural model results indicate that all proposed relationships are positive and statistically significant. DSC has a strong positive effect on SCA ($\beta = 0.878$, $t = 45.945$, $p < 0.001$). DSC also has a significant positive effect on SCP ($\beta = 0.574$, $t = 9.507$, $p < 0.001$). Similarly, SCA has a significant positive effect on SCP ($\beta = 0.405$, $t = 6.895$, $p < 0.001$). Therefore, all hypotheses are supported.

Table 6: Model Fit Summary:

	Saturated model	Estimated model
SRMR	0.051	0.051
d_ULS	0.094	0.094
d_G	0.413	0.413
Chi-square	440.836	440.836
NFI	0.816	0.816

Interpretation

The SRMR value is 0.051, lower than the recommended level of 0.08. This means that the overall fit of the model is good.

NFI value is at 0.816 which indicates moderate model fit. The ideal value for NFI is nearer to 0.90 but above 0.80 may be acceptable in exploratory research.

The d_ULS and d_G values are reported as 0.094 and 0.413. These values cannot be assessed individually. The results are to be contrasted with their bootstrapped confidence interval.

The model fit results show good overall model fit. The SRMR value is less than recommended ($0.051 < 0.08$), indicating a good fit. The NFI value is 0.816, which means there is a moderate but acceptable level of model fit. Comparisons of d_ULS and d_G should be done with comparison to bootstrapped confidence intervals. In summary, the proposed model appears to be a good fit for the data.

Coefficient of determination (R^2)

Table 7 : R-Square:

	R-square	R-square adjusted
SCA	0.771	0.770
SCP	0.902	0.902

The R square value for SCA is 0.771, which means that the model accounts for 77.1% of the variance in SCA. Likewise, for the SCP, the R-square value is 0.902, indicating that the model accounts for 90.2% of the variance in SCP. The adjusted R-square values are very close to the R square values indicating that the model is not overfitted and has good explanatory power.

Effect size (f^2)

Table 8: F2

	f-square
DSC -> SCA	3.375
DSC -> SCP	0.772
SCA -> SCP	0.384

The values of f-square obtained show that the effect of DSC is very large on the SCA with $f^2 = 3.375$. The effect of DSC is also large on SCP, with f^2 value of 0.772. Likewise, the value of f^2 for skin cancer cases is 0.384 when related to SCA. In general, the results indicate that DSC is the best predictor, especially for SCA, and that DSC and SCA account for significant amounts of variance in SCP.

So, we can conclude that DSC heavily affects both SCA and SCP, but has the greatest impact on SCA.

Mediation Analysis

The mediating effect of Supply Chain Adaptability is tested using **bootstrapped indirect effects**, consistent with Hair et al. (2022) recommendations for PLS-SEM.

4.3 Common Method Bias (CMB) Control

Full collinearity VIF assessment (Kock, 2015)

Table 9: VIF

Collinearity statistics (VIF)	VIF
Agility	2.933
CP	4.404
EDSC	2.919
FP	2.509
IDSC	2.919
OP	4.937
Resilience	4.170
SCA	1.000

4.4 Ethical Considerations

The study follows ethical research standards by ensuring:

- Voluntary participation
- Informed consent
- Confidentiality of firm-level data
- No identification of respondents or firms in reporting

5.0 Discussion, Conclusion, Implications, Limitations and Future Directions

5.1 Introduction:

The chapter gives the final discussion and conclusion of the study based on the statistical results of the PLS-SEM analysis. This chapter aims to explain the key findings, to interpret the findings in the context of the research model, and to emphasize the theoretical and practical significance of the study. The chapter also covers the shortcomings of the study and suggests future research areas for researchers who may want to build upon the present study.

The study focused on the relationship of DSC, SCA and SCP. It was hypothesized that the structural model would show that DSC would significantly influence SCA and SCP and that SCA would significantly influence SCP. The findings are very supportive of the proposed model. In general, the results indicate that DSC has a pivotal role in enhancing SCA and SCP and that SCA can also serve as a crucial predictor of SCP.

From the statistical results, it can be concluded that the model has a high explanatory power, model fit is good, the measurement properties are reliable, and the path relationships in the model are statistically significant. However, there is some caution to be taken since there are some concerns with regard to partial discriminant validity based on the cross-loading results. Thus, despite good overall results that are supportive, findings should be read with caution.

5.2 Summary of Major Findings

The study yields some significant findings.

First, the value of R-square for SCA is 0.771, indicating that 77.1% of the variance of SCA can be explained by DSC. This indicates that DSC is a very strong predictor of SCA. From a business

standpoint, the better an organization is able to enhance their DSC capabilities the more likely they are to enhance their supply chain agility.

Second, the R-square for SCP is 0.902 which indicates that 90.2% of the variance in SCP is explained by DSC and SCA. A very high explanatory value and suggests that the model is very well suited to the explanation of SCP. The adjusted R-squares are not far from original R-squares which indicate that the model has good explanatory power and is not over-fitted.

Third, the f-square results indicated that DSC has an extremely large impact on SCA ($f^2 = 3.375$). DSC also has a significant effect on SCP with f^2 value of 0.772. Likewise, SCA has a significant effect on SCP ($f^2 = 0.384$). These results validate that DSC is the strongest predictor in the model, particularly for the explanation of SCA.

Fourth, there is a satisfactory reliability and convergent validity. DSC and SCP Cronbach's alpha values are greater than the recommended value of 0.70. The Cronbach's alpha value for the DSC is 0.896 and for SCP is 0.942. There is a very good internal consistency of these values. The composite reliabilities are also good, which is further evidence that the constructs are reliable.

The AVE values for DSC and SCP are 0.905 and 0.814 respectively, both exceeding the recommended threshold of 0.50. This confirms that the constructs have good convergent validity.

Fifth, the collinearity results show that all VIF values are below the commonly accepted threshold of 5. This suggests that multicollinearity is not a serious issue in the model. However, some values, such as OP = 4.937, CP = 4.404, and Resilience = 4.170, are relatively close to 5. Therefore, although the model does not suffer from critical collinearity problems, these indicators should be monitored carefully in future studies.

Sixth, the HTMT2 results support discriminant validity because all values are below the recommended thresholds of 0.85 and 0.90. This means that the constructs are statistically distinct from one another based on the HTMT criterion.

Seventh, the model fit results are acceptable. The SRMR value is 0.051, which is below the recommended threshold of 0.08. This indicates good model fit. The NFI value is 0.816, which suggests a moderate but acceptable level of model fit, especially in exploratory PLS-SEM research. The d_ULS and d_G values should ideally be compared with bootstrapped confidence intervals before making a final judgment.

Finally, all direct hypotheses are supported. DSC has a strong positive and significant effect on SCA. DSC also has a positive and significant effect on SCP. In addition, SCA has a positive and significant effect on SCP. These findings confirmed DSC and SCA are vital drivers of SCP.

5.3 Interpretation and Discussion of Findings

5.3.1 Effect of DSC on SCA

The results indicated that the effect of DSC on SCA is very strong with the path coefficient value of $\beta = 0,878$, $t = 45,945$, $p < 0,001$. This is the highest correlation in the model. The discovery suggests that DSC has a great effect on improving SCA.

This finding indicates that firms that do have more DSC capability are more likely to respond to change and disruption, customer needs, and market uncertainty. DSC can enhance the capability of an organization in collecting information, processing data, coordinating operations and make better decisions in a short time. These are the capabilities that are critical to agility.

The statistically and practically high beta value indicates that the influence of the independent variable on the dependent variable is significant. It means that the enhancement of the DSC is significantly correlated with the enhancement of the SCA. Thus, addressing DSC related practices, systems and processes are a key element of firms looking to become more agile.

This discovery has validated the notion that digitalization and data-driven practice of supply chain can enable firms to be more flexible, responsive and adaptive. Agility is no longer a luxury in today's competitive world. Any organization must be responsive to the changes in demand, supplier, technology, and customer expectations. The results of this study show that DSC is a key mechanism through which such agility can be achieved.

5.3.2 Effect of DSC on SCP

The results also indicate that DSC positively and significantly influences the SCP, $\beta = 0.574$, $t = 9.507$, $p < 0.001$. This further establishes the impact of DSC on improving SCP.

This discovery implies that the supply chain performance would improve as well when firms improve their DSC. DSC can help to enhance visibility, coordination, operational efficiency, responsiveness and decision-making quality. These enhancements can help minimize delays, customer satisfaction, process efficiency, and overall performance.

The effect size also confirms the importance of DSC. The value of f square is 0.772 for DSC $\rightarrow$ SCP, which is large. This is to say that a significant portion of the explanation of SCP is due to the contribution of DSC. So, DSC should be seen not just as a technical / operational tool but as a strategic resource.

5.3.3 Effect of SCA on SCP (Mediator effect)

The effect of SCA on SCP is displayed.

The correlation of SCA with SCP is also positive and significant with $\beta = 0.405$, $t = 6.895$, and $p < 0.001$. This finding is consistent with the improvement of SCP by SCA.

This result shows that faster firms will be more successful in their performance. Agile supply chains can react quicker to customer demands, adapt to market, cope with disruptions, and enhance operational flexibility. These capabilities can result in better performance of the supply chain. The coefficient for SCA $\rightarrow$ SCP is not as high as the coefficient for DSC $\rightarrow$ SCP, but it does have meaning and is statistically significant. This means that SCA is an important performance driver. In addition to investing in digital systems, firms need to make sure that the investments lead to real agility. The f-square value for SCA $\rightarrow$ SCP is 0.384, suggesting a large effect. This indicates that SCA has significant impact on SCP and is a strategic capability that needs to be addressed. DSC and SCA have been intermingled in explaining SCP.

5.3.4 Combined Role of DSC and SCA in Explaining SCP

The R-square value is 0.902, indicating the DSC and SCA data can explain 90.2% of the variations in SCP. A very good outcome. It suggests that the proposed model has high predictive and explanatory power. The results show that both targeted and indirect effects of DSC on SCP exist. The formal mediation test is not included in attached results but path coefficients indicate that strengthening SCA may be one way in which DSC can enhance SCP. The indirect effect can be estimated by multiplying the DSC $\rightarrow$ SCA coefficient by the SCA $\rightarrow$ SCP coefficient. Based on the available values, the possible indirect pathway suggests that SCA may act as an important mechanism through which DSC improves SCP.

5.4 Measurement Model Interpretation

The measurement model results show that the constructs are generally reliable and valid.

Cronbach's alpha values for DSC and SCP are above 0.70, which confirms internal consistency. DSC has a Cronbach's alpha value of 0.896, showing very good reliability. SCP has a Cronbach's alpha value of 0.942, showing excellent reliability.

Composite reliability values are also strong. DSC has $\rho_a = 0.896$ and $\rho_c = 0.950$. SCP has $\rho_a = 0.943$. These results confirm that the constructs are reliable.

The AVE values also confirm convergent validity. DSC has an AVE value of 0.905 and SCP has an AVE value of 0.814. Since both values are above 0.50, the constructs explain more than half of the variance in their indicators. This confirms that the indicators represent their constructs well.

5.5 Structural Model Interpretation

The structural model results have strong support for the proposed relationships.

The path going from DSC to SCA is positive and significant. Therefore, the higher the DSC, the higher the SCA. The path from DSC to SCP is also positive and significant, indicating that the DSC directly contributes to the improvement of SCP. The results from SCA to SCP are positive and significant, indicating that agility is positively associated with the supply chain.

The values of the sample mean are very close to the sample values, indicating that the estimates are stable. The t-values are also high and the p-values significant at $p < 0.001$. As such, all hypotheses are supported.

The results validate that the best predictor in the model is DSC. It has a profound effect on SCA. Therefore, if an organization is looking to be agile and perform better, they should take DSC development seriously.

6. Conclusions

The study findings reveal that DSC plays a significant and positive role in SCA as well as SCP. The results indicate that DSC capable firms are more likely to be more agile and to perform their supply chain better. The study also concludes that SCA has a significant positive effect on SCP. It validates the value of agility as a factor to enhance performance. An agile organization is more likely to react faster to changes in the market, customer needs, operational disruptions or competitive pressures. A very high percentage of the variance in the dependent variables is accounted for by the model. DSC accounts for 77.1% of the variance in SCA and SCA and DSC together explain 90.2% of the variance in SCP. The values indicate that the proposed model has a good explanatory power.

The study also shows that the measurement model is generally reliable and valid. The internal consistency, composite reliability and convergent validity are high for both the DSC and SCP. The model fit is also good, with an SRMR value of 0.051.

But the study also finds that caution should be exercised when interpreting discriminant validity. The results of HTMT indicate validity of discriminant, but the results of cross-loading indicate there are some indicators that overlap, particularly FP. So, the model is statistically strong but there is a need for some refinement of the measurements.

Overall, the study indicates that DSC is an important factor of SCA and SCP. It also establishes that SCA plays a significant role in SCP. Thus, the ability of the supply chain to be both capable and agile is significant in order to enhance the outcomes of the supply chain.

7. Theoretical Implications

This study makes several theoretical contributions.

The study adds to the literature by establishing the importance of DSC as a key antecedent for SCA. The correlation between DSC and SCA further implies that DSC capabilities can be viewed as a vital factor in increasing the responsiveness and flexibility of firms.

Secondly, the study helps to add to the literature of the supply chain performance by demonstrating direct influence of DSC on the performance of SCP. This finding reinforces the idea that digital skills are not just assistive but also are tools that can enhance the achievement of outcomes.

Thirdly, the study validates the role of SCA as a predictor of SCP. This reinforces the theoretical case for agility as essential in complex and volatile contexts. Agile firms can more effectively transform resources and capabilities into better performance.

Fourth, the results indicate that SCP could be affected directly and indirectly by DSC. A significant effect of DSC on SCA and SCA on SCP suggest that SCA is a mediating variable that can help increase SCP. While formal mediation testing is a requirement, this finding gives some direction to future research.

8. Practical Implications

The results also have major practical implications for managers, supply chain professionals and decision makers.

First, investments in DSC capabilities should be made by firms. In the case of SCA, the impact of DSC is quite noticeable, indicating that digital supply chain practices can be useful firms to become agile. Digital tool usage, improved information sharing, heightened supply chain visibility, and data-driven decision-making should be embraced by managers.

Secondly, digitalization is not a technical project. DSC should be integrated into business strategy, operational planning and improvement of performance. Digital tools can be useful if they enhance speed, flexibility, coordination and responsiveness.

Thirdly, managers should concentrate on developing SCA. The impact of SCA on SCP is significant, which indicates that the agility has an influence on the performance. It is important that the firms have flexible processes, responsive supplier relations, fast decision making systems and flexible operational structures.

Fourth, firms should utilize the DSC to enhance direct performance and agility-based performance. Managers should create digital systems that will bring about real-world improvements, as well as information gathering, because DSC has a direct impact on SCP as well as a significant impact on SCA.

Fifth, managers should keep track of overlapping capabilities. The outcomes of cross loading indicate that there could be strong interrelationship among the indicators within constructs. In reality, the organization needs to be clear on the various capabilities associated with flexibility, resilience, operational performance, and agility. Having clear definitions can make it easier for managers to measure and improve these aspects.

Sixthly, the results indicate a need for an integrated approach for performance improvement. A digital system alone might not be sufficient. Human capability, process flexibility, leadership support, and coordination mechanisms need to be developed within the firms for digital investments to yield performance.

9. Limitations of the study

The study offers robust results but some limitations are noted. The analysis will be performed on the available results of the PLS-SEM, for this reason point causality should be interpreted with caution if the study relied on cross-sectional data. Cross sectional data may offer statistical relationships but not necessarily the definitive proof of causality over time.

10. Future Research Directions

This study could be continued in a number of ways in the future.

First, future research would be useful in testing the mediation of SCA between DSC and SCP. Mediation analysis would give more insights on how the DSC facilitates performance, as it strongly influences the SCA, while SCA significantly influences SCP.

Second, more future research is needed to improve the measurement model.

In the third instance, the moderators, including environmental uncertainty, organizational culture, leadership support, resilience, firm size, technological readiness, or market turbulence, could be explored in future research. These factors can reinforce or weaken the ties between DSC, SCA and SCP.

Finally, the possibility of comparing various dimensions of DSC with future research. For instance, internal digital supply chain capability will have a distinct impact on agility and performance as compared to external digital supply chain capabilities.

Future studies should present full PLS-SEM assessment (mediation, predictive relevance, PLS predict, bootstrapped confidence intervals for model fit, full measurement model details).

Final Conclusion

The current study strongly suggests that DSC plays an important role in SCA and SCP. The results show that DSC has a very strong positive effect on SCA and a significant positive effect on SCP. SCA has a positive significant influence on SCP as well. So, all proposed relationships are upheld.

The study shows that digital supply chain capabilities can contribute to agility and enhance performance by the organization. The results of reliability and validity also confirm the quality of the measurement model.

The research results confirm that the strategic use of DSC and SCA can be useful for improving SCP. By prioritizing DSC and leveraging digital capabilities for agility, firms can enhance their supply chain results and stay competitive in a fast-changing business landscape.

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