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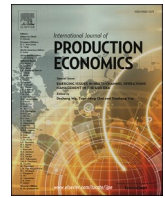
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# Alliances and digital transformation are crucial for benefiting from dynamic supply chain capabilities during times of crisis: A multi-method study

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## ABSTRACT

During times of crisis, businesses need strategic partnerships and digital transformation to survive. Understanding how digital transformation and alliance management capability can work together to enhance supply chain capabilities during a crisis is important. We have developed a theoretical framework that explains how the alliance management capability, under the mediating influence of digital transformation, helps build supply chain capabilities for unprecedented crises. This framework highlights key enablers such as alliance management capability, digital transformation, supply chain agility, and supply chain adaptability that are essential for organisational performance. We tested our theoretical model using a survey of 157 individuals working in the manufacturing industry in India. Our findings suggest that combining alliance management capability and digital transformation enhances supply chain capabilities, which improves an organisation's ability to respond to crises. Moreover, digital transformation, supply chain agility, and adaptability are critical determinants of organisational performance during crises. Therefore, companies that use digital technologies to increase their agility and adaptability are more likely to perform well during times of crisis. To collect qualitative data, we interviewed key participants ( $n = 27$ ) and identified four key enablers for a digital transformation strategy for supply chains: coordination, digital leadership, digital culture, and digital talent management. Our study offers a detailed understanding of the dynamic capability view in digital transformation, highlighting key drivers for competitive advantage.

## 1. Introduction

Increasing uncertainties and challenges of operating in a digital environment are forcing organisations to reevaluate their dynamic supply chain capabilities to react to changes quickly and adapt their structures as needed (Cohen and Kouvelis, 2021; Naughton et al., 2020; Queiroz et al., 2023; Ivanov, 2023). Unexpected crisis events, such as the pandemic resulting from the novel coronavirus, have caused great volatility and disruption to supply chains (Craighead et al., 2020; Gereffi et al., 2022; Ye et al., 2022; Shen and Sun, 2023). This has led organisations to invest in building capabilities to negate the adverse effects of

such events (Alexander et al., 2022; Wulandhari et al., 2022; Juan and Li, 2023). Patrucco and Kähkönen (2021) noted that agility and adaptability are dynamic capabilities that help organisations navigate crises and maintain strategic growth.

Agility is "... the responsiveness, flexibility, and efficiency of the supply chain in meeting the day-to-day uncertainties and variations in supply and demand", whilst adaptability is "... the strategies needed to make a supply chain dynamic, able to meet changes in needs and environment over time" (Lee, 2021, p. 174). Building agility and adaptability during the unprecedented crises caused by a novel coronavirus and geopolitical tensions requires internal and external dynamic capabilities, including

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networking capability and inter-organisation collaborations (Roscoe et al., 2022; Müller et al., 2022; Dubey et al., 2023; Hamann-Lohmer et al., 2023; Queiroz et al., 2023). Amidst the turbulence of uncertain times, it has been widely recognised that inter-organisational relationships hold a pivotal role. Studies conducted by scholars (see, Squire et al., 2009; Friday et al., 2021; Mandal and Dubey 2021; Aslam et al., 2022; Klimas et al., 2023) have affirmed the significance of these relationships. However, organisations often lack clarity when investing in alliance management capability as the exact benefits of such capability during times of uncertainty are not yet fully understood. To date, though, most studies on inter-organisational relationships in the supply chain have focused on coordination and/or collaboration among the partners (Moshtari, 2016; He et al., 2020; Yang et al., 2021). Many studies acknowledge the role of such relationships in building agility (Fayezi and Zomorodi, 2015; L'Hermitte et al., 2016; Jajja et al., 2018; Dubey et al., 2021a) and adaptability (Namagembe, 2022) in uncertain times, there is still a lack of clarity on how inter-organisational relationships help shape agility and adaptability.

It is posited that inter-organisational relationships enable a build-up of alliance management capabilities (AMC) (Kauppila, 2015; Yang et al., 2015), which are useful in developing and managing critical partnerships, which are considered important during turbulent times (see, Stuart, 1997; Schilke, 2014a; Dubey et al., 2021b). Coordinating, communicating, and bonding are three components of AMC (Schreiner et al., 2009). These allow organisations to address resource constraints (Kauppila, 2015), tackle competitive pressures (Borys and Jemison, 1989), navigate through turbulent times, and maintain strategic growth (Schilke and Goerzen, 2010). Alliances are often formed and developed over time through established practices (Anand and Khanna, 2000; Aggarwal, 2020; Zhou et al., 2023). However, when faced with a crisis or highly uncertain times, it is unclear how alliances can be formed and leveraged to build supply chain capabilities (Gabler et al., 2017; Pournader et al., 2020). This is a significant issue as the effectiveness of supply chains is critical to a business's success. Unfortunately, the existing operations management literature has not provided sufficient insights into this issue, mainly because it has focused on coordination and collaboration between partners, without paying enough attention to how alliances are leveraged to build supply chain capabilities (Ketchen and Craighead, 2020). As a result, it is essential to understand the role of alliances during a crisis and how they can be effectively leveraged to build supply chain capabilities. Businesses can better prepare themselves and their supply chains for future crises and uncertainties (Wieland, 2021).

As a first area of focus, we will examine AMC in a supply chain management context. Whilst scholarly interest in supply chain agility (SCA) and adaptability (SCAA) has increased following the seminal work of Lee (2004), the forming of AMC and its impact on such dynamic capabilities is still not fully understood (Richey et al., 2010; Cheung et al., 2011). Hence, we explore the relationships between AMC and SCA/SCAA and seek to answer the following research question (RQ1): *What are the effects of AMC on SCA and SCAA?*

The existing literature needs to provide an adequate theory-driven explanation of how inter-organisational relationships help build dynamic capabilities in crises. Our goal is to provide an empirical contribution to the literature on the role of AMCs in developing dynamic capabilities, specifically SCA and SCAA, by addressing a research question based on theory.

We have a second area of focus: the role of digital transformation (DT) in building dynamic capabilities in the supply chain (Rai et al., 2006; Devaraj et al., 2007; Alvarenga et al., 2023). According to Liu et al. (2011), DT is an organisational transformation integrating digital technologies and business processes in a digital economy (Harju et al., 2023; Huang et al., 2023). It is believed that DT, which includes distributed ledger technology, machine learning, predictive analytics powered by big data, artificial intelligence, the Internet of Things (IoT), supply chain control tower, and other emerging technologies (Verhoef

et al., 2021; Papanagnou et al., 2022), will play a critical role in bringing supply chain partners closer together as they share information and coordinate their activities better (Lee, 2021; Escamilla et al., 2021). However, in many cases, digital transformation results have not met expectations (Hess et al., 2016; Guo et al., 2023), and in some cases, digital transformation capability has yielded differential results (Schräge et al., 2022). Therefore, further investigation is needed to understand the effects of DT on supply chain capabilities and performance outcomes (Centobelli et al., 2020; Meng et al., 2023). In situations where digital transformation is at play, it can either act as a mediator between two variables (Nayal et al., 2022; Tsou and Chen, 2023) or have an interactive effect (Wang and Du, 2022) on them. This means that the changes brought about by digital transformation can either influence the relationship between two variables or directly impact them, depending on the context. Specifically, it is not well understood how AMC affects the supply chain capabilities and organisational performance (OP) under the mediating effect of digital transformation. To address this knowledge gap, our second research question (RQ2) is: *What are the effects of AMC on the SCA/SCAA and OP under the mediating effect of DT?*

To address our research inquiries, we gathered information from professionals in the automobile, cement manufacturing, steel manufacturing, heavy machinery, and pharmaceutical industries. These sectors frequently employ alliance formation to mitigate disruptions in the supply chain due to unpredictable factors (Turken and Geda, 2020; Shrey et al., 2022). Additionally, organisations are increasingly investing in digital capabilities, following the COVID-19 crisis (Alicke et al., 2021; Acciarini et al., 2021). To explain how the constructs of AMC, SCA, SCAA, OP and DT are interlinked we used the dynamic capability view (DCV), which is a theoretical lens that helps understand the connection between capabilities and performance under dynamic conditions (see, Schilke, 2014a; Ringov, 2017; Lam et al., 2019).

To achieve our goals effectively, we organised the remaining sections of our paper as follows. Firstly, we will delve into the study's theoretical background, primarily focusing on the dynamic supply chain capabilities-building process. Further, we will also shed light on the key constructs of AMC and DT and present the research hypotheses. These hypotheses explore the relationships between AMC, DT, SCA, SCAA, and OP. We then present the research setting: companies in various manufacturing sectors, our construct measures, the sampling strategy, individuals working in companies in India ( $n = 157$ ), and the data collection process. Next, we describe the data analysis method. We then present how we address common method bias, the constructs' measurement properties, and the hypotheses' testing results. Next, we present the results of exploratory interviews with key informants ( $n = 27$ ) on the interactions between DT and supply chain capabilities. We present emergent themes from the interviews: coordination, agile capability, digital adaptability, driving technology transformation for values, missing digital leadership, culture and talent management. We then discuss the findings and outline implications for theory and practice, limitations of our study and future research directions. This includes derivation of a framework for digital transformation strategy for supply chains, which shows key enablers of coordination, digital leadership, digital culture and digital talent management. The final section draws conclusions, stressing the dynamic capabilities' complicated associations with organisational performance and digital transformation.

## 2. Theory development

### 2.1. Dynamic supply chain capabilities-building process

Dynamic capabilities (DC) are “the firm's ability to integrate, build and reconfigure internal and external competencies to address changing environments. Dynamic capabilities thus reflect the organisation's ability to achieve new and innovative forms of the competitive advantage given path dependencies and market positions”, (Teece et al., 1997, p. 516). The DC

framework is a multi-disciplinary perspective that explains risk management and uncertainties (Teece et al., 2016, p. 13). It offers a theoretical perspective on building strategic capabilities to enable organisations to sustain continuous growth during turbulent times and gain superior performance (Mohamud and Sarpong, 2016). There exists a rich body of literature that informs our understanding of dynamic capabilities, but contradictions in conceptualisation and definitions often limit our understanding of dynamic capabilities and their linkage with competitive advantage (Winter, 2003; Zahra et al., 2006; Fainshmidt et al., 2016; Hunt and Madhavaram, 2020; Ye et al., 2022; Yang and Yee, 2022; Zhang et al., 2023).

The dynamic capability framework (Teece, 2007; Easterby-Smith et al., 2009) is the next level of resource-based perspective, often referred to as RBV/RBT (see, Teece et al., 1997). RBV aims to identify and utilize resources to gain a competitive advantage. The dynamic capability view (DCV) emphasises resource deployment and capability building to gain and maintain competitive advantages. DCV assumes organisations within an industry are heterogeneous in their competencies and capabilities; and that the competencies and capabilities cannot be shared across the firms in the industry (Eisenhardt and Martin, 2000). The dynamic capabilities framework is built on three characteristics (Lee and Rha, 2016). Firstly, the supply chain capabilities must possess the ability to sense opportunities and threats. Lee and Rha (2016) argue that the sensing capability needs to be in harmony with supply chain visibility or transparency, which is the ability to manage the flow of information. Within and outside the organisation, sensing includes scanning, learning, and interpretive activities (Teece, 2007). Sensing helps an organisation anticipate supply and demand situations and serve its customers effectively and efficiently, by adopting appropriate strategies to mitigate supply chain risks (DuHadway et al., 2019). Secondly, the supply chain capabilities must possess the ability to seize opportunities. Seizing is about implementation and getting things done (Teece, 2007, p. 22.). For instance, building an inventory of critical items or having enough flexibility in manufacturing capacity to tackle the exponential rise in the demand for PPEs, medicines, sanitisers, toilet paper, face masks, and other important items required during the COVID-19 crisis (Sodhi et al., 2023). Thirdly, organisations must be able to reconfigure through continuous renewal and transformation of organisational routines (Ellström et al., 2021). For instance, Pfizer reconfigured its assets and competencies to develop vaccines to tackle the COVID-19 crisis, which helped Pfizer establish itself as a leading vaccine manufacturing company. A framework with the characteristics described above can be constructed by undertaking a dynamic supply chain capabilities-building process. This can be undertaken by revisiting the agility and adaptability capabilities, which are powered by digital transformation, rather than by investing in building new supply chain capabilities.

## 2.2. Alliance management capability (AMC)

Alliances between organisations are usually voluntary agreements aimed at developing and commercialising new technologies, services, or products (Gulati, 1998). Alliance management is a “*firm-level dynamic capability that allows the firm to integrate, build and reconfigure internal and external competencies to address rapidly changing environments*” (Rothaermel and Deeds, 2006, p. 432). So, AMC can be understood as a combination of capabilities essential for any organisation to build and manage its alliances (Schreiner et al., 2009), involving various activities, including searching for potential partners, coordinating cooperation processes, and aligning objectives (Kumar, 2009).

AMC has been regarded as an innovative form of competitive advantage (see, Rothaermel and Deeds, 2006; Schilke and Goerzen, 2010; Schilke, 2014a; Dubey et al., 2021b). Hence, based on the assumptions of DCV, AMC can contribute to firm-level competitive advantage (Kauppila, 2015; Dhaundiyal and Coughlan, 2022). Levitt and March (1988) further argue that AMC is a path-dependent capability

built over time through multiple interactions. Following RBV arguments (see, Barney, 1991), AMC is conceived as marshalling heterogeneous and immobile resources of a firm, thus forming a source of sustained competitive advantage (Kauppila, 2015; Lioukas et al., 2016). AMC is often considered valuable and rare because strategic alliances are difficult to form. Alliances develop over time, and organisations that are purely interested in short-term collaboration often face difficulties in realizing the benefits; thus, such strategic alliances often fail (Prashant and Harbir, 2009). Following Sirmon et al. (2011) resource orchestration view, AMC forms through the bundling of resources and capability to generate sustained competitive advantage.

## 2.3. Digital transformation (DT)

DT is conceived as the application of emerging technologies to augment human efforts to support transformation in the way businesses operate, such as streamlining operations or creating new business models (Sousa-Zomer et al., 2020; Nasiri et al., 2022; Omrani et al., 2022). Warner and Wäger (2019) argue that DT is a transformation of the organisation which involves the integration of new technologies with business activities to address the fast-paced turbulent economy. Put simply, DT is the integration of digital technologies into all business areas, resulting in a paradigm shift in how businesses operate (Hanelt et al., 2021; Ye et al., 2022; Ning et al., 2023).

In DT, customer satisfaction is the main objective, with customers looking for speed, visibility, and value for money (Kumar et al., 2021). These requirements are met using technologies that enable seamless integration of end-to-end activities of a supply chain (Rao et al., 2021). Moreover, with the help of analytics tools powered by artificial intelligence, companies sense market opportunities and threats resulting from unexpected events (Sheng et al., 2021; Bag et al., 2022) with the information gathered using advanced DTs helping an organisation to improve its product development capability and improve performance (Helo and Hao, 2022). In the digital era, organisations need to possess abilities to sense, seize, and transform the opportunities to tackle the challenges posed by a hypercompetitive environment (Sousa-Zomer et al., 2020; Fosso Wamba et al., 2020b; Zhao et al., 2023), with DTs augmenting the dynamic capabilities of the organisation (Yeow et al., 2018). With the help of DTs, the organisation can scale its business operations in response to the unexpected needs of the situation (Vaia et al., 2022). DT is an ongoing dynamic process of applying technologies in day-to-day activities, which rely on organisational agility woven around the fabrics of digital and collaborative culture (Warner and Wäger, 2019).

## 2.4. Hypotheses

Our research model is based on Fainshmidt et al. (2016) and Schilke et al.'s (2018) organising framework for dynamic capabilities, which was developed in response to earlier criticism around the constructs of dynamic capabilities. See Fig. 1.

We consider AMC, DT, and SCA/SCAA as distinct dynamic capabilities of different orders and examine their effects on organisational performance. Moreover, we treat DT as a mediating variable between AMC and SCA/SCAA. Our analysis draws from the previous literature that has established DT as a dynamic capability (Sousa-Zomer et al., 2020; Nasiri et al., 2022). However, more research has yet to explore how DT capability compares with other dynamic capabilities. Therefore, we conceptualise DT as a mediator, following Fainshmidt et al.'s (2016) hierarchical view of dynamic capabilities. Finally, we present our hypotheses to support our constructs and their associations in Fig. 1.

### 2.4.1. AMC and SCA/SCAA

Effective alliance management capability (AMC) is crucial in developing and maintaining successful supply chain capabilities (Ketchen and Craighead, 2020; Lee, 2021). This involves creating and nurturing



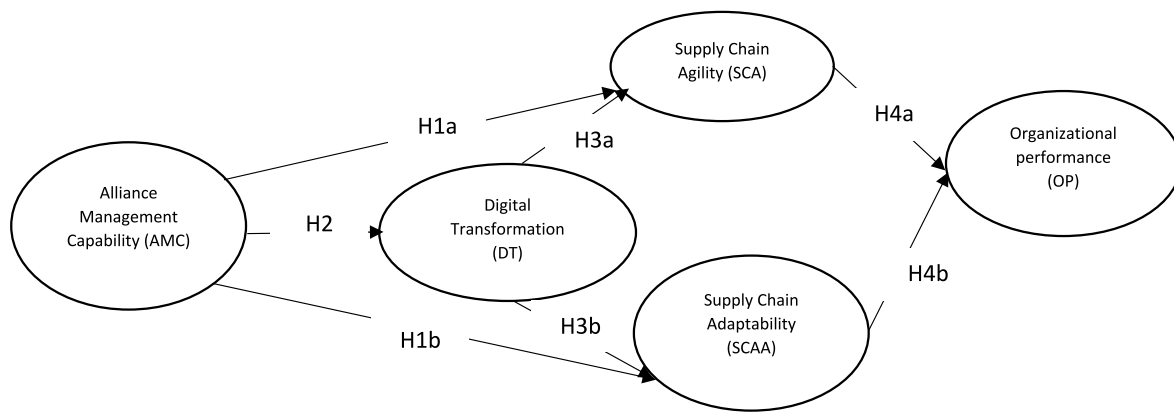


Fig. 1. Research model.

long-term relationships with valuable partners, working collaboratively to achieve common goals, and constantly monitoring and improving these relationships to ensure mutual benefits (Niesten and Jolink, 2015). AMC also involves aligning strategic objectives, negotiating favourable terms and conditions, managing risks, and resolving conflicts fairly and transparently (Al-Tabbaa et al., 2019). By leveraging the strengths and resources of different partners, organisations can enhance their competitiveness, innovation, and resilience in today's complex and rapidly changing business environment (Forkmann et al., 2018; Bouncken et al., 2022).

Effective alliance management can play a crucial role in enhancing the agility and adaptability of the supply chain during times of crisis (Lee, 2004, 2021). Alliances can help businesses leverage their combined resources and capabilities, such as shared knowledge, expertise, and technology, to overcome challenges and respond more effectively to changing circumstances (Rothaermel and Deeds, 2006; Teng, 2007; Kumar, 2014). By fostering collaboration and cooperation between different parties, alliance management can also help build more agile and adaptable supply chains better equipped to handle disruptions and minimise the impact of unexpected events (Cortez and Johnston, 2020). In summary, an effective alliance management strategy is a key driver of supply chain success, particularly in times of crisis (Sarker et al., 2022). Based on the preceding discussions, we hypothesise that:

**H1a.** The alliance management capability (AMC) is positively linked with the supply chain agility (SCA).

**H1b.** The alliance management capability (AMC) is positively linked with the supply chain adaptability (SCAA).

#### 2.4.2. AMC and DT

Alliances allow organisations to acquire resources beyond their boundaries (Schilke and Goerzen, 2010). Alliance Management Capability (AMC) is crucial as it allows organisations to expand their resource base. Previous research has shown poor supply chain visibility can reduce actors' cooperative behaviour in supply chain crises (Sodhi and Tang, 2021; Chen et al., 2022a,b). Information sharing among partners can improve trust and commitment, influencing cooperative behaviour (Squire et al., 2009). Through alliances, organisations can increase information exchange, improve trust and commitment among partners, maintain desired inventory levels of critical items, and develop contingency plans (Patrucco and Kähkönen, 2021). Digital transformation integrates technology into various business operations to enhance efficiency and productivity (Warner and Wäger, 2019; Sousa-Zomer et al., 2020). It involves developing new systems, processes, and strategies that leverage technology to improve the organisation's overall performance (Correani et al., 2020; Appio et al., 2021).

In the supply chain industry, digital transformation is critical in building capabilities that enable businesses to adapt and thrive in times

of crisis (Karimi and Walter, 2015). By embracing digital technologies, companies can streamline their operations, optimise their resources, and increase their agility, allowing them to respond quickly and effectively to changing market conditions. Thus, organisations can benefit from forming strategic alliances with other companies to foster digital transformation and stay competitive in today's rapidly evolving business landscape (Li et al., 2018; Hanelt et al., 2021). Such alliances can help organisations access valuable expertise and resources that can be leveraged to drive innovation and growth (Ghosh et al., 2022). By working closely with partners, organisations can develop new technologies, processes, and solutions that better meet the needs and expectations of customers, while also improving operational efficiency and reducing costs (Prashant and Harbir, 2009). Therefore, forming strategic alliances can be a key enabler of digital transformation and a powerful way for organisations to stay ahead of the curve (Warner and Wäger, 2019). Based on the preceding discussions, we can hypothesise:

**H2.** The organisation alliance management capability (AMC) is positively related to digital transformation (DT).

#### 2.4.3. DT and SCA/SCAA

DT has been critical in strengthening supply chain capabilities to deal with unexpected challenges (Tallon et al., 2019). By embracing new technologies and innovative solutions, businesses have quickly and efficiently responded to disruptions, ensuring uninterrupted delivery of goods and services (Rapaccini et al., 2020). Inventory management has been optimised by leveraging data analytics, warehouse operations have been streamlined through automation and robotics, and remote transactions have been made possible by adopting e-commerce platforms (Min et al., 2019). DT has become an essential strategic tool for companies looking to build resilient and adaptable supply chain capabilities for future challenges (Enrique et al., 2022).

SCA and SCAA are essential elements of a long-term strategy to cope with unprecedented crises (Lee, 2021). These concepts allow organisations to identify new sources or develop new markets to tackle disruptions resulting from trade restrictions (Lee, 2021; Patrucco and Kähkönen, 2021). In a hyper-competitive environment, DT offers opportunities for organisations to exploit digital capabilities strategically (Nasiri et al., 2022; Enrique et al., 2022). Several studies have found positive associations between IT capabilities and SCA (Queiroz et al., 2018; Grover, 2022), and SCAA (Schoenherr and Swink, 2015). There are also positive effects of BDA capability on SCA (Fosso Wamba and Akter, 2019; Awan et al., 2022), cloud computing technology on SCA (Liu et al., 2018), artificial intelligence on SCA (Wang et al., 2022), and IT capability on SCAA (Lee, 2021).

DT promotes relational capabilities and knowledge-sharing activities, often leading to superior performance over competitors (Faruque et al., 2021; Cherbib et al., 2021). Recent digitally enabled strategies adopted by e-tailers such as Alibaba, JD.com, and Amazon during the

COVID-19 crisis enabled them to pre-position their inventory to address fluctuations in demand and supply and build an agile organisational culture (Lee, 2021). Other recent literature reports similar links between DT and agility (Guo et al., 2023; Schräge et al., 2022). Building on this literature, we can hypothesise that:

**H3a.** Digital transformation (DT) has a positive effect on supply chain agility (SCA).

Organisations are constantly changing to adapt to complex business environments and maintain growth (Del Giudice et al., 2021). However, many need more resources and better alliances among supply chain partners (Wright et al., 2019). Inaccurate or incomplete data, poor communication, and a lack of digital analytics culture are reasons for poor alliances (Lin et al., 2022). According to Lee (2021), digital technologies enable adaptation.

The retailer LF is a company that has transformed traditional supply chain models by providing customers speed, innovation, and data-driven insights through a digital-enabled supply chain (Apparel, 2017). LF has built a strong global supply chain network that vertically integrates design houses, sourcing agents, manufacturers, logistics service providers, and retailers within three global networks: trading, logistics, and distribution, through an aggressive acquisition strategy. The network orchestration strategy of LF plays a significant role in managing a complex supply chain network. The company provides complete supply chain solutions for new product design, raw material sourcing, final production at manufacturing centres, and product distribution. This adaptability, enabled by DT, gives LF a competitive edge over its competitors. The experience of this company and others reported in the literature, leads to the final hypothesis:

**H3b.** Digital transformation (DT) has a positive effect on supply chain adaptability (SCAA).

#### 2.4.4. SCA/SCAA and OP

Multiple studies have established a positive correlation between SCA/SCAA and OP (see Whitten et al., 2012; Eckstein et al., 2015; Alfalla-Luque et al., 2018; Gligor et al., 2020; Fosso Wamba et al., 2020a). Scholars have conceptualised SCA/SCAA as DCs (Eckstein et al., 2015; Aslam et al., 2018; Dubey et al., 2023). The key element of the DCV is that performance is the outcome (see Schilke, 2014b; Fainshmidt et al., 2016). Hence, following DCV (see Teece et al., 1997) arguments, we view SCA/SCAA as possessing the ability to sense, seize and reconfigure the internal and external competencies to tackle unexpected rapid environmental changes.

SCA helps organisations address short-term changes through continuous information sharing among all partners, collaborating with suppliers and customers to develop or redesign products or services, and exercising a postponement strategy (Lee, 2004). SCA is positively linked with cost performance (Cadden et al., 2022). For instance, SCA helps reduce the cost of goods sold, i.e., direct materials, overheads, and labour (Whitten et al., 2012; Cadden et al., 2022). Similarly, it is suggested that SCA has a positive impact on OP, which includes product quality, service levels, and on-time delivery (see, Whitten et al., 2012; Eckstein et al., 2015; Gligor et al., 2015; Alfalla-Luque et al., 2018; Park et al., 2023), market performance such as sales growth or increase in market share (Whitten et al., 2012; Gligor et al., 2015; Alfalla-Luque et al., 2018; Park et al., 2023), and financial performance (Whitten et al., 2012; Gligor et al., 2015; Alfalla-Luque et al., 2018). Given findings from prior literature, we hypothesise as follows:

**H4a.** Supply chain agility will be positively related to OP.

SCAA is about adjusting supply chain design to address the rapid and unexpected changes in the business environment or market (Lee, 2004; Eckstein et al., 2015; Fosso Wamba et al. 2020; Lee, 2021). To build adaptability, organisations need to track continuous changes in the external environment with the help of digital technologies and develop alternate sourcing strategies to handle any kind of trade restriction or

disruption caused by political turbulence or geopolitical crises. They must create flexibility in their supply chains and have multiple sources/markets to address supply/demand uncertainties (Lee, 2021). The difference between SCA and SCAA is one of orientation. SCA is short-term, and SCAA is a long-term strategy (see Lee, 2004; Richey et al., 2022). The prior literature posits that SCAA will positively influence the market and financial performance measures. Hence, we hypothesise:

**H4b.** Supply chain adaptability will be positively related to OP.

#### 2.4.5. The mediating effect of digital transformation

The adoption of various technologies in all aspects of business is the essence of DT, which ultimately enhances customer value (Berman, 2012; Bharadwaj et al., 2013). The efficient functioning of AMC can be further enhanced by the proper utilization of digital technologies, which in turn helps build better trust and fosters collaboration (He et al., 2020; Lin et al., 2022). Moreover, DT can also enable advanced analytics and data-driven decision-making in alliance management, which can help identify potential supply chain risks and opportunities (Chen et al., 2022a,b; Ghosh et al., 2022). This can lead to a more proactive approach to supply chain management and enable companies to respond more quickly to changing market conditions or customer needs (Dubey et al. 2021). Therefore, it is essential to consider the role of DT when assessing the impact of AMC on SCA and SCAA. By leveraging digital technologies, companies can enhance their AMC, improve their supply chain capabilities, and ultimately gain a competitive advantage. Hence, we hypothesise it as:

H5a/H5b: Digital transformation mediates the effects of alliance management capability on (a) supply chain agility and (b) supply chain adaptability.

### 3. Research methods

#### 3.1. Research setting

We surveyed manufacturing organisations based in India (see Table 1). We chose the four industry sectors Food, Apparel Manufacturing, Computer and electronics goods manufacturing, and Plastics and Rubber goods manufacturing because alliances are quite common, with companies typically relying on several vendors that

**Table 1**  
Respondents characteristics (n = 157).

Industry	Sample (n)	%
Food	36	22.93
Apparel Manufacturing	23	14.65
Computer and electronics goods manufacturing	40	25.48
Plastics and Rubber goods manufacturing	58	36.94
<b>Firm Size</b>		
<100 employees	21	13.38
100-499 employees	36	22.93
500-1499 employees	69	43.95
1500-4999 employees	24	15.29
>5000 employees	7	4.46
<b>Firm age (years)</b>		
<10	12	7.64
10-19 years	41	26.11
20-29 years	48	30.57
>30 years	56	35.67
<b>Designation</b>		
Head of Supply Chain Department	72	45.86
Regional Head	61	38.85
Consultant	24	15.29
<b>Tenure of the respondent (years)</b>		
<1	12	7.64
1-5 years	36	22.93
6-10 years	62	39.49
>10 years	47	29.94

supply raw materials and provide logistics services, IT support, and sales and services. We ensured that the companies were selected as having had recent experiences of crises or disruptions due to COVID-19 and geopolitical crises. The focal organisations in these sectors use close collaboration to secure raw materials, gain market intelligence, and knowledge, ensuring the availability of the products at *the right time, the right place, and in the right condition*, despite fluctuations in the demand and supply due to the unexpected events (Shen and Sun, 2023). Furthermore, DT's role in building supply chain capabilities in these industry sectors during pandemics and geopolitical crises has been noted (Bosman et al., 2020; Alexander et al., 2022; Brammer et al., 2023).

### 3.2. Measures

Our study employed multi-item scales to measure the constructs shown in Fig. 1. We considered the constructs used in our study as reflective constructs and developed our measures based on previous empirical studies conducted by Boyer and Pagell (2000), Forza (2002), and DeVelis (2003). To generate our items, we refined the existing literature by conducting interviews with 27 managers from diverse sectors. To eliminate any ambiguities or confusing items, we pre-tested the questionnaire with 30 managers. We further cross-referenced the survey-based information collected from respondents with other data sources to ensure accuracy and minimise biases resulting from a single source of data collection, as recommended by Flynn et al. (1990) and Homburg et al. (2012).

In our study, we used various sources to measure different concepts. For instance, we assessed alliance management capability (AMC) using a four-dimensional, second-order construct based on Schilke's (2014) scale. Similarly, to measure digital transformation (DT), we used a three-dimensional, second-order construct based on Sousa-Zomer et al.'s (2020) measure. However, during our analysis, we noticed that the digital intensity (DI) average variance extracted value was below the cutoff value, and some indicators' factor loadings were below 0.5. As a result, we decided to exclude the digital intensity (DI) dimension from our analysis and proceeded with a two-dimensional construct of DT. Additionally, supply chain agility (SCA), supply chain adaptability (SCAA), and organisational performance (OP) were operationalised as reflective constructs based on measures developed by Alfalla-Luque et al. (2018). Appendix A includes additional details on the constructs and the items used to operationalise them.

### 3.3. Sample and data collection

We sampled multinational companies in the industry sectors identified above using NAICS codes with manufacturing units in India. We used the Confederation of India Industries (CII) database on manufacturing firms, which provides details of those engaged in DT under the CII "smart manufacturing platform" initiative. We identified 456 companies, which we validated using the Dun & Bradstreet database on manufacturing companies in India.

Scholars have argued there are no perfect proxies or secondary data to measure the various dimensions of AMC nor of the outcomes of such alliances (Gulati, 1998; Schreiner et al., 2009; Schilke, 2014). Hence, we relied on the perceptions of the key informants, who we selected based on 1) their knowledge of their firm's alliance activities; 2) their familiarity with the DT initiatives of their firm; and 3) their firm's supply chain management activities. By doing this we ensured that the participants were appropriately involved in the issues under study (Campbell, 1955; Stuart, 1997; Forza, 2002; Schreiner et al., 2009). To enhance validity, we followed suggestions from some organisational researchers who have examined inter-organisational relationships (i.e. Kumar et al., 1993; Schreiner et al., 2009; Moshtari, 2016). This involved including questions to confirm they met our selection criteria.

We emailed the survey to individuals in the 456 selected companies and sent two reminders to those who had yet to return the surveys at

least two weeks after the initial email. We finally received 162 completed questionnaires (response rate = 35.45 %). We excluded 5 questionnaires because we needed more information. The characteristics of the respondents ( $n = 157$ ) are provided in Table 1.

We tested for non-response bias (NRB) in three ways (see Hulland et al., 2018). Firstly, we compared early wave respondents – responses received from 18th July to August 4, 2022 – with late wave – August 5, 2022 to December 9, 2022 – regarding their demographic characteristics. Secondly, we compared the firm's age and the number of employees of the 157 respondents with 67 non-respondents selected randomly. Thirdly, following recommendations for the wave analysis (see, Armstrong and Overton, 1977), we calculated the t-statistics ( $p > 0.05$ ) between early and late waves. Our analyses concluded that NRB is not a major issue in our study, and we can safely proceed with our data analysis.

## 4. Data analysis

We used WarpPLS 7.0, which addresses traditional weaknesses of the PLS-SEM method (Kock, 2019) by estimating factors. PLS-SEM has gained significant attention from the management research community as a useful method to build theory (see Ringle and Sarstedt, 2016; Akter et al., 2017). Classical PLS-SEM differs from covariance-based SEM in that it does not consider factors but rather composites, so it cannot fully estimate measurement errors, which often results in biased parameters. Kock (2019) argues that the PLSF (Partial least squared with factors estimation) builds on traditional PLS techniques and fully accounts for measurement errors. Therefore, PLS-based SEM is a suitable method for statistical analyses (see, Akter et al., 2017). We conducted the analyses in two stages, following the suggestions of leading scholars: firstly examining the construct validity and scale composite reliability (SCR) of the proposed research model (see Fig. 1) and secondly testing the research hypotheses (see, Sarstedt et al., 2016; Akter et al., 2017; Hair et al., 2017; Kock, 2019).

### 4.1. Common method bias (CMB)

In line with other organisational research on inter-firm processes, we gathered responses from a single key informant in each company (see, Cuevas-Rodríguez et al., 2014; Schilke, 2014; Kauppila, 2015; Xu et al., 2022). Thus, CMB is possible (see Viswanathan and Kayande, 2012), and to minimise this, we took two important steps. Firstly, we undertook procedural remedies following MacKenzie and Podsakoff (2012) recommendations. We developed our final questionnaire to eliminate the causes that often reduce the ability of the respondents to respond to questions accurately. As mentioned, we pre-tested our questionnaire with 30 managers to avoid ambiguous or double-barrelled questions. Secondly, we performed post-hoc analysis, often called partial correlation procedures (see, Hulland et al., 2018, p. 102). The differences observed between adjusted and previous correlations were insignificant. After undertaking these two steps we can safely say that, whilst common method bias is a potential problem in the case of single-informant cross-sectional data, the impact of such bias in our study is limited.

### 4.2. Measurement properties of constructs

In Table 2, we have provided values (see Cronbach alpha ( $\alpha$ ), scale composite reliability (SCR), and average variance extracted (AVE)) that demonstrate the properties of the multi-item measures used in the study to gather data. We observed that our values are well above the threshold values for  $\alpha$ , SCR, and AVE for each construct used in Fig. 1 (see, Sarstedt et al., 2022). Hence, we conclude that our constructs possess convergent validity. Further, we assessed the discriminant validity of the constructs (see Table 3). The square root of the AVE is larger than the absolute correlation value among the constructs in each row and column. In addition to Fornell and Larcker's (1981) discriminant validity test, we

**Table 2**  
Convergent validity.

Construct		Item	Factor loadings	Variance	Error	SCR	AVE
AMC ( $\alpha = 0.97$ ) (second-order reflective-reflective construct)	IC (first-order reflective construct) ( $\alpha = 0.917$ ) (SCR = 0.90, AVE = 0.75)	IC1	0.87	0.75	0.25	0.97	0.72
		IC2	0.84	0.71	0.29		
		IC3	0.89	0.80	0.20		
	APC (first-order reflective construct) ( $\alpha = 0.92$ ) (SCR = 0.91, AVE = 0.72)	APC1	0.85	0.71	0.29		
		APC2	0.85	0.72	0.28		
		APC3	0.84	0.70	0.30		
		APC4	0.87	0.75	0.25		
	IL (first-order reflective construct) ( $\alpha = 0.926$ ) (SCR = 0.91, AVE = 0.73)	IL1	0.83	0.70	0.30		
		IL2	0.86	0.74	0.26		
		IL3	0.87	0.76	0.24		
		IL4	0.84	0.71	0.29		
	AP (first-order reflective construct) ( $\alpha = 0.909$ ) (SCR = 0.89, AVE = 0.68)	AP1	0.86	0.73	0.27		
		AP2	0.84	0.71	0.29		
		AP3	0.77	0.60	0.40		
		AP4	0.83	0.68	0.32		
SCA ( $\alpha = 0.85$ ) (first-order reflective construct)		AGIL1	0.88	0.77	0.23	0.91	0.77
		AGIL2	0.88	0.77	0.23		
		AGIL3	0.87	0.76	0.24		
SCAA ( $\alpha = 0.87$ ) (first-order reflective construct)		ADAP1	0.87	0.75	0.25	0.92	0.79
		ADAP2	0.90	0.81	0.19		
		ADAP3	0.90	0.81	0.19		
OP ( $\alpha = 0.76$ ) (first-order reflective construct)		ROA	0.87	0.76	0.24	0.92	0.79
		ITO	0.88	0.77	0.23		
		OTD	0.91	0.82	0.18		
DT ( $\alpha = 0.88$ ) (second-order reflective-reflective construct)	DSS (first-order reflective construct) ( $\alpha = 0.922$ ) (SCR = 0.95, AVE = 0.85)	DT_DSS1	0.95	0.90	0.10	0.97	0.86
		DT_DSS2	0.94	0.89	0.11		
		DT_DSS3	0.88	0.77	0.23		
		DT_CAR1	0.91	0.83	0.17		
	CAR (first-order reflective construct) ( $\alpha = 0.935$ ) (SCR = 0.95, AVE = 0.87)	DT_CAR2	0.95	0.90	0.10		
		DT_CAR3	0.94	0.89	0.11		

Notes: AMC-alliance management capability; IC-inter-organisational coordination; APC-alliance portfolio coordination; IL-inter-organisational learning; AP-alliance proactiveness; DT-digital transformation; DT\_DSS: digital savvy skills; DT\_CAR: conditions for action and reaction; SCA-supply chain agility; SCAA-supply chain adaptability; OP-organisational performance.

**Table 3**  
Discriminant validity.

	Scale Range	Mean	Standard Deviation	IC	APC	IL	AP	DT_DSS	DT_CAR	SCA	SCAA	OP
IC	1–7	5.62	1.00	0.87								
APC	1–7	5.77	0.92	0.65	0.85							
IL	1–7	5.69	0.91	0.57	0.44	0.85						
AP	1–7	5.68	0.89	0.62	0.55	0.51	0.82					
DT_DSS	1–7	5.59	0.95	0.53	0.61	0.42	0.60	0.92				
DT_CAR	1–7	5.6	0.96	0.44	0.52	0.62	0.51	0.67	0.94			
SCA	1–7	5.64	0.91	0.65	0.50	0.53	0.47	0.58	0.50	0.93		
SCAA	1–7	5.64	0.92	0.68	0.42	0.66	0.53	0.64	0.64	0.65	0.89	
OP	1–7	5.75	0.96	0.47	0.67	0.56	0.50	0.50	0.60	0.57	0.47	0.89

Notes: AMC-alliance management capability; IC-inter-organisational coordination; APC-alliance portfolio coordination; IL-inter-organisational learning; AP-alliance proactiveness; DT-digital transformation; DT\_DSS: digital savvy skills; DT\_CAR: conditions for action and reaction; SCA-supply chain agility; SCAA-supply chain adaptability; OP-organisational performance.

**Table 4**  
Heterotrait-Monotrait (HTMT) values.

	IC	APC	IL	AP	DT_DSS	DT_CAR	SCAG	SCAA	OP
IC									
APC	0.72								
IL	0.84	0.82							
AP	0.80	0.73	0.89						
DT_DSS	0.70	0.88	0.89	0.88					
DT_CAR	0.81	0.89	0.88	0.88	0.78				
SCAG	0.87	0.81	0.93	0.80	0.78	0.80			
SCAA	0.78	0.72	0.95	0.64	0.84	0.73	0.69		
OP	0.84	0.84	0.84	0.78	0.68	0.76	0.68	0.87	

Notes: AMC-alliance management capability; IC-inter-organisational coordination; APC-alliance portfolio coordination; IL-inter-organisational learning; AP-alliance proactiveness; DT-digital transformation; DT\_DSS: digital savvy skills; DT\_CAR: conditions for action and reaction; SCA-supply chain agility; SCAA-supply chain adaptability; OP-organisational performance.



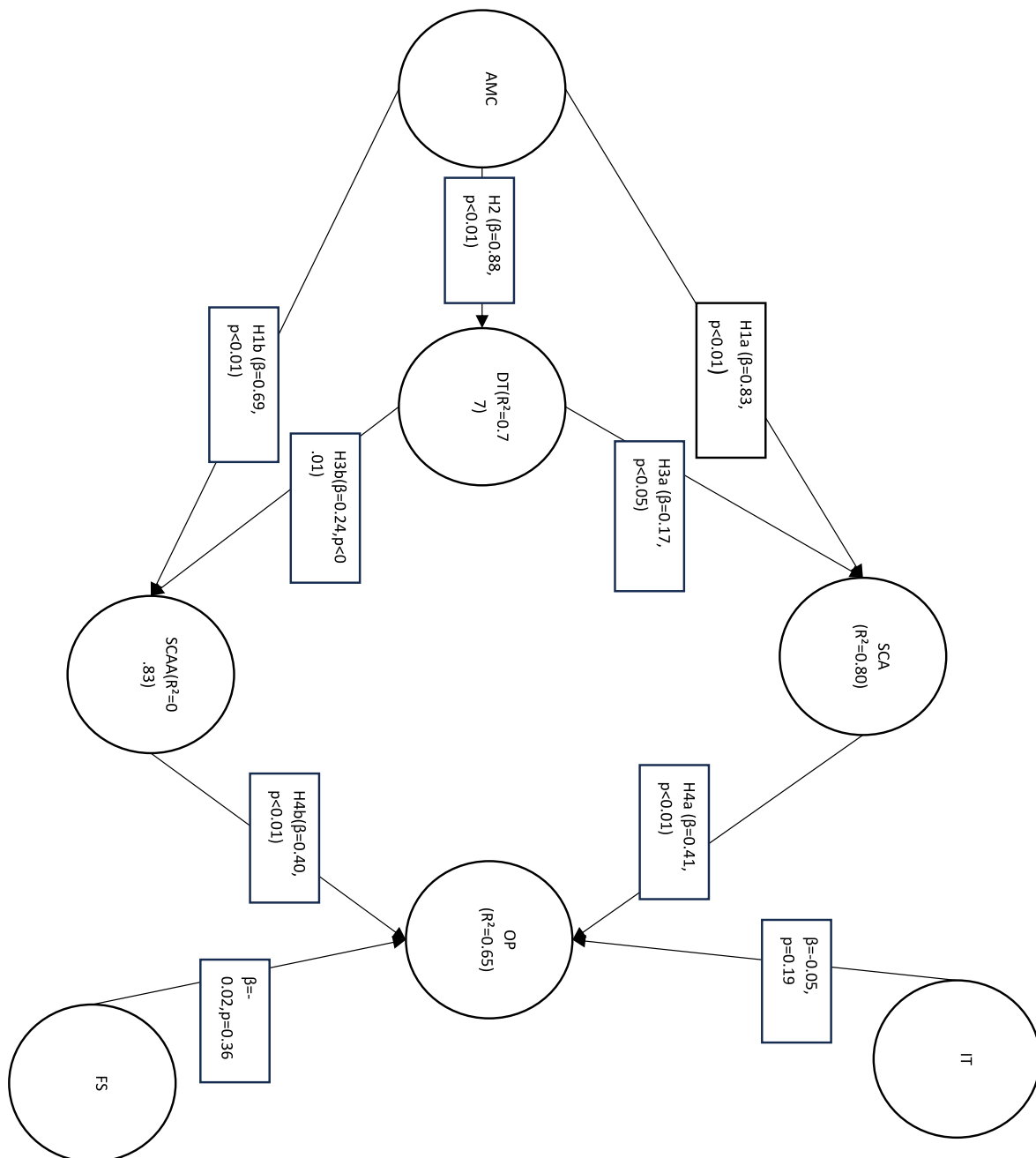
performed the HTMT (heterotrait-monotrait ratio of correlations) test (see Table 4). The HTMT values are well below the recommended threshold values (see Henseler et al., 2015), which indicates that the constructs possess sufficient discriminant validity. In totality, the constructs possess construct validity that is sufficient to enable the interpretation of structural estimates.

#### 4.3. Hypothesis testing

PLS-SEM is a statistical method that uses linear combinations of indicator variables to represent conceptual variables in a model. This approach allows us to model latent constructs with fewer observed variables, resulting in more accurate results. PLS-SEM has been validated by various researchers in different fields of study, including Akter et al. (2017), Benitez et al. (2020), and Hult et al. (2018). However,

before hypothesis testing, it is essential to perform an endogeneity test. Although scholars have suggested several methods for identifying and correcting endogeneity, it remains a contentious issue. We conducted a normality test using Kolmogorov-Smirnov with Lilliefors correction on the standardized composite scores of AMC, DT, SCA, and SCAA. Since none of the scores were normally distributed, we considered them endogenous in the Gaussian copula analysis. Using three regression models, we found that endogeneity was not an issue. Moreover, we used Simpson's paradox ratio (SPR), r-squared contribution ratio (RSCR), statistical suppression ratio (SSR), and non-linear bivariate causality direction ratio (NLBCDR) to evaluate the hypothesised relationships. After assessing the relationships, we concluded that the hypothesised relationships were supported, and the reversed path was either weak or did not exist. Fig. 2 presents the final model.

Our study aimed to assess the effectiveness of a proposed model in



**Fig. 2.** Final model. Notes: AMC-alliance management capability; DT-digital transformation; SCA-supply chain agility; SCAA-supply chain adaptability; OP-organisational performance; FS-firm size; IT-industry type.

explaining the variation in organisational performance (OP). We found that the model has an average  $R^2$  value of 0.76, indicating that it can explain almost 76 % of the variation in OP. Our research provides empirical evidence to support the hypothesised relationships between alliance management capability (AMC), supply chain agility (SCA), and supply chain adaptability (SCAA). Specifically, we found that AMC is positively related to SCA ( $\beta = 0.83$ ,  $p < 0.01$ ) and SCAA ( $\beta = 0.69$ ,  $p < 0.01$ ), supporting H1a and H1b, respectively. Our results further indicate that AMC is positively related to digital transformation (DT) ( $\beta = 0.88$ ,  $p < 0.01$ ), supporting H2. These findings highlight the critical role of AMC in building supply chain capabilities and supporting DT efforts, which are crucial for organisations to respond to uncertainties and crises. Our research emphasises the importance of AMC in enhancing organisational performance and promoting growth in challenging times. Furthermore, we found that the AMC and digital transformation explain 80 % of the total variation in SCA and nearly 83 % in the SCAA. These results demonstrate that AMC, under the mediating effect of DT, can help organisations enhance their agility and adaptability, which are essential to deal with crises. Our research provides empirical evidence to support the critical role of AMC in enhancing organisational performance, building supply chain capabilities, and supporting digital transformation efforts (Chen et al., 2019; Lee, 2021; Gereffi et al., 2022).

Our study produced empirical evidence that supports several hypotheses. Firstly, H1a/b and H2, which were already established in previous studies, received further validation. Secondly, we found support for H3a (DT→SCA) ( $\beta = 0.17$ ,  $p < 0.05$ ) and H3b (DT→SCAA) ( $\beta = 0.24$ ,  $p < 0.01$ ), indicating that the impact of digital transformation on supply chain agility and adaptability is significant. These findings corroborate the results of previous studies that have explored the role of big data analytics capability (e.g. Fosso Wamba and Akter, 2019; Fosso Wamba et al., 2020a) in enhancing supply chain capabilities. Our study further reinforces the findings that when properly utilised, digital transformation can significantly improve supply chain performance. By leveraging digital technologies, organisations can enhance their agility and adaptability to changing market conditions and improve their competitiveness.

Finally, we found support for the hypothesised relationships between SCA and OP ( $\beta = 0.41$ ,  $p < 0.01$ ) (H4a) and SCAA and OP (H4b) ( $\beta = 0.41$ ,  $p < 0.01$ ). SCA and SCAA explain 65 % of the total variation in the OP ( $R^2 = 0.65$ ). The findings confirm previous findings that SCA and SCAA are strong determinants of organisational performance in dynamic conditions (see Eckstein et al., 2015; Alfalla-Luque et al., 2018). Table 5 shows our hypothesis testing values.

We conducted additional tests to determine the mediation effect of digital transformation (DT) on the relationship between alliance management capability (AMC) and supply chain agility (SCA)/supply chain adaptability (SCAA). According to Hayes (2009), mediation refers to how a third variable (in our case, digital transformation) impacts the

relationship between two variables (AMC and SCA/SCAA). We conducted the mediation test in two ways. Firstly, we followed Baron and Kenny's (1986) recommendations. In the first path, we tested the direct impact of AMC on SCA ( $\beta = 0.83$ ,  $p < 0.01$ ), which was significant. In the second path, we tested the direct impact of AMC on DT ( $\beta = 0.88$ ,  $p < 0.01$ ), which was also significant. In the third path, we tested the impact of DT on SCA ( $\beta = 0.17$ ,  $p < 0.05$ ), which was also statistically significant. Finally, we controlled the effect of DT in the final equation, where we tested the influence of AMC and DT as predictors of SCA. In this case, we observed that the impact of AMC on SCA had decreased. We determined the significance of the mediation test using Sobel's test (Sobel, 1982). The Sobel statistics showed that the DT acted as a partial mediator between AMC and SCA, with a value of 2.89, which was significant at  $p < 0.01$ .

Similarly, we tested AMC as an independent variable, DT as a mediator, and SCAA as a dependent variable. We found a significant impact of AMC on SCAA ( $\beta = 0.69$ ,  $p < 0.01$ ), AMC on DT ( $\beta = 0.88$ ,  $p < 0.01$ ), and DT on SCAA ( $\beta = 0.24$ ,  $p < 0.01$ ). When we controlled for the effect of DT on the effect of AMC on SCAA, the impact decreased. We determined the Sobel statistic to be 4.09, significant at  $p < 0.01$ , indicating that the DT acted as a partial mediator between AMC and SCAA.

Although the approach introduced by Baron and Kenny (1986) for analysing indirect effects has faced criticism from some scholars (such as Preacher and Hayes in 2004, Hayes and Preacher in 2010, and Aguinis et al., in 2017), we chose to use an alternative method proposed by Kock (2014) to investigate these types of effects. To perform path analyses, we utilised a commercial software called WarpPLS. We used the Kock (2014) test based on the recommendations of Hayes and Preacher (2010) to analyse indirect effects. We found that the total sum of indirect effects of AMC on SCA consists of a single path (AMC→DT→SCA), which is marginally significant ( $\beta = 0.058$ ,  $p < 0.08$ ,  $f^2 = 0.05$ ) with a small effect size. Similarly, the total sum of indirect effects of AMC on SCAA consists of a single path (AMC→DT→SCAA) which is significant ( $\beta = 0.212$ ,  $p < 0.01$ ,  $f^2 = 0.2$ ). This indicates that the DT has partially mediated between AMC and SCA/SCAA.

#### 4.4. Exploratory interviews on the interaction between digital transformation and supply chain capabilities

To enhance the validity of our empirical findings, we conducted semi-structured exploratory interviews (Conlon et al., 2020) (see Appendix B). These interviews were designed to obtain additional insights and perspectives from the participants (Corbin and Strauss, 2014; Bansal et al., 2018). The interview process involved open-ended questions allowing participants to express their thoughts and ideas freely. We analysed the data collected from these interviews to gain a deeper understanding of the research topic and identify potential gaps in our research. By incorporating these interviews into our research methodology, we obtained a more comprehensive understanding of the subject matter and improved the overall quality of our research. We adopted an inductive approach, using qualitative data to help uncover hidden insights that advance theoretical insights (Gioia et al., 2013). The interviews were spread over four months and captured the insights of experts engaged in implementing digital technologies to further enhance their supply chain capabilities.

Based on Glaser and Strauss' (1967) recommendations, the lead author contacted senior managers either currently working on projects to digitalise their existing supply chain design or recently implementing digital transformation. To avoid bias, managers working in one of the Indian manufacturing units of multinational companies (MNCs) were contacted. For further details of the interview protocol and the reflective analysis and inter-coder reliability measures, please refer to Appendix C.

We conducted the interviews in two parts. Firstly, we asked questions about alliance management capability and its impact on supply chain capabilities. Secondly, how digital transformation impacts/imposed supply chain capabilities and organisational performance

**Table 5**  
Results of hypothesis testing.

Hypothesis	Driving variable	Outcome variable	$\beta$
H1a	AMC	SCA	0.83*
H1b	AMC	SCAA	0.69*
H2	AMC	DT	0.88*
H3a	DT	SCA	0.17**
H3b	DT	SCAA	0.24*
H4a	SCA	OP	0.41*
H4b	SCAA	OP	0.40*
Mediation test			
Hypothesis	Sobel value	Mediation	
H5a (AMC-DT-SCA)	2.89 at $p < 0.01$	partial	
H5b (AMC-DT-SCAA)	4.09 at $p < 0.01$	partial	

\* $p < 0.01$ ; \*\* $p < 0.05$ .

Notes: AMC-alliance management capability; DT-digital transformation; SCA-supply chain agility; SCAA-supply chain adaptability; OP-organisational performance.

impacts. The initial interview guidelines and questions were adjusted during the discussion, based on the insights gathered from previous interviews (see, Gioia et al., 2013). We reached theoretical saturation after 27 interviews (Corbin and Strauss, 2014).

We followed Gioia et al. (2013) guidelines, which provide a framework to analyse qualitative data rigorously, through an interpretive process. This process is recommended when the participants' experiences are used to develop a theoretical understanding of a phenomenon. Hence, we developed theoretical insights with the help of the participant's personal experiences.

The dominant emergent themes in the data further corroborate our empirical findings by highlighting how a lack of coordination, missing digital leadership and digital talent, and poor digital talent management may negatively influence supply chain capabilities and their impact on organisational performance. In this respect, it confirms that competitive advantage originates from how the technologies are exploited rather than from the technology itself (Barratt and Oke, 2007). Hence, organisations need to pay careful attention to the enablers of digital transformation, for their supply chain capabilities to achieve superior performance.

Interviewees suggested that organisations have no choice but to embrace digital transformation in the digital era. As stressed by interviewees (see, for example, quotes from P18, P20, P22, P23, in Appendix D), a digital culture is about a digital mindset, innovation, the right use of operational and experience data, and an open culture. Such a culture is the backbone of successful digital transformation. Moreover, developing and retaining the right digital talent are crucial to successful digital transformation (see, quotes from P24, P25, P26). Whilst digital transformation may be a high priority, the hardest part is to decide when and how to embark on such a transformation. Most of the time, an organisation is concerned about the return on investment of any new initiative (quote from P22). Hence, for proper alignment with technology and strategy, the role of digital leadership is crucial (see quotes, P16, P17, P21 and P19). Further excerpts from the interview data describe some of the components of digital transformation essential for enhancing the effects of supply chain capabilities on performance (see Appendix D).

## 5. Discussion

Our empirical survey results, supplemented by qualitative interview data, provide a nuanced understanding of the relationships between AMC, SCA, SCAA, DT and OP. Our findings offer useful implications for theory and practice. Overall, we provide robust evidence to support the contention of Lee (2021, p.176) that *“as the scope of supply chains expands in multiple dimensions, the use of digital platforms will become more and more important”*. We demonstrate a statistically significant link from AMC to SCA and SCAA. We further explore the enablers and barriers to DT, which affect supply chains' agility and adaptability during crises.

### 5.1. Implications for theory

Organisations should assess their business needs and technical abilities to leverage digital technologies and enhance their supply chain capabilities. This can improve overall organisational performance (Rai et al., 2006; Devaraj et al., 2007). To digitally transform a supply chain, it is crucial to build technological infrastructure, foster a culture that supports innovation, develop strong leadership, and cultivate talent management capabilities (Centobelli et al., 2020). Our study addresses research questions and gaps in this area that were identified by Craighead et al. (2020) and Lee (2021). By analysing the data we gathered, we hope to provide insights that will inform future research and add to the existing body of knowledge in this field.

Our study uses the concept of dynamic capabilities and the hierarchical view of the firm (Fainshmidt et al., 2016). Dynamic capabilities are crucial for organisations to adapt to the rapidly changing business

environment. We examine the interplay of various dynamic capabilities necessary for organisations to maintain a competitive advantage. These capabilities include alliance management capability, digital transformation, supply chain agility, and supply chain adaptability. By understanding the hierarchical view of dynamic capabilities, organisations can develop effective strategies to navigate the complexities of the modern business environment and maintain a sustainable competitive advantage.

Our study focuses on the effectiveness of dynamic capabilities theory (DCV) in supply chain activities and its impact on organisational performance. To address criticisms of DCV, we have conceptualised our constructs - AMC, SCA, and SCAA - as higher and lower-order constructs (see, Easterby-Smith et al., 2009; Zhang et al., 2023). Our theoretical framework provides a detailed understanding of dynamic capabilities in the context of digital transformation. Our study sheds light on the essential drivers of dynamic capabilities and how they can be employed to gain a competitive advantage in the digital age. We have analysed how digital transformation can help organisations form alliances to develop complex supply chain capabilities, enabling them to respond promptly to rapid internal and external environmental changes. We emphasise the importance of building agility and adaptability in supply chains to gain a competitive advantage.

Our findings suggest that effective alliance management capability and digital transformation can help organisations enhance their supply chain capabilities, enabling them to respond to changes in the market, customer preferences, and other external factors. Overall, our study provides valuable insights into how companies can leverage their dynamic capabilities to improve organisational performance in the digital age. By expanding the dynamic capability view boundary, this study sheds light on the mechanisms through which organisations continue to evolve their supply chain management practices.

Our research also answers calls that seek empirical evidence to explain how strategic alliances, especially in the digital era, enhance supply chain capabilities to deal with unprecedented crises (see He et al., 2020; Roscoe et al., 2022). Our study investigated how Alliance Management Capability (AMC) enhances supply chain agility and adaptability. We found that AMC is critical in promoting cooperation, clear communication, trust, and transparency in the supply chain. Through these mechanisms, AMC helps organisations build high supply chain visibility, enabling them to better deal with crises and other disruptions. We gained profound insights into how AMC promotes cooperation, communication, trust, and transparency in the supply chain. Our results support Lee's (2004, 2021) arguments regarding the importance of AMC in supply chain management and highlight the need for further empirical studies on this topic, as suggested by Verbeke (2020) and Brammer et al. (2023). This is evident in examples of leading pharmaceutical companies, digital companies, and electronic chip manufacturers that have robust strategies for supply chain disruptions. They used their diversified supply base to mitigate supply uncertainties. By promoting cooperation, communication, trust, and transparency in the supply chain, AMC helps organisations build high supply chain visibility and, in turn, enhances their supply chain agility and adaptability. In line with this, Our research indicates that organisations that invest in building strong AMC are better prepared to deal with supply chain disruptions.

Our study clarifies the boundary conditions for Dynamic Capabilities View (DCV). By understanding the relationship between alliance management, agility, and adaptability, organisations can develop a more comprehensive approach to strategic management and enhance their long-term prospects for success. We found that digital transformation plays a vital role in improving and strengthening the impact of alliance management on the development of supply chain capabilities. Furthermore, we found that digital transformation acts as a mediator in this relationship, facilitating and enhancing the effectiveness of alliance management in achieving this goal. This finding emphasises the growing importance of digital transformation in the modern business landscape, highlighting its potential as a critical driver of progress and success in

supply chain management.

Digital transformation is a complex process requiring a systematic approach to leverage its benefits and achieve desired outcomes effectively. As such, senior managers must be ready to meet the challenge of this wave of digital transformation, as no sector or organisation is immune to its effects. Our study focuses on the dynamic aspects of digital transformation, providing a platform to evaluate how dynamic capabilities can produce results under different conditions, especially when organisations are undergoing digital transformation.

Ultimately our study aims to clarify the role of digital transformation within the dynamic capability framework. Our findings contribute to developing more effective strategies for organisations to manage digital transformation and enhance their overall performance. The results further confirm the importance of proper coordination, quick responses, and embracing innovation as essential drivers of supply chain capabilities for organisations operating under high environmental uncertainties resulting from pandemics or geo-political crises.

In summary, our study offers valuable theoretical contributions to the field of supply chain management by highlighting the role of digital transformation in alliance formation and management. It provides insights into how organisations can build agility and adaptability in their supply chains leading to a competitive advantage.

## 5.2. Implications for practitioners and policymakers

Our research study offers valuable insights for those involved in digital transformation or managing supply chains in the digital era. Managers should improve coordination and promote inter-organisational learning to enhance their alliance management capability. Regular meetings should be organised with the participation of all supply chain actors to reduce behavioural uncertainties and opportunistic behaviour among partners during times of crisis. This helps foster mutual trust among partners and promotes a culture of collaboration and information sharing.

Further, inter-organisational learning is crucial for organisations to quickly respond to crises and adapt their supply chain structures and processes. Managers need to encourage learning from past experiences and mistakes so that the supply chain can be improved and made more efficient. Building a culture of mutual respect is also essential, as it fosters open communication and promotes learning from one another.

Organisations leveraging digital technologies to improve their supply chain performance must carefully consider their business needs and existing capabilities. This requires a critical assessment of resources and capabilities, including infrastructure, human resources, organisational structure, and financial resources, to determine the success of digital

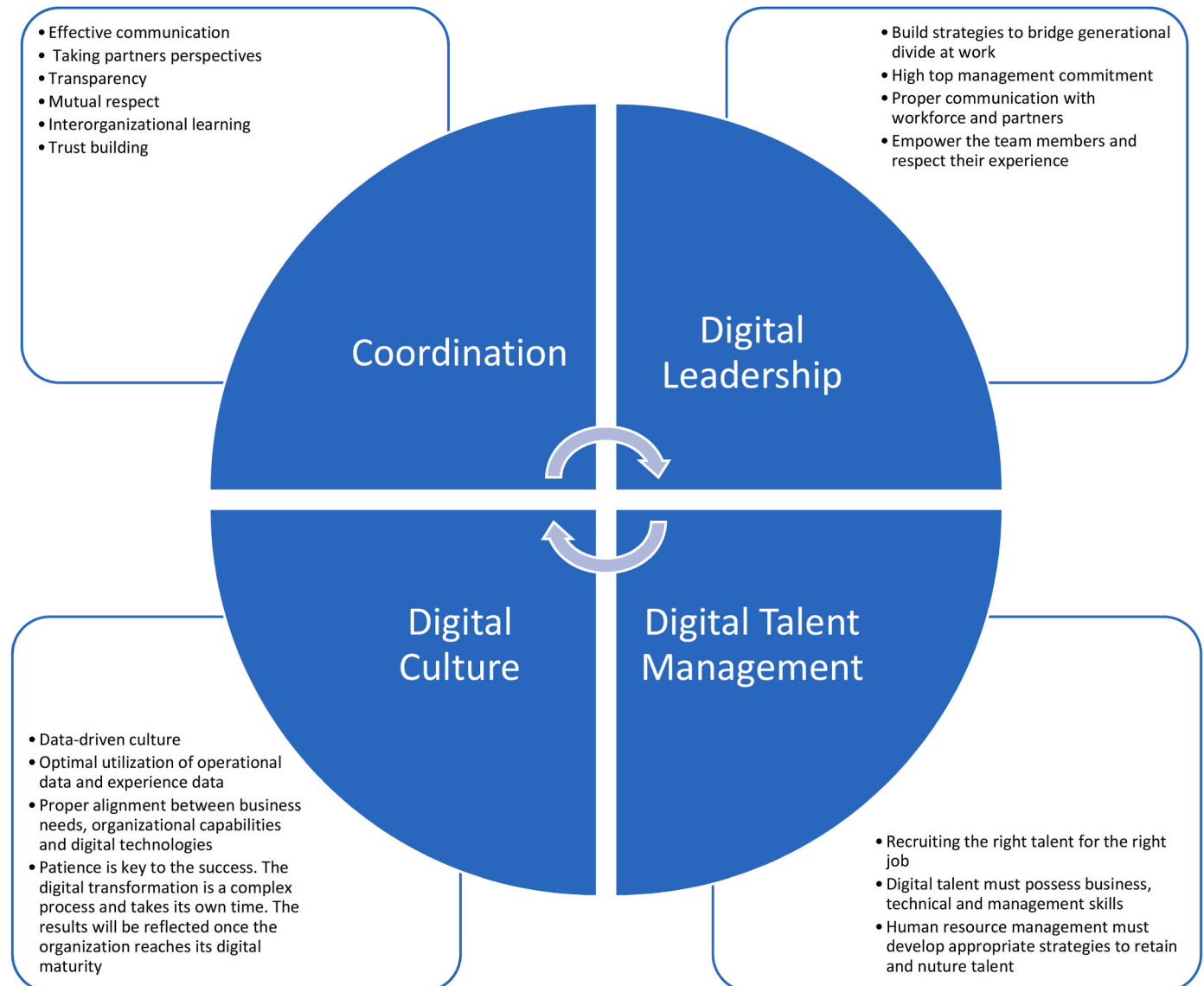


Fig. 3. Digital transformation strategy for supply chain.



transformation. Organisations should also ensure they have digital-savvy leaders with high commitment and belief in digital transformation. Such leaders can attract and retain the right digital talent, invest in building capabilities for the workforce, and empower individuals to make decisions.

Promoting a culture of collaboration and mutual respect is essential for organisations to transform their existing supply chain into digitally empowered ones successfully. This involves creating an environment where organisations encourage people to speak up and share their ideas and where there is a willingness to work together to solve problems. Leaders and managers should focus on four key areas: *coordination, digital leadership, digital culture, and digital talent management*, as shown in Fig. 3. By focusing on these areas, organisations can improve their alliance management capabilities, reduce uncertainties, and successfully transform their supply chain for the digital era.

The study's findings shed light on key implications for policymakers. Firstly, they should prioritise drafting policies specifically tailored to industry. Secondly, policymakers should provide comprehensive support for companies to manage crises effectively. This includes investing in developing dynamic capabilities, such as digitalisation and promoting the formation of alliances with other companies. By investing in these capabilities, companies can better navigate crises and emerge with a stronger performance. Overall, the study highlights the importance of proactive policymaking and investing in the right capabilities to achieve long-term success in the industry.

### 5.3. Limitations of the study and future research directions

To fully address the limitations of our study and gain new insights, we recognise the need for future research avenues. Firstly, although we used a scientifically rigorous approach, it is important to note that our dataset only applies to specific industry sectors. Therefore, one needs to exercise caution when generalising our findings to all industry sectors. To improve the precision of our model, we recommend that future studies collect longitudinal data instead of cross-sectional data. This will enable researchers to track changes over time and to make more accurate predictions.

Secondly, we acknowledge that we collected survey-based data using a single-informant questionnaire, which could lead to common method variance (CMV) concerns. However, we used an appropriate theoretical framework to develop the model and validated our statistical results with qualitative semi-structured interviews to mitigate these limitations. We also recommend that future studies take steps to reduce CMV concerns, such as utilising multiple informants or triangulating data obtained from various sources.

Finally, moving forward, we suggest that scholars investigate the role of institutional pressures in shaping supply chain and digital transformation strategies. This is a key area of research as the digital transformation of supply chains is a complex and multifaceted process heavily influenced by external factors. Additionally, we recommend using resource-based and dynamic capability theories to explore how firms can develop the necessary resources and capabilities to navigate digital transformation successfully. By taking these steps, future research can provide a more nuanced understanding of the challenges and opportunities associated with digital transformation in supply chains.

## 6. Conclusions

Our research study sought to answer two specific questions related to

the supply chain and operational performance:

1. *What are the effects of AMC on SCA and SCAA?*
2. *What are the effects of AMC on the SCA/SCAA and OP under the mediating effect of DT?*

In our research, we explored the topic of alliance formation and digital transformation through a combination of deductive and inductive approaches. We attempted to gain a deeper, more comprehensive understanding of the mechanisms underlying alliance formation and the impact of digital transformation on this process. Our study was grounded in the dynamic capability framework, which we sought to expand based on criticisms from scholars. Through this framework, we aimed to better understand the complex phenomenon of alliance management capability and how it can be leveraged to improve supply chain agility and adaptability during times of crisis. By conducting in-depth interviews, we were able to identify the critical role of digital transformation in mediating the relationship between alliance management capability and supply chain capabilities.

We found that alliance management capability is positively related to both supply chain agility and supply chain adaptability. These findings show the importance of alliance management for uncertain times. Further, the mediating role of digital transformation points to the opportunity to exploit this approach to multiply the effect of alliance management.

Specifically, we found that digital transformation can facilitate communication and collaboration between alliance partners, leading to improved decision-making, faster response times, and greater overall agility and better adaptability, thereby making the alliance more effective. Our study offers a nuanced understanding of this complex phenomenon and highlights the need for further exploration of unresolved issues and questions. We hope that our findings provide motivation for researchers and practitioners to continue exploring the role of digital transformation in alliance formation and management.

### CRediT authorship contribution statement

**Rameshwar Dubey:** Writing – review & editing, Writing – original draft, Validation, Methodology, Investigation, Data curation, Conceptualization. **David J. Bryde:** Writing – review & editing, Conceptualization. **Constantin Blome:** Writing – review & editing, Validation, Methodology, Conceptualization. **Yogesh K. Dwivedi:** Writing – review & editing, Conceptualization. **Stephen J. Childe:** Writing – review & editing, Writing – original draft, Methodology, Conceptualization. **Cyril Foropon:** Writing – review & editing, Resources, Conceptualization.

### Data availability

Data will be made available on request.

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## Appendix A. Measurement scales and items

Scale	Source	Items
Alliance management capability (AMC) (strongly disagree = 1; strongly agree = 7)	Schilke (2014)	<p><b>Interorganisational coordination</b></p> <ul style="list-style-type: none"> <li>- We coordinate our activities in the supply chain with our partners.</li> <li>- Our partners' competencies are always considered when assigning work tasks to ensure the best possible outcome.</li> <li>- Before making any decision, we ensure to engage with all partners in the supply chain.</li> </ul> <p><b>Alliance portfolio coordination</b></p> <ul style="list-style-type: none"> <li>- We ensure coordination among the partners in the supply chain network to share strategic resources.</li> <li>- We determine the areas of collaboration in our supply chain network.</li> <li>- We identify the interdependencies between our partner's alliances in the supply chain network.</li> <li>- We carefully determine any overlaps between our alliances in the supply chain network.</li> </ul> <p><b>Interorganisational learning</b></p> <ul style="list-style-type: none"> <li>- Our supply chain network allows us to gain invaluable knowledge from our alliance partners and continuously improve our operations.</li> <li>- Our supply chain alliance partners provide valuable opportunities to acquire new knowledge and enhance our managerial competencies.</li> <li>- Our capabilities are sufficient to effectively analyse the information obtained from our alliance partners within the supply chain network.</li> <li>- Our successful collaboration results from integrating the information provided by our alliance partners with our existing knowledge.</li> </ul> <p><b>Alliance Proactiveness</b></p> <ul style="list-style-type: none"> <li>- We always seek opportunities to establish alliances with supply chain partners.</li> <li>- We always take the initiative in approaching our supply chain partners with proposals for alliances.</li> <li>- We excel in proactively seeking and establishing robust partnerships with our supply chain network partners, setting us apart from our competitors.</li> <li>- We actively monitor the environmental conditions to seek opportunities to build strong partnerships.</li> </ul>
Digital transformation (strongly disagree = 1; strongly agree = 7)	Sousa-Zomer et al. (2020)	<p><b>Digital savvy skills</b></p> <ul style="list-style-type: none"> <li>- Our top management team is familiar with digital technologies.</li> <li>- Our functional managers are familiar with digital technologies.</li> <li>- Our workforce is familiar with digital technologies.</li> </ul> <p><b>Conditions for actions and reactions</b></p> <ul style="list-style-type: none"> <li>- Our organisation encourages its employees to be entrepreneurial.</li> <li>- opportunities or dealing with challenges.</li> <li>- Our organisation is based on a multi-divisional structure.</li> </ul> <p><b>Digital intensity</b></p> <ul style="list-style-type: none"> <li>- Our organisation pays significant attention to external partnerships and fosters collaboration to help improve its digital capabilities.</li> <li>- Our organisation makes significant fund allocations on investment in digital capabilities.</li> <li>- Our organisation invests in the dynamic sensing capability to detect any short-term dynamic changes in the external environment.</li> <li>- Our organisation can quickly adjust its production capabilities in response to rapid changes in market demand.</li> <li>- In times of supply chain disruptions, our organisation stands ready to promptly meet the need for product variety.</li> </ul>
Supply chain agility (strongly disagree = 1; strongly agree = 7)	Alfalla-Luque et al. (2018)	<ul style="list-style-type: none"> <li>- Our organisation makes significant fund allocations on investment in digital capabilities.</li> <li>- Our organisation invests in the dynamic sensing capability to detect any short-term dynamic changes in the external environment.</li> <li>- Our organisation can quickly adjust its production capabilities in response to rapid changes in market demand.</li> </ul>
Supply chain adaptability (strongly disagree = 1; strongly agree = 7)	Alfalla-Luque et al. (2018)	<ul style="list-style-type: none"> <li>- In times of supply chain disruptions, our organisation stands ready to promptly meet the need for product variety.</li> <li>- Our organisation is adaptable to market changes and can modify its supply chain process and structure accordingly.</li> <li>- To stay ahead of technological advancements, our organisation proactively identifies and implements the latest technologies in our processes, products, and information systems.</li> <li>- We focus on investing in capabilities that allow us to anticipate and address market changes in our supply chain, ensuring that we remain ahead of the curve.</li> </ul>
Organizational performance (strongly disagree = 1; strongly agree = 7)	Alfalla-Luque et al. (2018); Sousa-Zomer et al. (2020)	<ul style="list-style-type: none"> <li>- Return on Asset (ROA)</li> <li>- Inventory turnover ratio</li> <li>- Market capitalisation</li> <li>- On-time delivery</li> </ul>
Firm size	Eckstein et al. (2015)	(Number of employees) (ln)

## Appendix B. Sample Interviews

Participant	Designation	Interview duration	Gender	Experience (years)
P1	Staff Systems Engineer	00: 29:32	F	9
P2	Global Supply Chain Manager	00:33:21	M	12
P3	Chief Manager	00: 36: 18	M	16
P4	Senior Manager	00: 28:37	M	11
P5	Cluster B&I Head	00: 37:23	F	18
P6	Group Product Manager	00: 28: 26	M	16
P7	Business Analyst	00:23:24	M	8
P8	Principal Consultant	00:37:25	M	12
P9	Data Strategy Consultant	00:36:12	F	10

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Participant	Designation	Interview duration	Gender	Experience (years)
P10	Head-Logistics	00:33:11	M	22
P11	Senior Data Scientist	00: 26:13	F	8
P12	Deputy General Manager	00: 23:39	M	19
P13	Manager	00:17:23	M	9
P14	Senior Consultant-Supply Chain Design	00:36:21	M	11
P15	Manager-Logistics	00:19:21	M	13
P16	Senior Manager-Product Supply Chain	00:33:27	M	9
P17	Manager-Digital Transformation	00:37:21	M	11
P18	Distribution Planner	00:16:38	M	8
P19	Senior Consultant-Supply Chain Management	00:17:21	M	23
P20	Manager-Supply Chain Planning	00:28: 21	F	12
P21	Manager-Data Analytics	00:23:11	F	9
P22	Data Modeller	00:19:13	M	7
P23	Lead Consultant	00:16:27	M	16
P24	Procurement Manager	00:31: 12	F	7
P25	Technology Consulting Manager	00:26:33	M	9
P26	Associate Manager	00:25:21	M	8
P27	Senior Project Controls Engineer	00:23:21	M	11

### Appendix C. Interview protocol and the reflective analysis and intercoder reliability measures

The focus of this research is to examine how alliance management capability impacts supply chain capabilities like agility and adaptability to enhance organisational performance during times of crisis. Additionally, the study will explore the role of digital transformation capability in augmenting the effects of these supply chain capabilities on organizational performance. Through this interview, we hope to gain a better understanding of how alliance formation influences supply chain agility and adaptability, as well as the varying impacts of digital transformation on supply chain capabilities and organisational performance. Please note that all participant and company information will be kept confidential. If you agree, I would like to record our conversation to aid in the analysis of our discussion.

#### Part 1

1. How do you personally deal with your partners during crises?
2. In your opinion, what makes alliances between partners successful?
3. Can you think about how your organisation responds to the needs of the consumers during the crises?
4. In your opinion, how a company can adapt its business model during crises?

#### Part 2

5. What do you know about the digital transformation initiatives taken by your company?
6. What, in your view, are the key factors that impact digital transformation?
7. In your opinion, to what extent does the digital transformation in your company impact the supply chain of your company during the recent crises (e.g., COVID-19, geopolitical tensions, and other crises)?
8. Can you identify the main issues related to digital transformation in your company?
9. Are there any other details that would be important for us to comprehend?
10. Is there anything you would like to ask or share about the interview?

### Appendix D. Summary of findings based on qualitative interviews

Participant	Excerpt from interviews	Aggregate dimensions
P1, P5, P7, P8, P10, P11	P1: "We take our partner's perspectives into consideration while coordinating our actions and allocating resources". P5: "We communicate and coordinate among our partners to understand how we can respond to the stock out of inventory of critical items". P7: "We are transparent with our partners to avoid any level of confusion during the time of action". P8: "We coordinate together during product design". P10: "We do not blame each other for mistakes. Instead, we learn from our mistakes and support each other". P11: "Trust is an essential element that helps build good chemistry between each other, which in turn improves the coordination and sharing of knowledge and skills".	<b>Coordination</b>
P1, P2, P3, P6	P1: "Data-driven insights help [...] predict the demand". P2: "In recent times, we rely on digital technologies to a greater extent to monitor the market conditions [...] and prepare for the manufacturing of the necessary items". P3: "GPS is used to track the real-time movement of our containers. We can adjust our production capacity to assure that we can produce and deliver on time". P6: "I use an AI-based analytics tool to simulate the variations in the market [...] and prepare for the shipment capability".	<b>Agile capability</b>
P4, P9, P13, P14	P4: "I am adapting myself in a fast-evolving environment. Now I have accepted that technology is complementary to my skills and experience". P9: "I have seen that our organisations are spending resources to train us to use digital technologies in day-to-day	<b>Digital adaptability</b>

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Participant	Excerpt from interviews	Aggregate dimensions
P12, P15, P27	business activities. Initially, I was a bit reluctant to use but thanks to my team for the kind of support and motivation they provided to me [...], I am now quite confident and able to make better decisions based on results obtained using analytics tools". P13: "Our organization in response to demand, created several new functional departments such as "data analytics manager" or "sales unit logistics head", which did not exist a few years back". P14: "Our organization keeps on introducing the latest technologies to improve the visibility and help track the flow of materials and information to minimise any sorts of confusion". P12: "I sometimes get lost amidst a rapidly changing environment. A few years back we were busy with the SAP R/3, and SAP HANA and now we are told to work on the advanced version of SAP S/4 HANA". P15: "I believe most of us are not clear when it comes to reporting to higher-ups or dealing with the clients. Sometimes, I find it too difficult to prepare the daily report and deal with customers' queries". P27: "I am not against technology-driven insights. However, field managers' experiences are far more valuable during crises. During the COVID time, I found data-driven insights were far more confusing. Hence, I cautiously used machine output and the field managers' insights to plan supply chain activities".	<b>Driving technology transformation for values</b>
P16, P17, P21, P19	P16: "I find despite the high level of enthusiasm among the young staff, [...] the generational divide between two generations often creates disruption". P17: "I find there is a lack of commitment at the top level, [...], the use of digital technologies is the result of consultant recommendations. We need some time to adapt to the transition from old technologies to the new generation technologies". P21: "I find something is missing between the top management team and the ground-level staff which creates a divide between us [...], every functional department is trying to maximize its own benefits at the cost of organization values". P19: "Consultants are supposed to solve our problems. Unfortunately, they end up creating a mess and we struggle for months to clean it. The top management needs to respect our opinion. The ground realities are much different from top management vision about digital technologies".	<b>Missing digital leadership</b>
P18, P20, P22, P23	P18: "We are not innovating. Instead, we are copying other best practices without understanding our own contexts". P20: "I believe that analytics tools are quite easier to use. However, the findings of the tool are not coherent with the experience of the ground staff. While making decisions, we need to carefully utilize data and experience of the ground-level staff". P22: "I think we are too impatient. The digital culture in India is in the early stage, [...] a long way to go when it comes to realizing the true benefits of the investment in building digital assets". P23: "We are not good at optimal utilization of our digital capabilities. Over-investing in technologies that are waste for our organization is one of the main areas of concern [...]".	<b>Missing digital culture</b>
P24, P25, P26	P24: "Retaining good talent is a problem. In recent years we have lost many talented data scientists to other industries". P25: "We have recruited some young data scientists who have enormous technical skills. However, they still lack business skills. Most of the time their reports are hard to link with real situations". P26: "I feel some of the senior colleagues are too impatient and do not cooperate with the new data analytics manager [...], feel sorry for them as we are supposed to cooperate with them so that they can really help us".	<b>Poor digital talent management</b>

## Alternative format.

Aggregate dimensions	Excerpt from interviews
<b>Coordination</b>	P1: "We take our partner's perspectives into consideration while coordinating our actions and allocating resources". P5: "We communicate and coordinate among our partners to understand how we can respond to the stock out of inventory of critical items". P7: "We are transparent with our partners to avoid any level of confusion during the time of action". P8: "We coordinate together during product design". P10: "We do not blame each other for mistakes. Instead, we learn from our mistakes and support each other". P11: "Trust is an essential element that helps build good chemistry between each other, which in turn improves the coordination and sharing of knowledge and skills".
<b>Agile capability</b>	P1: "Data-driven insights help [...] predict the demand". P2: "In recent times, we rely on digital technologies to a greater extent to monitor the market conditions [...] and prepare for the manufacturing of the necessary items". P3: "GPS is used to track the real-time movement of our containers. We can adjust our production capacity to assure that we can produce and deliver on time". P6: "I use an AI-based analytics tool to simulate the variations in the market [...] and prepare for the shipment capability".
<b>Digital adaptability</b>	P4: "I am adapting myself in a fast-evolving environment. Now I have accepted that technology is complementary to my skills and experience". P9: "I have seen that our organisations are spending resources to train us to use digital technologies in day-to-day business activities. Initially, I was a bit reluctant to use but thanks to my team for the kind of support and motivation they provided to me [...], I am now quite confident and able to make better decisions based on results obtained using analytics tools". P13: "Our organization in response to demand, created several new functional departments such as "data analytics manager" or "sales unit logistics head", which did not exist a few years back". P14: "Our organization keeps on introducing the latest technologies to improve the visibility and help track the flow of materials and information to minimise any sorts of confusion".
<b>Driving technology transformation for values</b>	P12: "I sometimes get lost amidst a rapidly changing environment. A few years back we were busy with the SAP R/3, and SAP HANA and now we are told to work on the advanced version of SAP S/4 HANA". P15: "I believe most of us are not clear when it comes to reporting to higher-ups or dealing with the clients. Sometimes, I find it too difficult to prepare the daily report and deal with customers' queries". P27: "I am not against technology-driven insights. However, field managers' experiences are far more valuable during crises. During the COVID time, I found data-driven insights were far more confusing. Hence, I cautiously used machine output and the field managers' insights to plan supply chain activities".
<b>Missing digital leadership</b>	P16: "I find despite the high level of enthusiasm among the young staff, [...] the generational divide between two generations often creates disruption".

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Aggregate dimensions	Excerpt from interviews
	P17: "I find there is a lack of commitment at the top level, [...], the use of digital technologies is the result of consultant recommendations. We need some time to adapt to the transition from old technologies to the new generation technologies". P21: "I find something is missing between the top management team and the ground-level staff which creates a divide between us [...], every functional department is trying to maximize its own benefits at the cost of organization values". P19: "Consultants are supposed to solve our problems. Unfortunately, they end up creating a mess and we struggle for months to clean it. The top management needs to respect our opinion. The ground realities are much different from top management vision about digital technologies".
Missing digital culture	P18: "We are not innovating. Instead, we are copying other best practices without understanding our own contexts". P20: "I believe that analytics tools are quite easier to use. However, the findings of the tool are not coherent with the experience of the ground staff. While making decisions, we need to carefully utilize data and experience of the ground-level staff". P22: "I think we are too impatient. The digital culture in India is in the early stage, [...] a long way to go when it comes to realizing the true benefits of the investment in building digital assets". P23: "We are not good at optimal utilization of our digital capabilities. Over-investing in technologies that are waste for our organization is one of the main areas of concern [...]".
Poor digital talent management	P24: "Retaining good talent is a problem. In recent years we have lost many talented data scientists to other industries". P25: "We have recruited some young data scientists who have enormous technical skills. However, they still lack business skills. Most of the time their reports are hard to link with real situations". P26: "I feel some of the senior colleagues are too impatient and do not cooperate with the new data analytics manager [...], feel sorry for them as we are supposed to cooperate with them so that they can really help us".

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