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Research article

Supply chain digitalization and performance: A moderated mediation of supply chain visibility and supply chain survivability

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A B S T R A C T

The COVID-19 crisis has notably impacted global supply chains as it has disrupted manufacturing operations. To recover from the aforementioned disruptions, supply chain digitalization [SCD] is increasingly being acknowledged to help the recovery process. Based on this, scholars have called for additional research on how SCD can enhance supply chain visibility [SCV] and boost supply chain performance [SCP] in turbulent environments. Based on 399 valid responses collected through cross-sectional method from Turkish manufacturing firms and using a non-probabilistic sampling method [i.e., purposive sampling], this research explores the effect of SCD on SCP. The mediating role of SCV and the moderating role of supply chain survivability [SCS] on the SCD-SCP relationship were also explored. The findings showed that SCD has a positive effect on SCP. SCD has a positive effect on SCV. SCV has a positive effect on SCP. The link between SCD and SCP is mediated by SCP. The results also revealed that SCS moderated the SCD-SCV link such that SCD has a stronger, positive relationship with SCV when SCS is high than when it's low. SCS moderates the SCD-SCP link, such that at low levels of SCS, the positive effect of SCD on SCP is weakened. The indirect positive effect of SCD on SCP via SCV is strongest when supply chain survivability is high. The findings suggest that SCD can improve cost-effectiveness, promote communication and information efficiency, and enhance supply chain resilience to improve performance after disruptions. This study provides insightful new implications for both supply chain literature and practitioners.

1. Introduction

Lately, disruptions in the supply chain from various sources have been receiving much attention both in academia and practice [1–3]. From this standpoint, the topic of managing supply chain disruptions is of great importance, as evidenced by recent scholarly studies [see 4, 5]. According to Craighead et al., disruptions relate to "unplanned and unanticipated events that disrupt the normal flow of goods and materials within a supply chain [4]." Catastrophic natural disasters such as floods, earthquakes, and most recently COVID-19 pandemic have all occurred in recent times. These disruptions can impede organizations' performance, whether in the short or long term [4].

Enterprises have invested in developing capabilities to mitigate the detrimental effects of such disruptions caused by disasters on SCP [5]. The implementation of supply chain digitalization (SCD) has been accelerated due to logistic disruptions, changes in workplace and market environments; SCD has attracted significant attention from firms and has emerged as a prominent topic in

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operations management research [6,5]. Specifically, the digitalization of the supply chain has been accelerated by advanced digital technologies such as artificial intelligence, blockchain and big data analytics [7–9]. The goal of digitalization is to increase operational efficiency and quality development by systematically using data to facilitate production and operations, covert and transform the supply chain and boost overall performance. According to Eller et al. [10], the implementation of SCD has resulted in the transformation of the conventional supply chain mode of operation, leading to the emergence of new business models and products.

Undoubtedly the COVID-19 pandemic has underscored the susceptibility of modern supply chain while simultaneously amplifying their strategic significance. The crisis has presented firms with a chance to develop preparedness strategies to reduce future uncertainties and enhance the visibility of modern supply chain for survivability in the post COVID-19 crisis [1]. Based on the benefits of digitalization, scholars are currently exploring the potential of digitalization to enhance firms' ability to rapidly recover from disruption to their prior performance level [5,11]. While prior studies have promoted our understanding of the benefits of SCD [5,11], there remains a dearth of knowledge regarding its performance-related outcomes in the post COVID-19 era. It has been suggested that using advanced technologies such as IoT can improve SCV [12], structural flexibility adjustment, capabilities while also enhancing quality of product and promoting supply chain operations [13]. For instance, to date, it is unclear how SCD fosters supply chain visibility (SCV). While emerging studies have reported that SCD has performance implications [5,11], studies regarding the mechanism via which SCD fosters supply chain performance are still scarce, particularly in post COVID-19 era. In-part, this study responds to research calls by Refs. [5,14] to examine the mechanism through which SCD translates into performance enhancement in crisis scenarios. Therefore, our study fills this gap in the operations management literature.

In a digitalized supply chain, structure and operations are dynamic and self-adaptable [15]. The dynamic system can adapt to both internal and external uncertainties, withstand disruptions, and improve supply chain survivability. Moreover, the digitalized process of supply chain enhancement requires empirical validation to yield measurable outcomes that can serve as reliable reference for firms' supply chain resilience management practices [5,13]. From this standpoint, little is known under which specific conditions SCD drives supply chain performance. Therefore, combining resource-based view (RBV) [16] and dynamic capability theory (DCT) [17], we constructed a moderated mediation model (shown in Fig. 1) to examine the impact of SCD on SCP in the context of Turkish manufacturing firms. Specifically, we investigate the mediating role of SCV in the relationship between SCD and SCP. Further, we investigate whether the direct and indirect effects are contingent on supply chain survivability (i.e., resilience and agility).

Our study offers several contributions by addressing these empirical gaps. First, we aim to expand our understanding of the link between SCD and supply chain visibility. This is a significant contribution given that prior studies have not explicitly explored this connection, particularly in post COVID crisis. Understanding this relationship is of utmost importance since supply chain visibility is a crucial resource that leverages information within the supply chain and distributes it throughout the supply chain [18].

Second, although prior studies have reported that SCD predicts supply chain performance [5,11], the mechanisms through which this relationship occurs after a major disruption is far from being clearly understood. The current research adds to the existing body of knowledge by demonstrating that SCV is a mediating mechanism of the link between SCD and supply chain performance.

Third, we aim to expand the current literature on supply chain resilience [19–21] by exploring the circumstances under which the proposed predictor of supply chain performance may be more or less effective. From this standpoint, this study examines the moderating role of supply chain survivability (i.e., resilience and agility) on both the direct and indirect relationship between SCD and supply chain performance. This is crucial due to the ambiguity surrounding the buffering factors that could potentially influence the aforementioned relationships. Since scholars have suggested that firm survival is frequently dependent on establishing resilience and high levels of agility [22,23], it is logical to anticipate this situational construct may shed light on condition under supply chain visibility impacts supply chain performance. Additionally, the inclusion of supply chain survivability [via resilience and agility] is important given that it is not just the capacity to withstand disruption but also the capability of the supply chain to recover swiftly and restore to its prior performance level or even higher performance after disruptions [24]. Thus, we argue that for manufacturing firm with high survivability, the potency influence of SCV in driving SCP would be further strengthened. A major contribution to the theories within this research.

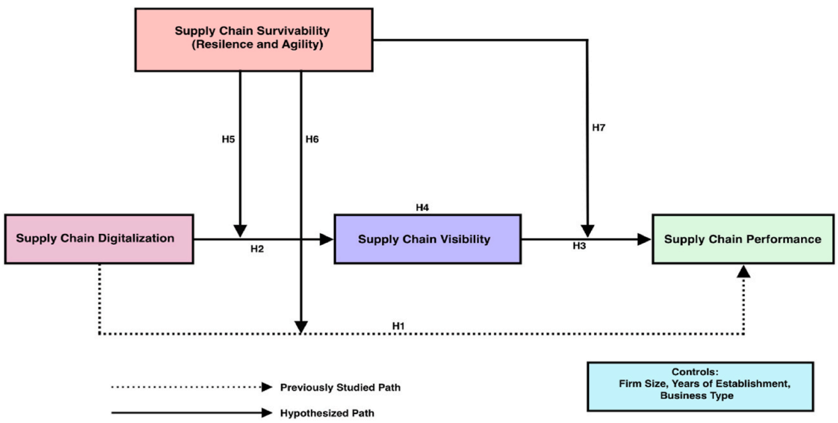

Fig. 1. Conceptual model.

2. Theoretical background and hypotheses

2.1. Underpinning theory

This study uses Resource Base View (RBV) [16] and the capability-building perspective [25] as a theoretical foundation to comprehend how SCD relates to SCP and lead to supply chain performance. The aforementioned theories can also serve as a theoretical foundation on how manufacturing firms can use their organizational capabilities to support SCD to improve SCP. Moreover, Jafari-Sadeghi et al. [26] pointed out that RBV endorses the utilization of organizational resources as a dynamic capability for achieving firm success and competitive advantage. Further, RBV offers an argument that it can attain sustainable superiority by possessing resources that are unbeatable, uncommon, useful and hard to replicate [16]. The study further stated that the resources encompass intangible and tangible intellectual, human, knowledge and financial resources. The RBV is formulated from a static paradigm and examines the competitive edge provided by an organization's distinctive internal resources. Certain academics argued that when operating in a dynamic environment, the competition dynamic could change and the sturdiness of resources cannot ensure a sustained competitive edge [e.g., 28]. From this standpoint, Teece et al. [17] established the concept of dynamic capabilities founded on RBV to offer an explanation on intense condition in a dynamic market. Thus, using these two well-established theories as a theoretical foundation are considered appropriate for the current study.

Dynamic capabilities relate to the capacity of an enterprise to blend, organize and restructure external and internal resources together with capabilities to rapidly and effectively respond to shifts in the external environment [17,27]. According to dynamic capability theory, to obtain competitive edge from limited resources, effective management of these resources is necessary [28]. Firms operating in dynamic environments must exhibit flexibility in how they adjust their dynamic capability to deal with changes.

2.2. Supply chain digitalization (SCD)

Supply chain digitalization is the adoption of digital technologies, including artificial intelligence, blockchain, big data, cloud computing and internet of things (IoTs) into various activities of the supply chain to establish an operational process characterized by decision making backed by data [28–31]. The integration of advanced technologies in conventional supply chain operations results in a substantial volume of data and information being generated. Such information can be used to improve the supply chain value. For instance, digital technologies including intelligent labels, smart contracts and digital storage allow the establishment of traceability across all stages of a product's life cycle, spanning from the acquisition of raw materials to the delivery of final product [32]. In contrast to closely related concepts, digital technology adoption and digital transformation, supply chain digitalization stresses how digital technologies implementation transforms supply chain business processes and decision making [33].

The COVID-19 crisis resulted in logistic disruption, which led to a heightened demand for remote work, electronic operations and supply chain process reconfiguration. This has intensified the speed of supply chain reconfiguration, allowing firms to manage the risk of disruption effectively [34]. From this standpoint, Dolgui and Ivanov [35] emphasized that analytical algorithms and digital services for supply chain have recently become the primary drivers of competitiveness. For instance, in the manufacturing sector, blockchain has been increasingly implemented in the food supply chain to support core firms and other associated parties in overseeing and tracking of food production operation [36]. Additionally, the integration of advanced technologies in SCD has led to increased interest and research from both industry practitioners and academia by monitoring the changes in supply chain activities and business triggered by SCD [28–31].

2.3. Supply chain visibility (SCV)

In this study, SCV relates to obtaining and assessing information related to the supply chain, which helps mitigate disruptive events and enhance the quality of decision making [37]. Somapa et al. [38] described SCV as the extent to which supply chain members have timely access to information that is useful and necessary for enhancing supply chain activities. SCV aims to obtain relevant information promptly and effectively, while also monitor the movement of inventory, raw materials and goods in the supply chain [39]. This has made SCV concept very prominent and useful in SCM studies [40]. SCV facilitates prompt responses in business settings, including variations in demand and supply, inventory and the market conditions as a whole [41–43], leading to data produced via SCV being of great significance in augmenting supply chain control [44].

Furthermore, the implementation of SCV can effectively lessen supply chain risks, minimize lead times, and boost supply chain quality, resulting in organizations attaining their desired objectives [45]. SCV can provide access to reliable and valuable information regarding the movement of products within the supply chain. Such information encompasses demand and supply, and market visibility which can lead to a reduction in operational costs by minimizing inventory expenses [42]. Modgil et al. [46] emphasized that SCV is crucial in the supply chain decision making process.

2.4. Supply chain survivability (SCS)

According to Oxford [47], the term survivability relates to "unbroken operations and disruptions." Survivability in a supply chain results in resilience and stability [48]. The term SCS in our research relates to resilience and agility. The concept of resilience is commonly employed in several disciplines, including but not limited to psychology, management, systems and supply chain management. Singh et al. [49] highlight that resilience pertains to the capacity to proactively plan and manage a supply chain in light of unforeseeable circumstances and uncertainties and to subsequently recover from such occurrences to attain a state of robustness. In the current research, supply chain resilience relates to the ability of a supply chain to effectively address and manage disruptions, reestablish stability and promptly recover from uncertainties and disturbances [24].

In the 1900s, agility was perceived as a viable approach to handle unpredictable business environments [50]. As per Swafford et al. [51], agility entails using strategies and advances to combine factors such as information and technology and supply chain management to react promptly to unforeseen disruptions. It is imperative for firms to synchronize their internal resource to attain supply chain agility, which would enable them to promptly respond to unforeseeable changes in the supply chain environment [24]. In this study, SCS relates to resilience and agility; hence it is measured as a unified construct [24,48].

2.5. SCD and supply chain performance

Digitalization can facilitate the integration of data within the supply chain system between the core firm and other stakeholders by leveraging robust data analysis and precise market analysis [5]. This can lead to the acceleration of efficiency in product innovation, promote the creation of novel services and products, and facilitate the expansion of market shares for firms, leading to dominant market position and superior performance [52]. Specifically, the implementation of digital technologies such as blockchain in manufacturing and products distribution can enhance the degree of product information transparency, thereby elevating sensitive customers' confidence, promoting their inclination to make purchases, augmenting customer surplus, and improving SCP [53],

According to Saryatmo and Sukhotu [54], the application of SCD can enhance productivity and product quality, while simultaneously decreasing cost and enhancing the entire SCP. Further, SCD integrates digital procurement, production, sales and logistics to enhance products' lifecycle and promote sustainable performance enhancement [55]. Additionally, SCD can facilitate the management of lifecycle of individual products, starting from the design phase to the production, through the effective involvement of all stakeholders [56]. In line with the discussion above, it is hypothesized that.

H1. SCD has a positive effect on Supply chain performance

2.6. SCD and supply chain visibility

Dubey et al. [57]] argued that the utilizing sophisticated of analytical methods through big data analytics can enhance SCV, by building statistical and predictive models that improve SCV management's awareness in the supply chain. Similarly, the use of big data analytics has been suggested to establish uniformity in data analysis techniques and enable collaborative activities, thereby mitigating information asymmetry in the supply chain to promote supply chain visibility [58]].

Ben-Daya et al. [59] argued that digital technologies such as IoT can improve decision making processes on market dynamics, demand and supply through the development of predictive models that leverage the data generated IoT within the supply chain [59], thereby improving supply chain visibility. Similarly, SCD can support logistics quality by enabling real-time and precise delivery, and facilitating the identification of distribution markets and locations, leading to enhanced external supply chain visibility [60,61]. Further, it has been argued that SCD via modern technologies such as IoT can address SCV issues concerning conflicts of interest because integrating IoT in the supply chain can enhance visibility by establishing proficient and intelligent supply chain [62]. Also, SCD through the use of BDA can be applied to provide solution to SCV related problems such as conflicts of interest due to behavioral uncertainty within the supply chain that may undermine SCV [60,63]. The majority of the above discussion are theoretical arguments that warrant empirical validation. Hence, it is hypothesized that.

H2. SCD has a positive effect on supply chain visibility

2.7. SCV and supply chain performance

According to Raut et al. [64], supply chain visibility can aid in identifying lapses within the supply chain, curtailing the cost of distribution while improving supply chain responsiveness to unexpected disruptions and changes. SCV facilitates greater collaboration and integration within the supply chain [65], and such collaboration and integration may improve SCP. SCV can offer relevant information regarding customers and suppliers as well as monitor where they are located to devise the most suitable means of transportation [66]; this may result in a favorable impact on supply chain performance. Similarly, with a high SCV, advanced tracking system with high accuracy can be leveraged, enabling supply chain to optimize external and internal operations [67].

High quality information can be leveraged SCV to achieve integration and promote partnership between supply chain partners [68]. Such can promote supply chain's responsiveness to disruptions while enhancing the overall supply chain performance. Based on RBV, supply chain visibility can support managers in making effective decisions and assist in the selection of optimal alternatives by monitoring the flow of information and products, leading to operational performance and sustained competitive superiority [45,67]. In advancing the existing body of knowledge and based on DCT, we argue that the crucial role of SVC in improving supply chain performance by exploring firms' supply chain visibility capabilities, which promotes high visibility in the supply chain. Hence, we hypothesized that.

H3. SCV has a positive effect on supply chain performance.

2.8. SCV mediation

Drawing on RBV and DCT, the present research explores the mediating role of SCV in the link between SCD and SCP. By looking at the discussion on how organization capabilities promote performance [57,68], SCD can be utilized as a promising firm's capability to promote supply chain visibility. SCD through emerging technologies offers firms tools for analyzing reliable and consistent information that can allow for real-time identification of inventory level, market fluctuations, demand and supply, improving the performance of the entire supply chain. Moreover, the earlier study of Barratt and Oke [68] based on RBV, suggested that the attainment of improved performance fostered by firm's resources and capabilities can be achieved through enhanced visibility. From this perspective, it can be inferred that SCV leverages information within the supply chain and transmits it in real time to boost supply chain performance.

SCD driven by modern technologies (such as BDA) can be applied to boost the responsiveness of supply chain visibility [1]. In line with dynamic capability view, SCV may offer the capability to enhance the efficiency and efficacy of supply chain operations by relying on SCD; hence, supply chain visibility can act as a mediator in strengthening supply chain performance. For example, the integration of blockchain technologies in SCV is a prevalent practice that can potentially improve the reliance and data protection, boosting operational performance [60,69]. Similarly, prior research has shown that modern technology such as IoT plays a crucial role in enhancing SCV by enabling better monitoring and control, as well as improved demand and supply alignment [70].

Hence, it is reasonable to argue that based on RBV and DCT, firm resources needed by SCD can boost supply chain visibility and SCV reliant on supply chain digitalization can improve supply chain performance. Additionally, the existing literature has not explicitly explored SCV as a mediating mechanism between SCD and SCP. In advancing the current body of knowledge, it is posited that.

H4. The link between SCD and SCP is mediated by supply chain visibility

2.9. Supply chain survivability as a moderator

The application of digital technologies into an enterprise's pre-existing supply chain activities promotes data visibility, fosters digital business operations, including product design digitalization and production, enhances operation efficiency, and diminishes cost of production, which in turn potentially benefits SCP [29,69]. However, the COVID-19 lockdown caused a major disruption within the supply chain. According to Lin and Lanng [71], Tradeshift, an institution that focuses on supply chain analytics, reported a 56% (in February 2020) reduction in transactions in China and 26% drop was observed in Europe, U.S. and the United Kingdom. Based on this, survivability has become a special dynamic capability due to its increasing importance [24,72]. The idea of survivability is commonly linked to generating agility, resilience and limiting disruption to information, inventory, and supply chain services [15,24]. Further, recent research in the COVID-19 context [21,49] argued that an enterprise's survivability must be assessed based on its current market and supply chain conditions. Despite this, the role of supply chain survivability as an organization condition remains unresearched. Hence, based on RBV and DCT, our research proposes supply chain survivability as a driving force that can make the relationships in our integrated research model more or less effective, which will be explained further.

Agility is essential to operate in complex and dynamic environments [25]. Agility is reflected in firm's capability to deploy internal resources and expertise to promptly and effectively respond to alterations in the business environment [73]. According to Barata's [74] viewpoint, the integration of digital technologies enables smart supply chain can result in various benefits such as reduction in cost, improved visibility, improved risk management and exacerbated consumer proximity. However, every sector, including the manufacturing sector is faced with unpredictable changes and dynamic environments, thus relying solely on supply chain competencies may not necessarily result in operational performance [75,76]. We argue that supply chain survivability (i.e., agility) is the capability that allows firms to use digital technologies to adapt to changes in the business environment, which can ultimately result in improved supply chain visibility and performance. Hence, it is reasonable to infer that SCD can promote data visibility within the supply chain, which can be leveraged by manufacturing firms to minimize the effect of disruptions as well as improve supply chain efficiency (i.e., supply chain performance).

In the survivability of an organization's supply chain networks, resilience is a comprehensive capability that may be used to mitigate threats to performance [5,24,77]. While the concept of resilience can be extensive, a lack of resilience can be catastrophic and lead to a complete collapse of the supply chain [78]. A supply chain is deemed resilient if it can withstand and restore basic performance after disruptions [79]. Although a digital supply chain has been suggested to improve SCV through the adaptation of a flexible structure while enhancing the quality of products [13]. However, a high resilience accelerates the procedures involved in creating of superior services and products, promoting swift launch of new products while helping firms obtain increased market shares [80], which is likely to further enhance the SCD-SCV link.

Lastly, a high resilience can enhance the recovery capability within the supply chain by minimizing losses while promoting operational efficiency [81]. From this standpoint, organizations can reconfigure their capabilities and resources to obtain new opportunities for value growth [82]. Based on this, SCD for performance enhancement can be further strengthened. Hence, we hypothesize the following.

H5. SCD has a stronger, positive relationship SCV when supply chain survivability is high than when it's low

H6. At low level of supply chain survivability, the positive effect of SCD on SCP is weakened.

H7. The indirect positive effect of SCD on SCP via supply chain visibility is strongest when supply chain survivability is high

3. Method

3.1. Research context

The constructed moderated mediation model in this study was examined using sample from manufacturing firms operating in Turkey. Our research focuses on manufacturing firms in Turkey because it is an emerging market with a fast-growing economy and considerable prospect for further growth [83]. Turkey has emerged as a regional center for manufacturing, logistics and management, attracting multinational corporations to establish their operation in the country [84]. This can be attributed to its strategic geographical position that connects three continents.

The export volume of Turkey exhibited a notable increase from US $36 billion in 2002 to US $255 billion in 2021, resulting in the proportion of its exports in the global market has exceeded 1% for the first time in its history [84]. The majority of this export volume originates from the manufacturing sector. However, due to COVID-19, the manufacturing sector has encountered numerous challenges, including supply chain disruptions. Cushman & Wakefield Plc's Global Manufacturing Index, which evaluates a nation's capacity to revive its manufacturing industry, gave Turkey a high “Bounce Back” rating, placing it among the top nations in the ranking based on its economic conditions and infrastructure that can aid its rapid recovery [84]. Thus, making the nation an intriguing research context for our study. Additionally, it is crucial to comprehend how and under what conditions does SCD translate into performance in manufacturing firms in Turkey.

3.2. Sample and data collection

This research focuses on manufacturing firms operating in Istanbul, Izmir, Konya and Kocaali industrial cities of Turkey that have attained a specific level of digitalization and are significantly impacted by supply chain disruptions. In contrast to other cities, these selected cities have higher economic development and a greater concentration of manufacturing firms. The firms operating in the selected cities are actively engaged in supply chain management and are more likely to embrace digital management practices as a means of securing competitive edge. Thus, purposive sampling method was adopted for data collection. The targeted participants of the survey were upper and middle level managers, including supply chain managers, material managers, VP of operations and VP of supply chain. These individuals were targeted to ensure that the data obtained provides an accurate reflection of the operational conditions of the surveyed firms. Thus, the participants of this study are more suited and are in better position to handle complicated supply chain issues of their firms and had a greater comprehension of operations regarding supply chain management and implementation of digital technologies [85]. This study surveyed Turkish manufacturing firms whereby the aforementioned respondents may face difficulty in comprehending English questionnaire in its original form, we employed a translation and back-translation approach during the survey. Precisely, the questionnaire was submitted to a proficient translator to translate it to Turkish. Subsequently, we assigned a different translator to translate the Turkish questionnaire back to English, without prior exposure to the original English version. Consequently, the translators were consulted to review and improve the Turkish questionnaire by comparing the original, the translated and the back-translated versions, while also cross-check if there are any inconsistencies.

The questionnaire survey was distributed via email [containing a google form link] and on-site (physically). A follow-up email and phone call reminders were initiated to enhance the response rate. Data were collected between December 2022 and February 2023. A total number of 1080 questionnaires were sent out, out of which 417 were retrieved. After removing questionnaires that contained invalid/missing responses, 399 valid responses were obtained (243 via electronic means and 156 through on-site survey), yielding a response rate of 36.94%.

Table 1
Demographic information.

Items [N = 399]	Category	Frequency	Percentage [%]
Gender			
	Male	331	82.96
	Female	68	17.04
Firm Size [number of employees]			
	Less than 50	102	25.56
	51 and 100	211	52.88
	Above 100	86	21.56
Years of Establishment			
	Between 1 and 10	56	14.04
	11 and 19	244	61.15
	Above 20	99	24.81
Business Type			
	Textiles	115	28.82
	Building Materials	109	27.32
	Rubber and Plastics	38	9.52
	Food, beverage and alcohol	56	14.04
	Wood and furniture	35	8.77
	Pharmaceutical	37	9.27
	Chemical and Petrochemical	9	2.26

Table 1 illustrates the demographic information of the respondents. Based on gender, males account for 331 (82.96%), while females account for 68 (17.04%). In terms of firm size; firms with less than 50 employees account for 102 (25.56%), between 51 and 100 account for 211 (52.88%) and over 100 employees account for 86 (21.56%). Based on years of establishment; between 1 and 10 accounts for 56 (14.04%), 11 and 19 accounts for 244 (61.15%) and above 20 account for 99 (24.81%). In terms of business type; Textile 115 (28.82%), building materials 109 (27.32%), food, beverages and alcohol 56 (14.04%), rubber and plastics 38 (9.52%), pharmaceutical 37 (9.27%), wood and furniture 35 (8.77%0 and chemical and petrol chemical 9 (2.26%).

3.3. Measures

Supply chain disruption was measured using a three-item adopted from Zhao et al. [5]. The survey participants were requested to indicate the extent to which their respective firms and supply chains have integrated digital operation processes, digital services and products, and digital business models. A sample item was “we have adopted digital operation management”.

Supply chain visibility was measured with 8 items adopted from Williams et al. [86]. A sample item was “the information we have regarding finished goods locations status in the distribution network [e.g., distribution centers, transportation] is in a useful format”.

Supply chain survivability was evaluated with six-item adopted from the [75–77]. This construct elucidates the ability of a firm’s supply chain to effectively manage, respond promptly to, and recover from business disruptions. A sample item was “it would not take long to recover normal operating performance”.

Supply chain performance was measured using a four-item adopted from Beamon [87]. This construct measures the overall efficiency of the supply chain. A sample item was “we were able to save more on operating cost”. It is worth noting that all constructs in this study were measured using a 5-point Likert scale, with 1 indicating “Strongly Disagree” and 5 representing “Strongly Agree.”

3.4. Statistical approach

This study conducted a three-step analysis utilizing SPSS 27.0 and AMOS 24.0 to estimate the reliability and validity of the variables under examination and to examine the proposed hypotheses. In the first step, Cronbach’s alpha and confirmatory factor analysis (CFA) were used to assess the measurement items’ reliability and validity. In the second step, the PROCESS plugin [88] approach was adopted to test mediation and moderated mediation models, respectively. This technique is frequently used in social sciences to explore the connections among constructs, such as mediation, moderation and conditional coefficients [[9,89–91]]. Additionally, this technique offers distinct regression parameters estimates, which is especially relevant when using structural equation modeling to estimate moderated mediation coefficients has limitations [92]. In the second-step, to examine the mediating role of supply chain visibility in the relationship between SCD and SCP, model 4 of PROCESS macro was employed.

In the third-step, model 59 of the PROCESS macro was utilized to test the moderated mediation model [93]. Consequently, to examine whether the direct and indirect effects were moderated by (supply chain survivability) after standardizing the constructs, the interaction terms was integrated in the PROCESS macro. Further, the index of moderated mediation was used to examine whether the indirect effect of SCD on SCP via SCV was contingent on different level of supply chain survivability. The significance of the mediating effect and moderation (interactions) was based on the examination of the 95% confidence interval (CI). According to Zhao [5], the statistical significance of mediating and moderating effects can be inferred if the CI does not include zero.

3.5. Common method bias (CMB) and non-response bias

The present research employed both procedural and statistical techniques to mitigate the potential influence of CMB. In relationship to procedural control, the questionnaire was designed to be easy to comprehend with each construct arranged in a separate section with its measurement items. Middle and senior management (in which over 71% of them have at least 5 years of work experience) of the targeted firms were the respondents of the survey to ensure the data obtained precisely capture the actual operational conditions of the surveyed firms. Participants were assured that their identity would be protected and that there were inherently no “incorrect” or “correct” answers to the survey questions [94]. These measures allowed respondents to give thoughtful and accurate responses to the survey questions. As a result, we acquired information from reliable sources.

For further verification of CMB effect on the obtained data, this research used Harman’s one factor test in accordance to Podsakoff et al. [94]. The results of the test revealed that the first factor accounted for 30.693% of the overall variance, which falls below the 50% threshold. This suggests CMB is not a serious issue in this study. Subsequently, CFA was employed where a common latent factor was created and a regression line was added to all the measurement items. As indicated by the results, the single-factor’s model fit indices were found to be unsatisfactory and substantially showed poor fit (CMIN/DF = 5.771, NFI = 0.852, TLI = 0.855, IFI = 0.874, RFI = 0.830, RMSEA = 0.109) in comparison with the adopted model (CMIN/DF = 1.994, NFI = 0.951, TLI = 0.970, IFI = 0.970, RFI = 0.941, RMSEA = 0.050). This implied that the measurement items cannot be attributed to a single factor. Thus, as determined statistical tests of Harman’s single factor, common latent factor and CFA, CMB is not a concern in the present research.

Furthermore, we examined the possible effect of non-response by comparing non-respondents and respondents based on business type, years of establishment and firm size. The *t*-test results indicated that no significant difference between non-respondents and respondents. Further, the results also indicated that there was no significant variation between early responses [312] and late responses [85] among the manufacturing firms surveyed. Thus, demonstrating that non-response bias is not an issue in this research [95].

3.6. Measurement model results

The analysis of measurement model relates to the extent to which the indicators accurately represent the underlying latent variable in a given study [i.e., how reliable and valid]. This study adopts a CFA analysis to establish how reliable and valid the constructs under measure are, as suggested by Ref. [96]. The assessment of the measurement model was estimated through reliability, validity and model fit indices. As demonstrated in Table 2, Cronbach's alpha for each construct ranges (between 0.876 and 0.936), and composite reliability values (0.868 and 0.937), all of which exceed the suggested minimum threshold of 0.7 [97].

In this study, the evaluation of constructs' validities encompassing both convergent and discriminant validity was estimated. The assessment of convergent validity was estimated via two parameters; factor loadings and AVE. From this standpoint, it was recommended that factor loadings should be higher than 0.6 and AVEs should be above 0.5 [98]. As presented in Table 2 and displayed in Fig. 2, all constructs have sufficient factor loadings and AVE values exceed the recommended values. This confirms that the study does not suffer from any issues related to convergent validity. Further, this study adopts the criteria of [96] for discriminant validity. As per the specified criteria, it is expected that the square root of AVEs should exhibit higher values than the surrounding correlations. As illustrated in Table 3, the values in parentheses represent the square root of AVEs and were higher than the nearby correlations. Thus, showing evidence of discriminant validity.

This study evaluated model fit indices. The results were found satisfactory based on various model fit statistics AGFI (Adjusted Goodness of Fit), GFI (Goodness of Fit), and incremental fit metrics (IFI, TLI, CFI, NFI and RFI), all of which exceeded the lowest acceptable threshold of 0.9. Additionally, parsimony fit indices (namely, PCFI, PGFI, PNFI0 were well above the lowest acceptable threshold of 0.5 [99]. The RMSEA value obtained (0.05) was well below the recommended of 0.8 [100]. Lastly, the chi-square ration was found to be within the acceptable threshold when compared to the degree of freedom.

3.7. Testing for direct effects and mediation model

To test H1, H2, H3 and H4, this study employs model 4 of PROCESS Macro [93]. As illustrated in Table 4, the results revealed that SCD has a significant positive effect on SCP (β = 0.299, t = 6.772, p < 0.000), supporting H1. It was found that SCD has a significant positive effect on SCV (β = 0.582, t = 15.502, p < 0.000), validating H2. SCV has a positive effect on SCP (β = 0.312, t = 6.705, p < 0.000), offering validation for H3.

Furthermore, the bootstrap procedure was applied to examine the indirect effect of SCD on SCP via SCV as hypothesized in H4. The bootstrap procedure has become a widely accepted method for conducting mediation analysis due to its precision [88]. Besides, bootstrapping is a distinctive procedure that employs a dataset resamples to derive inferences and gain insights into the population. This study employed 5000 resamples to ensure precise outcomes for the mediation analysis. The results obtained from the bias-corrected percentile bootstrap technique confirm the mediating role of supply chain visibility (β = 0.182, SE = 0.038, 95% CI

Table 2
Measurement model assessment.

Variable	Indicators	FL	S.E.	T value	Reliability and Validity
Supply Chain Digitalization					α = 0.936; CR = 0.937; AVE = 0.832
	SCD1	0.918	0.031	30.024	
	SCD2	0.908	0.036	29.378	
	SCD3	0.909	0.035	29.458	
Supply Chain Visibility					α = 0.928; CR = 0.925; AVE = 0.607
	SCV1	0.764	0.069	14.310	
	SCV2	0.793	0.048	21.641	
	SCV3	0.804	0.064	16.300	
	SCV4	0.772	0.065	15.594	
	SCV5	0.756	0.062	15.365	
	SCV6	0.766	0.070	14.337	
	SCV7	0.800	0.063	16.255	
	SCV8	0.777	0.061	15.734	
Supply Chain Survivability					α = 0.876; CR = 0.868; AVE = 0.523
	SCS1	0.699	0.080	10.211	
	SCS2	0.703	0.075	10.505	
	SCS3	0.751	0.081	11.866	
	SCS4	0.788	0.082	11.373	
	SCS5	0.710	0.066	12.536	
	SC6	0.683	0.079	10.033	
Supply Chain Performance					α = 0.916; CR = 0.917; AVE = 0.734
	SCP1	0.868	0.045	21.843	
	SCP2	0.851	0.048	21.161	
	SCP3	0.864	0.045	21.701	
	SCP4	0.844	0.043	21.033	

Note: SCD = supply chain digitalization, SCV = supply chain visibility, SCS = supply chain survivability, SCP = supply chain performance, FL = factor loading, S.E = standard error, α = Cronbach's alpha, CR = composite reliability, AVE = Average variance extracted.

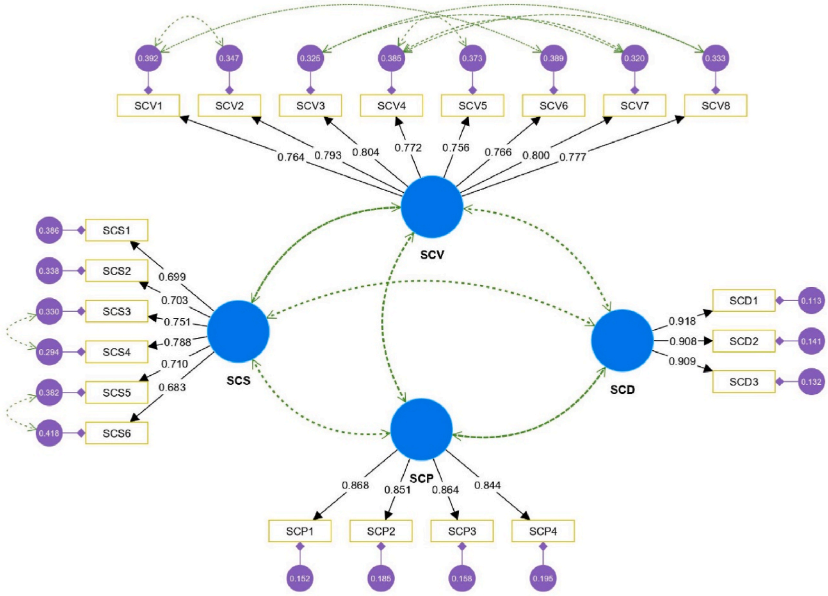

Fig. 2. CFA results.

Table 3
Discriminant validity.

Construct	M	SD	SCD	SCV	SCS	SCP	Firm Size	YOE	BT
SCD	4.217	0.823	**[0.912]**						
SCV	3.957	0.781	0.614**	**[0.779]**					
SCS	3.987	0.682	0.711**	0.579**	**[0.723]**				
SCP	4.008	0.721	0.549**	0.548**	0.722**	**[0.857]**			
Firm Size	1.226	0.427	0.113**	0.008**	0.109**	0.121**	–		
YOE	1.301	0.453	0.263**	0.024**	0.271**	0.209**	0.199**	–	
BT	3.669	0.699	0.149**	0.033**	0.249**	0.188**	0.204**	0.275**	–

Note: M = mean, SD = standard deviation, YOE = years of establishment, BT = business type. Values in brackets are square root of AVEs.

Table 4
Assessment of model fit index.

Model fit indices	Thresholds	Results Obtained
Absolute fit		
CMIN/DF	<3	1.994
AGFI	>0.9	0.901
GFI	>0.9	0.923
RMSEA	<0.08	0.050
Incremental fit		
IFI	>0.9	0.976
TLI	>0.9	0.971
CFI	>0.9	0.976
NFI	>0.9	0.951
RFI	>0.9	0.941
Parsimony fit		
PCFI	>0.5	0.808
PGFI	>0.5	0.829
PNFI	>0.5	0.788

(0.112, 0.264). Thus, SCV partially mediated the link between SCD and SCP and validated H4 as displayed in Table 4.

3.8. *Testing for moderated mediation*

The moderated mediation fit indices were obtained through CFA. The moderated mediation model that was developed consisted of four constructs (SCD, SCV, SCS and SCP). The CFA results revealed that the adopted model demonstrated an acceptable level of fit with the data collected, as evidenced by the following indices: CMIN/DF = 1.994, AGFI = 0.901, GFI = 0.923, TLI = 0.971, NFI = 0.951, IFI = 0.976 and CFI = 0.976,

This study's adopted model [i.e., the moderated mediation] is congruent with model 59 in Hayes' PROCESS macro which holds that the moderator affects the entire paths in the model. Using the model 59, the moderating role of SCS was examined on the link between a) SCD and supply chain visibility (H5), b) SCD on supply chain performance, c) SCD on SCP via supply chain visibility (indirect effect). As suggested by Hayes [101] a moderated mediation will be confirmed if; one or both of these paths are validated, a) the link between SCD and supply chain visibility is moderated by supply chain survivability, b) the link between SCD and SCP is moderated by supply chain visibility. Results shown in Table 5 suggest that both supply chain digitalization and supply chain visibility have significant positive effects on supply chain performance, with supply chain digitalization acting as a mediator in this relationship.

Table 6 presents the results of the moderated mediation analyses using PROCESS. In the mediator variable model (Model 1) of Table 6 to predict supply chain visibility. The results indicated that SCD has a positive effect on SCV, after controlling for firm size, years of establishment and business type ($\beta = 0.299$, $t = 5.358$, $p < 0.000$) and the main effect was moderated by supply chain survivability ($\beta = 0.175$, $t = 3.817$, $p < 0.000$), validating H5. This significant interaction was probed using simple slope test. At varying levels of SCS (-1SD below the mean and +1SD above the mean), Fig. 3 depicts the link between SCD and supply chain visibility. The conditional direct effect regarding the strength of the relationship showed that the link was stronger for firms with high supply chain survivability ($\beta = 0.419$, $t = 8.140$, $p < 0.000$) than those with low supply chain survivability ($\beta = 0.179$, $t = 2.411$, $p < 0.05$), offering further support for H5. Similar to the analysis above, in the dependent variable model (Model 2) of Table 6 to predict supply chain performance. The results showed that SCD has a direct effect on supply chain performance, after controlling for firm size, years of establishment and business type ($\beta = 0.105$, $t = 2.287$, $p < 0.000$) and the main effect was also moderated by supply chain survivability ($\beta = 0.167$, $t = 3.849$, $p < 0.001$), supporting H6. The significant interaction effect was further tested via simple slope analysis. At different levels of supply chain survivability (-1SD below the mean and +1SD above the mean), Fig. 4 depicts the link between SCD and supply chain performance. The conditional direct effect regarding the strength of the relationship showed that the link was stronger for firms with high supply chain survivability ($\beta = 0.219$, $t = 3.594$, $p < 0.000$) than those with low supply chain survivability ($\beta = 0.083$, $t = 0.173$, p = not significant], giving additional support for H6. Further, still in Model 2 of Table 6, the results offer no empirical support for the interaction ($\beta = 0.041$, $t = 1.020$, $p > 0.05$), revealing that supply chain visibility did not moderate the link between SCV and SCP.

Lastly, Fig. 5 depicts the interaction for H7 plotted at -1SD below the mean and +SD above the mean of supply chain survivability. This study discovered that the indirect effect of SCV on the relation between SCD and SCP was stronger for firms exhibiting higher level of supply chain survivability ($\beta = 0.302$, $t = 6.925$, $p < 0.05$) than those with low supply chain survivability ($\beta = 0.165$, $t = 3.774$, $p < 0.05$). Thus, providing additional evidence in support of H7.

4. Discussion

Drawing from RBV and dynamic capability view, this study explores the effect of SCD on SCP within the Turkish manufacturing sector. Additionally, this study sought to comprehend how SCD influences SCP through supply chain visibility. Consequently, we set out to explain the effect of SCD on SCP through the mediating mechanism of supply chain visibility. Further, we tested the moderating role of supply chain survivability on the relationships in our integrated theoretical model.

The findings indicated that SCD has a positive effect on SCP. This result aligns with the outcomes of prior studies [7, 104]. The alignment of this pattern of result could imply that the integration of digital technologies into services and products can support the collection of data and information from customers and suppliers, and the valuable insights obtained from the process can help firms in product development improvement based on customer preferences, while enhancing supply chain performance [72]. The implementation of digital technologies also help save costs, accelerate production, and enhance risk mitigation procedures while enhancing the overall SCP.

The findings showed a strong positive effect of SCD on supply chain digitalization. This result aligns with the arguments of prior studies [57,59,60]. This result could imply that a digitalized supply chain helps in inventory control and monitoring through effective supply chain management by promoting the visibility level within the supply chain. Digitalized supply chain empowered by modern

Table 5
Mediation analysis results.

Predictor	Outcome M: Supply chain visibility					Outcome Y: Supply chain performance				
	Coef.	SE	t	ULCI	LLCI	Coef.	SE	t	LLCI	ULCI
Constant	1.501	0.161	9.295***	1.183	1.818	1.513	0.165	9.158***	1.188	1.838
Supply chain digitalization	0.582	0.038	15.502***	0.509	0.656	0.299	0.044	6.772***	0.212	0.386
Supply chain visibility						0.312	0.047	6.705***	0.221	0.404
R^2	0.378					0.373				
F	240.315					117.654				
Indirect effect			**Boot SE**			**Boot LLCI**			**Boot ULCI**	
0.182			0.038			0.112			0.264	

Note: n = 399, M = model, SE = standard error, *** = p < 0.001, ULCI = upper level of confidence interval, ULCI = lower level of confidence interval.

Table 6
Moderated mediation analysis results.

Bootstrap CI (95%)						
	B (SE)	t	p-values	Confidence intervals LLUL		R^2
M1: mediator model	Outcome: Supply Chain Visibility					
Supply Chain Digitalization	0.299 (0.056)	5.358	0.000	0.190	0.409	0.439
Supply Chain Survivability	0.218 (0.068)	3.198	0.002	0.084	0.352	
Interaction:	0.175 (0.460)	3.817	0.000	0.085	0.266	
Supply Chain Digitalization X Supply Chain Survivability						
Controls: Firm Size	0.044 (0.012)	0.522	0.499	−0.062	0.051	
Years of Establishment	0.039 (0.015)	0.481	0.511	−0.039	0.068	
Business Type	0.063 (0.019)	0.611	0.227	−0.018	0.022	
Conditional direct effect of SCD on SCV						
Supply Chain Survivability (-1SD)	0.179 (0.075)	2.411	0.016	0.033	0.326	
Supply Chain Survivability (+1SD)	0.419 (0.052)	8.140	0.000	0.318	0.520	
M2: dependent model Outcome: **SCP**						
Supply Chain Digitalization	0.105 (0.046)	2.287	0.000	0.015	0.196	0.587
Supply Chain Visibility	0.126 (0.040)	3.114	0.002	0.046	0.205	
Supply Chain Survivability	0.501 (0.056)	8.972	0.000	0.391	0.611	
Interaction:	0.167 (0.043)	3.849	0.001	0.082	0.252	
Supply Chain Digitalization X Supply Chain Survivability						
Supply Chain Visibility X Supply Chain Survivability	0.041 (0.051)	1.020	0.308	−0.052	0.164	
Controls: Firm Size	0.052 (0.001)	0.212	0.779	−0.004	0.066	
Years of Establishment	0.033 (0.007)	0.186	0.552	−0.002	0.049	
Business Type	0.079 (0.005)	0.831	0.324	−0.034	0.099	
Conditional direct effect of SCD on SCP						
Supply Chain Survivability (-1SD)	0.083 (0.048)	0.173	0.862	−0.085	0.102	
Supply Chain Survivability (+1SD)	0.219 (0.061)	3.594	0.000	0.099	0.338	
Boot indirect effect (via Supply chain Visibility)						
Index of moderated mediation	0.066 (0.026)			0.042	0.063	
Conditional indirect effect of SCD on SCP (through Supply Chain Visibility)						
Supply Chain Survivability (-1SD)	0.165 (0.036)	3.774	0.039	0.067	0.109	
Supply Chain Survivability (+1SD)	0.302 (0.024)	6.925	0.014	0.092	0.244	

Note: n = 399; M = model, ULCI = upper level of confidence interval, ULCI = lower level of confidence interval.

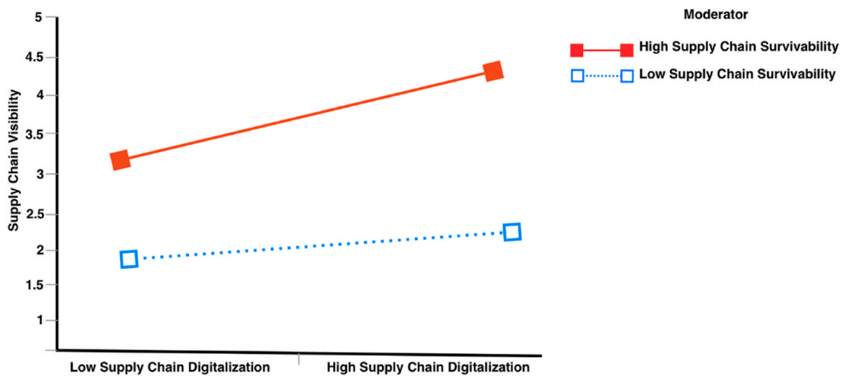

Fig. 3. The moderation of SCS on the relationship between SCD and SCV (low SCS = −1 SD, +1SD = high SCS).

technologies can handle large volume of data from different sources, providing support for supply chain activities, thus enhancing the quality of decision making.

SCV has a positive effect on SCP. This result is consistent with [65,66]. This result pattern could suggest that SCV can further elevate traceability and control among supply chain partners and promote coordination within the supply chain through the sharing of high-quality information, resulting in enhanced SCP.

A significant finding of this study was that SCV partially mediated the relationship between SCD and SCP. It can be inferred that the integration of SCD improves visibility and situation awareness, hence the insights obtained from information provided by digitalization can improve the control of flow of raw materials and products with the entire supply chain, leading to operational efficiency and SCP.

Lastly, the principal and the most important findings of this study, supply chain survivability moderated the SCD-SCV link in that SCD has a stronger, positive relationship when supply chain visibility is high compared to when it's low. Further, at low level of supply chain survivability, the positive effect of supply chain digitalization on SCD is weakened and insignificant according to simple slope

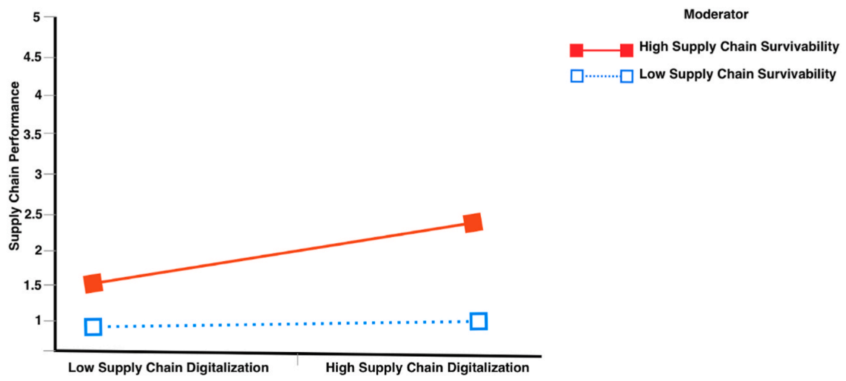

Fig. 4. The moderation of SCS on the relationship between SCD and SCP (low SCS = −1 SD, +1SD = high SCS).

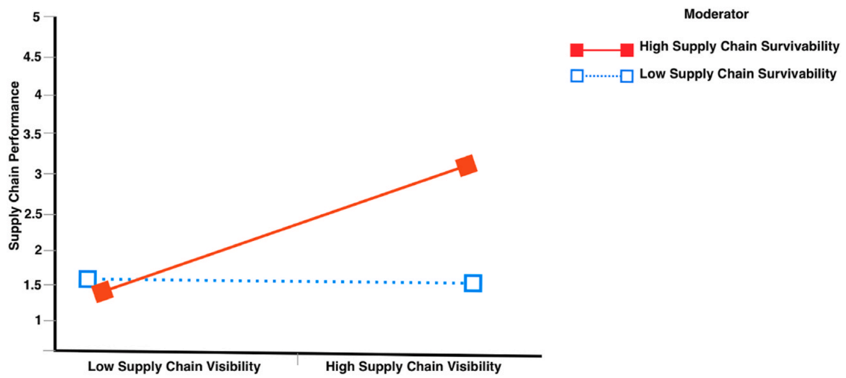

Fig. 5. The indirect effect of SCD on SCP (via supply chain visibility) at different levels of SCS (low SCS = −1 SD, +1SD = high SCS).

test. Additionally, the indirect positive effect of SCD on SCP via supply chain visibility is strongest when supply chain survivability is high.

4.1. Theoretical contribution

This study makes several important theoretical advances that help close the gaps in the existing body of knowledge.

First, our research is the first to explore and provide empirical evidence for the present integrated theoretical model in this manner. Our study advances the studies that draw on RBV and dynamic capability view as theoretical foundations in the operations management research [7, 62, 105]. Specifically, the results obtained indicated that SCV plays a partial mediating role in the SCD-SCP relationship. Though emerging studies in the extant literature have reported the crucial role of SCD in achieving enhanced supply chain performance [7, 104], the specific link between SCD and supply chain visibility has not been firmly established. Extant research has not provided sufficient insights how SCD affects supply chain visibility. Hence, by linking SCD with supply chain visibility and examining the mediating effect of supply chain visibility on SCP, we expand our comprehension on the link between SCD, supply chain visibility and SCP. These findings represent a crucial expansion of the use of capabilities for performance literature. The mechanism through which SCD affects SCP remains far from being clear understood. By providing empirical evidence that SCV is a mechanism through which SCD affects SCP, we close the research gap in the current literature [5].

Second, the most important contribution of the study is that it provides evidence that is currently not available in the extant literature regarding the condition under which the link between SCD, supply chain visibility and SCP could be more or less effective. By examining supply chain survivability as a moderator, this research goes a step further in the supply chain digitalization literature regarding the studies that examined just the mediating mechanism in the SCD-SCP relationship [7, 104]. Hence, employing a novel approach that transcends direct effects and mechanisms to reflect the complexity of the present situation.

Lastly, the majority of previous studies concentrated on supply chain in a normal and stable situation [75]. Recent studies on how SCD and supply chain visibility affect SCP in turbulent environments are still in their early stages. This research is one of the emerging studies that used supply chain samples after a major disruption. Despite the growing studies on digital technologies and supply chain, there is still limited studies on supply chain survivability in emerging markets. The results of the current research fill this gap and significantly contribute to the existing knowledge on supply chain survivability by revealing the condition under which the link between SCD, supply chain visibility and SCP is further enhanced or diminished.

4.2. Practical/managerial implications

The findings of this study offer some crucial practical implications and valuable managerial insights for manufacturing firms. First, supply chain digitalization entails the integration of digital technologies as a driving factor of the entire business process innovation, improved business model, services and products. Digitalization allows firms to restructure their value creation techniques, improve efficiency and flexibility. Hence, supply chain digitalization exhibits a level of alignment with operational objectives to achieve SCV. The complexity nature of the supply chain network and natural disasters are examples of external factors that can cause disruptions within the supply chain. Thus, managers should take advantage of the benefits of digitalization to improve communication through the exchange of information. Such action can promote the level of SCV by utilizing modern analytic procedures that generate new information that enhances information visibility in the supply chain. Second, the findings of this research recommend that the management of Turkish manufacturing firms should increase investment in the digitalization of the supply chain, as the outcome of this study revealed that SCD significantly improves performance of supply chain activities.

Third, our findings revealed that to fully unleash the benefits of digitalization of the supply chain for SCP is reliant on achieving agility and resilience capabilities in a turbulent environment. Firm with low survivability are less likely to fully reap the benefits of digitalization. Supply chain survivability (i.e., agility and resilience) is a decisive condition through which firms can fully reap the benefits of digitalization for improved visibility within the supply chain and SCP. Given the critical role of supply chain survivability in ensuring business continuity, firms must promote collaborative efforts among supply chain partners to foster the creation of combined risk mitigation strategies. Promoting the concept of win-win collaboration and equitable distribution of benefits has the potential to leverage the resources and capabilities of distinct firms across the overall supply chain, thereby facilitating a more sustainable supply chain operation.

Fourth, the management of manufacturing firms can use the findings of this study as a reliable reference in re-evaluating their existing supply chain shortfalls and develop the necessary resilience. Specifically, it is imperative to assess their agility and resilience and align it with their digital resource infrastructure to improve visibility within the supply chain and SCP. It is crucial to use digital resource infrastructure in a flexible manner to restructure, streamline processes and adapt business models.

Finally, the success of digitalization of the supply chain also depends on firm pro-actively adjusting digital structure, as well as recruiting digital talents and training personnel in digital skills.

4.3. Limitation

Despite the valuable insights provided by this study, this research has certain limitations that may present opportunities for future studies. First, the conceptual model was analyzed based on sample data collected from Turkish manufacturing industry; as a result, the generalization of the findings to other related sectors are needed in future research. Second, the conceptual model was built based on Turkish manufacturing industry, an emerging market. Future studies can apply this framework in other emerging markets with similar characteristics to generalize the results. Third, in recent times, there has been invitation for research regarding how enterprises can restructure their supply chains in order to ensure their survival. Future research may explore other capabilities or resources that could improve agility or resilience. For instance, the influence of intra-firm management capabilities or adaptation. Finally, our conceptual model may be expanded in future research to integrate additional resource perspectives. Specifically, we propose that knowledge and relational based views, which are extensions of RBV, may shed more light on the mechanisms of SCD-SCP relationship.

5. Conclusion

The research empirically examines the effects of SCD on SCV and SCP and uncovers the indirect effect of SCV on SCD-SCP relationship in the manufacturing industry in Turkey. Particularly, this study provides crucial evidence regarding the mediating role of SCV in the SCD-SCP relationship. Further, this research also significantly adds to existing knowledge on supply chain survivability as we found that it moderates the direct link between SCD and SCV, SCD and SCP and the indirect effect of SCD on SCP via SCV. This study made several contributions to fill the voids in the existing literature.

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Data availability statement

The datasets used in this study are available from the corresponding author upon reasonable request.

Additional information

No additional information is available for this paper.

CRediT authorship contribution statement

Abdelwahab Al Tera: Writing – original draft, Formal analysis, Conceptualization. **Ahmad Alzubi:** Supervision, Project administration. **Kolawole Iyiola:** Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e25584.

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