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The impact of artificial intelligence and supply chain collaboration on supply chain resilience: Mediating the effects of information sharing

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The study explores the combined influence of AI technology, supply chain collaboration, and information sharing on supply chain resilience. An integrated study model was developed and tested via SmartPLS using a purposive sample of 542 respondents across different industries, to understand how information sharing mediates the collective impact of AI technology and collaborative practices on supply chain resilience. The experimental results demonstrate that AI technology paves the way for timely information and insights generation, which develops collaborative relationships among supply chain partners, facilitates trust and transparency, and thereby, information sharing to exchange pertinent data and insights across the supply chain network. The data were collected by surveying 542 managers from various industries and analyzed using SmartPLS. Relationships among technology adoption, supply chain collaboration, information sharing, and supply chain resilience were investigated. Structural equation modeling (SEM) was employed to observe the direct and mediating effects of information sharing between technology adoption, supply chain collaboration, and supply chain resilience. This study implies that practical information-sharing activities are essential for achieving supply chain resilience amid unpredictability and disturbances in solid market environments. It presents how technology adoption and supply chain collaboration are crucial to supply chain resilience. Information sharing, however, is shown to be an essential mediator, as clear communication and knowledge exchange amongst supply chain partners are fundamentally important in achieving supply chain resilience. Organizations need to invest in AI-driven technologies and develop collaborative ties with their supply chains to be resilient. This paper constitutes a valuable study of the primary drivers of supply chain resilience. It offers implications that organizations can use to persist and grow in the current ambiguous business setting.

1. Introduction

Many decades of research in supply chain management (SCM) have identified two separate areas of study: supply chain collaboration and integration. Collaboration and integration in the supply chain were at first confused, but researchers have since defined the difference. Companies are always looking for ways to partner with suitable partners to improve their supply chains' efficiency and adaptability to market changes in today's competitive business environment. Recent complexity has

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made supply networks more susceptible to hazards, instability, and disruptions (Munir, Jajja, Chatha, & Farooq, 2020). About 65% of firms experience at least one interruption each year, and 13% of those that did in 2019 reported losses above e1 million. Integration and collaboration literature crosses specific sectors despite decades of research. Cooperation is prioritized in multi-firm network interaction while creating partnerships. The emphasis on relational and contractual mechanisms makes collaboration appealing (Baryannis, Validi, Dani, & Antoniou, 2019). Value co-creation emphasizes relationships (Ali, Abualrejal, Mohamed Udin, Shtawi, & Alqudah, 2022). Big data analytics study has demonstrated that predictive analytics may identify supply chain disruption reasons, improving SCRes (Kabra et al., 2019). Companies may strengthen their information capabilities by employing shared resident information to develop their analytical skills to maximize supply chain resilience (Wong, Lirn, Yang, & Shang, 2020).

Moreover, to mitigate disruptions, organizations generally construct business continuity plans and risk management strategies (Kwateng, Tetteh, Asare, & Manu, 2022). Implementing vendor-managed inventory contractual agreements (Baryannis et al., 2019)and structuring resilient supply chains to improve company performance in unpredictable times are common practical options (Abidi, de Leeuw, & Dullaert, 2020). Furthermore, Research has indicated that cutting-edge technologies like AI and Business Data Analytics (BDA) are necessary for continuing corporate operations, especially during external interruptions (Jeble, Kumari, Venkatesh, & Singh, 2020). In the past 20 years, several companies have tried to digitize. Industry 4.0 has become fashionable in business (Dolgui, Ivanov, Sethi, & Sokolov, 2019). AI is a prominent technology that facilitates device-machine communication (Toorajipour, Sohrabpour, Nazarpour, Oghazi, & Fischl, 2021a). AI can do complex tasks quickly and accurately while handling large volumes of data, and streamlining supply chain processes (Adem et al., 2018). AI is not new, but its wide variety of applications, such as supply chain management, has just recently been recognized (Khan, Bakkappa, Metri, & Sahay, 2009). AI may improve supply chain decision-making by anticipating and planning for future challenges. However, supply chain connections may go beyond information transfer to sharing experiences, risks, and rewards. Several manufacturers and service providers partnered with their main suppliers to improve supply and materials management and integrate them into their business strategy to succeed in the changing market. Long-term strategic planning is needed to spread risks and profits evenly across participants in supply chain management (Kaming, Olomolaiye, Holt, & Harris, 1997). Partnership and collaboration among supply chain members are the main drivers of effective management (Briscoe & Dainty, 2005). Supply chain collaboration may boost operational efficiency, effectiveness, and profitability, according to (Gligor & Holcomb, 2014). Sociology, psychology, marketing, management, and supply chain management have extensively studied collaboration. Supply chain collaboration was examined in this research. The main reason for collaboration is that one business cannot compete successfully alone. However, teamwork is still poorly understood. However, (Moeiny & Mokhlesi, 2011) presents a paradigm that emphasizes supply chain cooperation (SCC) in attaining collaborative advantage and improving business performance. This approach fills the (Atkinson, 1999) gap in appropriately describing SCC since earlier definitions focused on and overlapped with supply chain integration. They missed numerous key characteristics in their investigation. While SCC is well-known, its use in the service sector, especially in manufacturing, is still developing. SCRes is complex (Toorajipour et al., 2021a)and multidisciplinary (Tarafdar & Qrunfleh, 2017), transcending risk management (Munir et al., 2020). According to (Yang, 2014), this phenomenon includes several aspects that must be aggregated to explain. Applications and assessments have been done independently, dispersing current literature over multiple research streams. Despite SCRes' complex structure, this dispersion persists, highlighting the inadequate evaluation of AI methodologies to build and enhance SCRes in SC networks.

Three-way supply chain collaboration along with strategic AI integration is a hugely important approach to enhancing supply chain resilience (Ali, Udin, & Abualrejal, 2023). Where artificial intelligence plays a pivotal role by providing real-time insight through advanced analytics, which allows predictive insight into potential disturbances. Collaborative planning tools enhance the exchange of information between stakeholders, which enhances the collective response to changes (Atkinson, 1999). Information sharing is the cornerstone of responsive, adaptive, and agile in the face of dynamic business challenges

Based on the research gaps mentioned above, the following research questions were posed:

RQ1: Is there a relationship between supply chain collaboration and artificial intelligence on supply chain resilience?

RQ2: Does information sharing affect the relationship between supply chain collaboration and artificial intelligence in resilience supply chains?

In addressing the research questions, and based on the results, the current research is based on the theory (OIPT). The study population for this study consists of the industrial sector in Jordan, as this sector is considered one of the important sectors in Jordan because of its importance in strengthening the Jordanian economy through tax revenues and providing job opportunities. This study will look to detail hurdles in the industry, as well as gauge AI preparedness. The research proposes collaboration in the supply chain among stakeholder frameworks by the adaptation of AI solutions in Jordanian firms. Examining the mediation of information exchange will look to practical applications for improved collaboration. The research will tackle skill development, training, regulatory challenges, risk management, and sustainability. The current research aims to help in Ways to develop this sector in Jordan and the world in general, and from here stems the importance of the study that addresses the “The impact of AI Technology and Supply Chain Collaboration on supply chain resilience: Mediating effects of information sharing”.

2. Literature Review

2.1 Supply Chain Collaboration

Research on the value of cooperation in a variety of different fields has shown that working cooperatively with other members of the network has several advantages. In addition to easing purchasing, working with suppliers can boost the business by lowering transaction costs. (Alshawabkeh, Abu Rumman, & Al-Abbadi, 2024). Studies suggest that cooperatives can diversify their resources in numerous ways. (Khaled, Yahiya, Ahmad, Allahham, & Al-, 2024) and gain access to additional resources (Aljawazneh, 2024). Consequently, this promotes increased profitability and performance by facilitating the development of a long-term competitive advantage. However, to grasp and conceptualize cooperation within the specialized hospital supply chain, it is necessary to have a comprehensive knowledge of what constitutes collaboration and its many components. The existing body of research on collaboration has primarily concentrated on the significance and consequences of its involvement in planning activities, creation of a corporate context that encourages information sharing (Allahham et al., 2024), integration of cross-functional processes (Brandon-Jones, Squire, Autry, & Petersen, 2014), and establishment of aligned objectives (Guggisberg, 2022). While one set of supply chain collaboration researchers concentrated on lineage ratios, another group conducted a side study (Nandi, Nandi, Moya, & Kaynak, 2020). Supply chain collaboration (SCC) has been perceived and defined in many manners by numerous scholars (Moshtari, 2012). The study has examined the effects of supply chain collaboration (SCC) on several firms, encompassing cost savings and reaction time for all parties involved. Various elements of SCC have been recognized, such as information exchange, compatibility, incentive compatibility, resource sharing, cooperation, and shared knowledge generation.

Collaborative and integrated solutions for industrial AI are essential for enabling a network supply chain. Supply chain collaboration offers a flexible structure for considering alternative collaboration management systems. Collaboration throughout the supply chain enables collaboration to discover parts that are individually adaptable, and which improve the overall security of the supply network (Stentoft & Rajkumar, 2018). Furthermore, the supply chain was recovering from unfinished events and operating on schedule when the cooperative partnerships experienced a fast, lagged adjustment that led to the co-ops' subscriptions Over the last decade, resilience has become a hot topic in the supply chain, as a result, we have seen a growing number of researchers investigating different mechanisms of resilience (Ivanov, Dolgui, & Sokolov, 2019). At the same time, predictive real-time attack analytics improvements of artificial intelligence have changed these supply chains. For companies who are diverse and think out of the box, artificial intelligence can predict the future. This allows for proactively identifying and solving problems before they unfold (Choi, Wallace, & Wang, 2018). Instead of everything being running, captured, and recorded in real time. Since we are the ones who helped build the artificial intelligence systems, we use them. This is nice and can be referred to as artificial intelligence-prescribed responses. For example, prompt re-routing of shipments or finding alternative suppliers in the wake of a disruption facilitates a much more resilient and flexible supply chain (Kavota, Kamdjoug, & Wamba, 2020) When we fuse supply chain collaboration and creative artificial intelligence capabilities, we build a supply chain that is capable of enduring, adapting and recovering from disruptions we build a network that is more robust and resilient.

2.2 Artificial Intelligence

Digitization has been introduced in organizations by several companies during the twenty years before this one. It was only recently that the "Industry 4.0" term entered the corporate lexicon (Alazab, 2024). One of the leading technologies that make it possible for machines to communicate with one another and with people is Artificial Intelligence (AI) (Nandi et al., 2020). "AI clarifies the supply-chain picture by handling complex tasks with increased speed and accuracy while simultaneously managing very large data volumes" (Olivier Garos, 2020). Not a new concept, even though its applications in the supply-chain-management arena are just becoming evident a wide variety of applications exist for Artificial intelligence (AI) in supply-chain-management systems (Baryannis et al., 2019), including intelligent and adaptable decision-making as well as the ability to predict and preempt problems in the supply chain (Toorajipour, Sohrabpour, Nazarpour, Oghazi, & Fischl, 2021b). "AI system in place, a network for value chains operates smoothly with expense decreases due to the automation of compliance processes" (Nayal et al., 2021). Through the use of AI, the ability to forecast demand for today's dynamic and rapidly changing business environment is greatly enhanced (Belhadi, Mani, Kamble, Khan, & Verma, 2021a). "Highly customized interactions via AI-powered bots will elevate customer engagement to new highs" (Ali et al., 2023). These bots can help monitor the delivery status and are supported by echo users with the assistance of a customer service team (Nayal et al., 2021). Artificial intelligence may streamline laborious activities in warehouse operations by using automation. Amazon and Alibaba are now using AI-powered robots to optimize the productivity and efficiency of their supply chain (Fan, Zhang, Yahja, & Mostafavi, 2021). Within the supply chain, each minute and each mile are significant, and artificial intelligence (AI) employs algorithms to save time and expenses by optimizing routes and deliveries (Dubey et al., 2020). Artificial intelligence (AI) refers to the process of automating intelligent behavior. It involves a system's capacity to accurately interpret external data, learn from that data, and utilize the acquired knowledge to accomplish specific objectives and tasks by adapting flexibly. AI algorithms are designed to mimic the cognitive processes and information-processing abilities of human beings and other living species. They do this by including mechanisms of learning, adaptation, reproduction, and survival, as seen in nature (Zapke, 2019). Per the research conducted by (Guzman & Lewis, 2020) AI techniques," means data or knowledge formalism, methodology, architectures, and algorithms that can be clearly and explicitly articulated. Five areas can be used to group the techniques utilized in SCRes: genetic algorithms, machine learning, fuzzy logic, rough set theory, and multi-agent intelligent systems. These methods are extensively employed in numerous applications.

2.3 Information Sharing

The sharing of information (IS) would appear to be the object by which key strategic and tactical data is made available to businesses across the different stages of a supply chain. This data represents, among many others, inventory levels, sales forecasts, sales two encouragement, and advertising strategies (Nayal et al., 2021). The availability of visibility throughout the channel is crucial, as information for the fostering of supply chain collaboration would be seen as indispensable (Nandi et al., 2020). As far as this strategic domain of supply chain management is concerned, information sharing is critical as it will affect a number of performance outcomes of interest - among which is supply chain resilience. The intent of this undertaking would therefore be to examine the mediating role played by the sharing of information via supply chain collaboration and AI technology integration on the path to enhancing supply chain resilience (Rahi & Abd Ghani, 2021). The ability of its supply chain is what resilience would be seen as expressed (Christopher & Peck, 2004) to anticipate the threats (Zhou & Benton, 2007) as they emerge, be responsive to the resulting disruptions and any surprises that flow from the aforementioned (Brusset & Teller, 2017), and to then recover from them. As for real-time visibility on demand, transparency and the other elements would be delivered by IS with regard to setting supply chain resilience upward. Many times ahead, entities could share their information linked to demand trends, inventory levels, capacity usage, production lead times, and all the dynamics of the market (Anders & Biscop, 2019). This IS could allow entities to identify risks proactively, sync their operations and assets with those of partners, and coordinate with their vectors of recovery and contingency recoveries and contingency vectors (Zhou & Benton, 2007). AI technology has benefited significantly as analytics capabilities have arisen in supply chain management from AI technology. Its aforementioned AI technology offers predictive modeling and prescriptive modeling, real-time decision-making and proceeding, and in addition to pattern identification and sophisticated analytics that have come from the aforementioned permit the policing of colossal aggregates of unstructured and structured data that have been generated by ecosystems different sources. Among others, the data comes from radar monitoring, mobile phone agreements, legacy trade monitoring, and customer/client accounts (Allahham et al., 2024; Alrifai et al., 2023). Systems connected to the internet generate vast quantities of data, new information from shifts in demand patterns, latest information on seasonality and developments around products(Khaled et al., 2024). By using AI algorithms for demand, risk assessment, and inventory management, companies can enhance the accuracy and timeliness of information, which in turn can make them resilient from supply chain disruptions through early identification and quick operational responses.(Jermsittiparsert & Pithuk, 2019). Collaborative partnerships among supply chain partners support the exchange of resources, information, and expertise leading to mutual trust and shared objectives (Zhai & Shi, 2020). Various collaborative initiatives such as collaborative forecasting, joint planning, and vendor-managed inventory enable unfettered information sharing across organizational boundaries. The use of collaborative platforms and technologies allows organizations to achieve greater visibility into their supply chain operations, improved communication, and greater responsiveness to disruptions thus improving supply chain resilience (Chen, 2020). Information sharing is the core enabler for the interface of AI technology, supply chain collaboration, and resilience as it frees the flow of relevant data and insights across the supply chain network, enabling AI technology to maximize efficiency and accuracy in processing data so that organizations can generate insights that are timely and actionable, trust and transparency to facilitate collaboration across the supply chain that enables robust information sharing (Benzidia, Makaoui, & Bentahar, 2021). Doing this magnifies the benefits of these initiatives and helps organizations quickly adapt to changing market conditions and unforeseen events (Adem et al., 2018). The literature suggests that within the context of AI technology integration and supply chain collaboration, information sharing plays a critical role in enhancing supply chain resilience. Information sharing enables organizations to make their supply chains more efficient, agile and responsive by leveraging AI-driven insights and collaborative partnerships (Fan et al., 2021). Avenues for future research include exploring the mechanisms through which information sharing influence resilience outcomes and acquiring best practices for promotion of effective information sharing within supply chains (Alshawabkeh et al., 2024).

2.4 Supply Chain Resilience

The resilience of the supply chain resilience is "the capability to eradicate the undesirable effect of the unexpected and perturbing events and to possess the capability to return to its original or desirable pattern of operation or quickly take up a new position that is modified in such a way that it is better suited to qualify the desired operational, financial, and market performance" (Abou Kamar, Albadry, Sheikhelsouk, Ali Al-Abyadh, & Alsetoohy, 2023). Companies must identify and assess the numerous vulnerabilities of a supply chain and the potential impact of such vulnerabilities, the probability of their occurrence, and how they can be detected, among other things, for them to develop a resilient and robust supply chain (Liu, Shang, Lirn, Lai, & Lun, 2018).

Companies use different mechanisms to ensure the resilience of their supply networks. As the outbreaks of COVID-19 were starting to emerge, several supply chains started to realize that "some kind of extra inventory and excess capacity buffers would have made it more resilient" while others "started using some manufacturing capacity that was not being used for manufacturing drugs and other related products" (Brandon-Jones et al., 2014). Instead of relying on a single source of supplies, some supply chains were using multi-sourcing strategies to make their supply networks more resilient (Liu et al., 2018). "The COVID-19 pandemic has increased the prominence of near-shoring as a mechanism that can be used to reduce dependence on distant global networks which are geographically distant" (Belhadi, Mani, et al., 2021a). Local supply networks "not only provide better inventory management, but it allows you to respond to customers faster, and the local network, becomes the new normal, there's a lot of opportunity to standardize, the technology platforms that are used in each factory" (Al-Banna, Rana, Yaqot, & Menezes, 2023). This harmonization allows for a smooth flow of goods throughout the network (Alshawabkeh et al., 2024). Therefore, the uniformity of components across various goods, particularly those that are not vital and easily noticeable by the consumer, streamlines the procurement process and ultimately improves the level of resilience. In addition to the essential elements, the sustainability of the supply chain ecosystem heavily relies on its agreements with contract manufacturers and third-party logistics providers.

3. Hypothesis Development

3.1 Supply chain Collaboration and Supply chain Resilience

Supply Chain Collaboration refers to the cooperative efforts and coordinated operations of numerous supply chain players, including suppliers, manufacturers, distributors, and retailers. This collaborative approach is not only vital for achieving common goals, but it also has a significant impact on the overall strength of the supply chain system (Rha, 2020). Alshawabkeh et al. (2024) performed a survey to understand the effect of collaboration, both horizontal and vertical, on supply chain resilience. The results indicated that improved collaboration between firms in the supply chain could possibly lead to enhanced resilience. Based on the little data that's available, a process of analysis and response is carried out. subsequently, as the situation was manipulated, S.C. The structure must be influenced based on the content and amount of data gathered from the relevant studies. Therefore, this hypothesis proposes that collaborative efforts within the supply chain contribute positively to the system's resilience, emphasizing the critical role of Supply Chain Collaboration in developing and improving the supply chain network's adaptive capabilities in the face of uncertainties and disruptions." Therefore, we propose the following hypotheses:

Hypothesis 1: *Supply chain collaboration has a positive impact on supply chain resilience*.

3.2 Artificial Intelligence and Supply Chain Resilience

AI technology enhances supply chain resilience by determining and optimizing processes for making decisions. Technology provides data to be processed in real-time manufacturing, which improves responses and improves total flexibility. Data based on AI may help organizations discover dangers earlier, improve operations, and develop more robust and agile supply chains. Because AI may increase supply chain responsiveness and agility, dynamic capabilities were chosen as an acceptable lens to investigate supply chain resilience (Dubey et al., 2019). AI has long been seen as a key technology for facilitating communication between machines and their components (Jeble et al., 2020). Intelligence helps supply chain managers make smart and efficient decisions that anticipate difficulties. As a result, the proactive AI system contributes to improving service quality and satisfying consumers because of timely and undamaged delivery (Toorajipour et al., 2021a). According to (Green, Whitten, & Inman, 2012), artificial intelligence is a critical enabler for improving supply chain resilience. Enabling more efficient resource management within supply chains and bolstering their resilience. We consolidate and synthesize this fragmented knowledge through a systematic literature review of AI research in supply chain resilience and to facilitate more efficient management of supply chain resources, notwithstanding the growing prominence and potential advantages of AI in the supply chain domain. We curate and synthesize this dispersed knowledge by conducting a systematic literature review of AI research in supply chain resilience, notwithstanding the increasing prominence of AI in the context of supply chains and the potential advantages it may offer. So, according to previous studies, the following hypothesis has been proposed.

Hypothesis 2: *Artificial Intelligence has a positive impact on supply chain resilience.*

3.3 Mediating Effects of Information Sharing

Information sharing collaboration and the integration of AI technology significantly facilitate a positive mediating effect between supply chain resilience and information sharing. The seamless exchange of information enables a supply chain to be both adaptive and responsive (Yang, 2014). Through the real-time analysis of vast quantities of data, identification of patterns, and provision of actionable suggestions, AI technology further augments this symbiotic relationship. It was emphasized that the development of dynamic capabilities, which improve supply chain practices and performance, is dependent on the implementation of efficient information-sharing practices in supply chains. By drawing on AI-powered analytics, organizations can better predict disruptions and reveal collective risks so they can proactively act on them (Zhou & Benton, 2007). AI and supply chain collaboration together create a resilient ecosystem. Earlier studies have suggested that information sharing turns supply chain stakeholders into one powerful and self-analyzing organism that responds to market shifts, consumer requirements, and competitive pressures as one entity. In today's brutally competitive markets, it is very important to consider the strategic role of information sharing in securing a competitive edge (Alrifai et al., 2023). This is because information sharing enhances the intricacies of long-lasting collaboration and coordination that ultimately results in improved supply chain and firm performance (Allahham et al., 2024). Therefore, the enhancement of visibility through information sharing within supply chains enables improved collaborations, agility, and ultimately performance (Al-Emran & Teo, 2020).

Thus, we propose the following hypotheses, which state that;

Hypothesis-3. a, b information-sharing has a positive mediating effect on the relationship between (a) SSC and Supply chain Resilience (b) Artificial Intelligence and Supply chain Resilience (c) Information sharing and Supply Chain Resilience.

4. Conceptual Model

The organizational information processing theory (OIPT) states that a company's information-sharing performance is based on the ratio of the company's information-sharing capabilities to its information-processing needs (Belhadi, Mani, Kamble, Khan, & Verma, 2021b). If supply chain uncertainties materialize, they may weaken the connection between information-sharing skills and the results they provide. This means that supply chains need to work on their ability to communicate with stakeholders proactively so that their operations can be more seen and tracked. The literature provides a view of data analytics capability as an OIPT-based information processing capability, intending to study its impact on supply chain resilience (Belhadi, Kamble, Fosso Wamba, & Queiroz, 2021). In theory, businesses may lessen their data dependency by enhancing their information processing abilities or by relying on more "mechanistic" organizational resources (Galbraith, 1974). They have the choice between the two choices mentioned. Interdependent activities must be organized by dividing labor and centralizing decision-making in organizations that favor mechanistic models (Adem et al., 2018). Issues and complexities known as "exception scenarios" are often handled by them via the application of rules, hierarchy, objectives, and goals. Mechanistic model costs go up and responsiveness goes down significantly due to the high frequency of exception circumstances. (Qrunfleh & Tarafdar, 2014) state that establishing lateral and vertical information systems is an alternative way for an organization to improve its information-processing capabilities (Aranyossy, 2022). They argue that supply chain collaboration (SCC) may lead to supply chain resilience when the capacity of information-sharing is equal to the magnitude of disruptions in the supply chain. On the other hand, the supply chain network's inter-organizational information management abilities are not well described by this paradigm. Capabilities like supply chain collaboration and flexibility cannot be developed without them (Qrunfleh & Tarafdar, 2014).

The supply chain's inherent unpredictability may alter the correlation between information-sharing capacities and their associated consequences (Dubey et al., 2019). Therefore, supply chains must be able to proactively communicate with stakeholders to improve supply chain visibility and traceability. Thinking about data analytics to analyze information based on “OIPT” from the literature is one way to look at it. Then, you can look at how it affects supply chain resilience (Chowdhury, Quaddus, & Agarwal, 2019). In theory, businesses may reduce their reliance on information or improve their ability to manage data by using “mechanistic” organizational resources rather than information (Galbraith 1974). Specifically, OIPT states that for organizations to be resilient, they must be able to handle information that comes with growing amounts of uncertainty. Being able to process information in the face of uncertainty, volatility, and change is a critical skill for any company to have (Dubey et al., 2019). The results of this research suggest that AI should be built from the bottom up to eliminate functional difficulties and uncertainties; it is a tool for information-sharing.

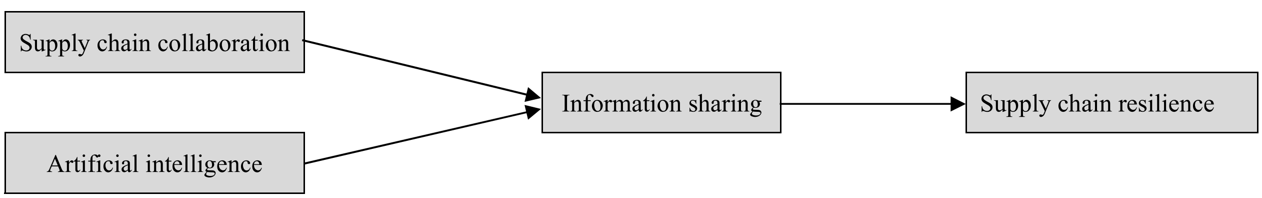

Fig. 1. Framework of Study

4.1 Population and Sampling

This research has used a quantitative approach to collect data using a well-structured questionnaire. The non-probability sample method was used, specifically a purposive sample, to select individuals for this current study. Specific criteria pertinent to the research objectives were defined to select participants who had knowledge relevant to AI technology, supply chain collaboration, and information sharing within Jordanian industries. The aim was to understand the manufacturing sector in Jordan, which plays a significant role in the country's domestic gross product. To ensure comprehensive representation, the sample included 542 companies, including small, medium, and large enterprises from the managers of those companies. The data collection period lasted from June 2023 to January 2024. The companies were selected purposely based on their use of artificial intelligence and their proactive management of supply chains. The study emphasized the importance of collaboration among supply chain stakeholders and the need for information-sharing practices to enhance resilience and fortify the ability to recover from disruptions within the supply chain. Table 1 provides an overview of the participating companies' demographic details, highlighting the sample's diversity.

The results from the demographic table1 of respondents (sample size n=542) show a significant diversity in the sample composition making substantial insights into the demographic context for the participants. A strong gender diversity was maintained with; Males 60%, Females 40%, and Balanced gender representation around the world as expected. A varied distribution of age categories was also maintained with; 35 and less than 45 (40%). Suggesting a varied age distribution based on the nature of dating. The years of experience also varied from; P10 (28%) and >25 (3%). Based on the job titles Business Administration was the highest with; a BA of 54%. Again, this suggests varied job titles of professionals in dating. A varied educational background was also seen with an undergraduate degree of 60% and a Master/PhD of 29%. The educational diversity within the sample was evident.

Table 1
Respondents' Demography

Dimension		Frequency	Percentage
Gender	Male	325	60%
	female	217	40%
	Total	**542**	**100%**
Age	less than 27	54	10%
	27-less than 35	108	20%
	35-less than 45	217	40%
	45 and above	163	30%
	Total	542	100%
Years of experience	less than 10	152	28%
	10-less than 15	120	22%
	15-less than 20	124	23%
	20-less than 25	130	24%
	25 and above	16	3%
	Total	**542**	**100%**
Job title	Business Administration	293	54%
	Accounting	119	22%
	Social sciences	103	19%
	Other	27	5%
	Total	**542**	**100%**
Education	Diploma	60	11%
	Undergraduate degree	325	60%
	Postgraduate degree (Master/PhD)	157	29%
	Total	**542**	**100%**

5. Data analysis

Data for this study was gathered using both online forms and physical questionnaires, employing a closed-ended questionnaire methodology derived from previous studies. The constructs under investigation included AI technology, supply chain collaboration, information sharing, and supply chain resilience. To evaluate the impact of AI technology and supply chain collaboration on information sharing as a mediating element for supply chain resilience, using PLS-SEM and PLS-MGA. Data was collected by a survey of 542 managers from manufacturing firms in Jordan to assess our hypothesized relationships. To assess the reliability of the data, we used Cronbach's alpha (CB), composite reliability (CR), and factor loadings.

Table 2
Cross Loading Analysis

Constructs	Items	Factor loadings	Cronbach's Alpha	CR	(AVE)
Supply chain Collaboration	SCC-1	0.744	0.819	0.839	0.645
	SCC-2	0.787			
	SCC-3	0.827			
	SSC-4	0.851			
Information Sharing	INFO-1	0.841	0.868	0.879	0.604
	INFO -2	0.822			
	INFO -3	0.833			
	INFO -4	0.751			
	INFO -5	0.730			
	INFO -6	0.672			
Artificial Intelligence	A1-1	0.833	0.860	0.866	0.641
	AI-2	0.827			
	AI-3	0.795			
	AI-4	0.767			
	AI-5	0.779			
Supply Chain Resilience	SCR-1	0.654	0.904	0.196	0.566
	SCR-2	0.680			
	SCR-3	0.700			
	SCR-4	0.746			
	SCR-5	0.718			
	SCR-6	0.842			
	SCR-7	0.806			
	SCR-8	0.786			
	SCR-9	0.815			

Table 2 shows that the reliability of all measurement models is established since CB alpha is above the recommended threshold of 0.70, CR is above 0.60, and factor loading is above 0.50 (Hair, 2014, 2017). Then to ensure overall validity, we evaluated convergent and discriminant validities. The convergent validity is confirmed as each measurement model has its AVE value outperformed the threshold of 0.50, as shown in Table 2. To test the discriminant validity, we used the Fornell-Larcker criteria. As shown in Table 3, the diagonal value of square-rooted AVEs is greater than their corresponding row and column construct values, indicating good discriminant validity for all measurement models. For the AI technology construct, consisting of seven items, such as Technology Adoption Commitment, Trust in Technology, Adaptability and Collaboration, Secure Implementation, Capability and Skill Development, Digital Experience, and Infrastructure Readiness, items were adopted from (Olan, Liu, Suklan, Jayawickrama, & Arakpogun, 2021).

Table 3
Discriminant Validity (Fornell-Larcker's test)

	Artificial Intelligence	Information Sharing	Supply Chain Resilience	Supply chain Collaboration
Artificial Intelligence	**0.801**			
Information Sharing	0.943	**0.777**		
Supply Chain Resilience	0.947	0.943	**0.752**	
Supply chain Collaboration	0.508	0.511	0.455	**0.743**

The supply chain collaboration construct, encompassing items like continuous technical improvement, information technology adoption commitment, collaborative new product development, reduced product development cycles, and optimized supply chain deliveries, was drawn from (Alshawabkeh et al., 2024; Uvet, Celik, Cevikparmak, & Adana, 2021). The information-sharing construct comprised six items, including Transparent Criticism Handling, Encouraging Partner Feedback, Employee Feedback from Suppliers, Open Information Sharing, Technology-Driven Information Sharing, and Guidelines for Effective Information Sharing, adapted from (Uvet et al., 2021). Lastly, supply chain resilience, Formalized Risk and Revenue Sharing Document, Sharing Information for Business Purposes, Collaboration for Risk Reduction, Assessment of Information Security Risks, Visibility Across the Supply Chain, Adaptive Capability for Resilience, Trust Requirements for Information Access, Incident Reporting Mechanism, Focus on Supply Chain Structure for Risk Reduction, and Sustainability for Resilience, was adopted from (Ali et al., 2023).

Following data collection through both online and physical means, the study utilized Partial Least Square-Structural Equation Modeling (PLS-SEM) to assess the impact of AI technology and supply chain collaboration on supply chain resilience and examine the mediation effect of information sharing. Additionally, the study explored the moderation effect of the control variable. PLS-SEM, chosen for its robust modeling approach, ensured fitness through a threefold strategy, encompassing the evaluation of reliability, validity (convergent and discriminant), and model fitness. Furthermore, the hypothesized relationships were tested. PLS-Multi Group Analysis (MGA).

6. Structural Model

Following the establishment of trust in the accuracy of the measurement system, the structural design is analyzed. In order to analyze structural models, it is necessary to evaluate the degree to which the theory or ideas are supported by the data, and as a result, it is necessary to determine whether or not the hypothesis is supported by the data. The result of the Fornell–Larcker test which examines the discriminant validity in CFA or SEM is provided in the table. In this table, all the values specified are either off-diagonal correlation coefficients between constructs or the square root of the Average Variance Extracted (AVE) for a construct is located on the diagonal. If the square roots of AVEs are larger than the correlations that each construct has with the remainder, then the criterion for discriminant validity is met. For example, to meet the discriminant validity criterion, construct “Artificial Intelligence” which has an αAVE(s) = 0.801 should be greater than its other construct correlations with “Supply chain collaboration”, “Information sharing” and “Supply chain resilience”. The same principle is also true for all the other constructs of the model. In short, this table allows us to check the independence and distinctiveness of each individual construct, and hence the reliability and validity of the measurement model in CFA or SEM analyses.

Table 4
Discriminant Validity HTMT

	Artificial Intelligence	Information Sharing	Supply Chain Resilience	Supply chain Collaboration
Artificial Intelligence				
Information Sharing	0.621			
Supply Chain Resilience	0.674	0.732		
Supply chain Collaboration	0.628	0.594	0.530	

The Heterotrait-Monotrait (HTMT) ratio test results are presented in the Table. All constructs in the model present discriminant validity as their ratios are below the well-accepted threshold. For instance, "Information sharing" and "Supply chain collaboration", and "Information intelligence" HTMT ratios are 0.621 and 0.530, respectively. Likewise, "Information sharing" and "Supply chain resilience", and "Information sharing" HTMT ratios are 0.732 and 0.674, respectively. All above-mentioned values imply that correlations within constructs are considerably higher than with the other constructs, and thus provide further evidence of the robustness of the analytical model and support the good discriminant validity hypothesis.

7. Hypotheses Testing

The path coefficient of the structural model was investigated using PLS. It is possible to compare the path coefficient of SmartPLS 3.0 to the beta weight of the regression. It is possible that these estimated route coefficients might range anywhere from -1 to 1, with -1 indicating that there is no link and 1 indicating that there is a substantial positive or negative association. The information on the significance level, T-value, P-value, path coefficient, and standard error is shown in Table 5. Path coefficients in the structural model with their sizes and pervasive connections between different variables are illustrated in Table 5. To examine specific relationships within the model, each hypothesis (H1 to H5) is designed to be tested. The results of the test reveal the presence of distinct relationships in all directions: the strength of IV artificial intelligence in driving supply chain resilience ($t=4.514$, $p < 0.001$), there is a high correlation. Furthermore, for “Supply Chain Resilience” and “Supply Chain Collaboration”, there is a strong relationship (0.411 path coefficient; t-value = 7.808, p-value < 0.001). Finally, “Information sharing” and “Supply Chain Resilience” are significantly linked with a coefficient value of 0.221 (t-value =

4.465, p-value < 0.001). On "Supply Chain Resilience", both hypotheses H4 and H5 highlight the combined effects of "Supply Chain Collaboration" and "Information sharing", with path coefficients of 0.236 and 0.245 (t-values > 5.353, p-values < 0.001). This finding tells us how important artificial intelligence is in supply chain resilience, as well as how beneficial their contributions can be.

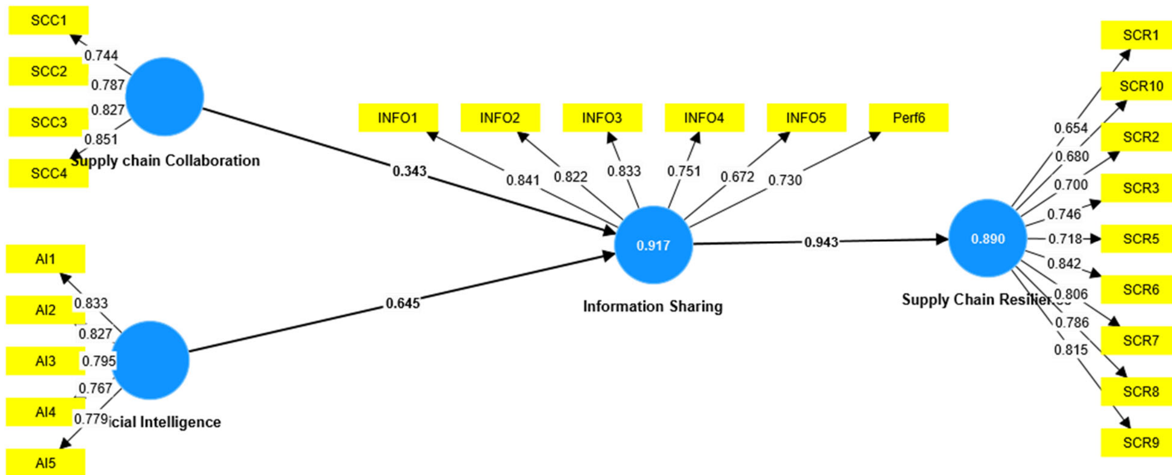

Fig. 2. Testing of hypotheses

Table 5
Structural model estimates (Path coefficients)

Hyp.	Relationships	Std. Beta	Std. Error	T-Value	P-Values	Decision
H1	Artificial Intelligence → Supply Chain Resilience	0.195	0.042	4.514	0.000	Supported
H2	Supply chain Collaboration → Supply Chain Resilience	0.411	0.051	7.808	0.000	Supported
H3	Information sharing → Supply Chain Resilience	0.221	0.052	4.465	0.000	Supported
H4	Supply chain Collaboration → Information sharing → Supply Chain Resilience	0.236	0.044	5.353	0.000	Supported
H5	Supply chain Collaboration → Information sharing → Supply Chain Resilience	0.245	0.051	7.461	0.000	Supported

Table 6
R^2 and R^2 Adjusted

Variable	R^2	R^2 Adjusted
Supply Chain Resilience	0.880	0.885

Table 6 contains the findings of R2 to assess the accuracy of the forecasts. The Supply Chain Resilience R2 score is 0.880. These findings demonstrate that explanatory factors account for more than 12 percent of variations.

8. Discussion

By studying the impact of AI technology and supply chain collaboration on supply chain resilience in light of Jordanian industries, with a specific focus on the mediating role of information sharing, this study hopes to offer several practical implications for improving the local business landscape. By closely reviewing the existing state of practices, this study hopes to support a comprehensive understanding of the extent of AI adoption and supply chain collaboration in Jordan. This understanding will be invaluable in identifying unique challenges faced by the industries and assessing their readiness for what is a seismic shift through AI integration. There is an immediate need to develop AI solutions that are tailored to the unique needs of Jordanian businesses, and this study hopes to provide initial frameworks for the effective collaboration of supply chain stakeholders to achieve this (Ali et al., 2023). Additionally, by looking into the mediating role of information sharing, this study hopes to come up with practical strategies for making focused, collaborative approaches work. So, although this study will provide some insights into the skill development and training that will be necessary, a potential benefit of this study would be that it also looks at issues surrounding regulation, risk management, and long-term sustainability in a Jordanian context. By doing so, and embedding the execution of this project in the active engagement of industry representatives, government bodies, and academia, it is hoped that academic inquiry and practical implementation can be brought much closer to one another, for the ultimate benefit of Jordanian industries and their competitiveness and resilience in a global environment that is becoming increasingly complex and demanding.

The findings of our study align with existing literature on AI Technology, supply chain collaboration, information sharing, and supply chain resilience. The significance of the relationship in the total sample and large subgroup indicates that adopting

AI technology has a more pronounced impact on information sharing in more extensive organizational settings (Zhong, Jia, Chen, Hong, & Yu, 2023). Furthermore, the consistent significance across all sample groups underscores the critical role of information sharing in enhancing supply chain resilience, aligning with established literature emphasizing the importance of information flow for effective supply chain management (Gupta, Rathore, & Biswas, 2022). Furthermore, the significant relationship observed across all sample groups reinforces the aforementioned positive influence of collaboration on information sharing. Such a result highlights that while the development of collaboration within the supply chain can foster improved information sharing (Kim & Shin, 2019), it does not only stop at this point. Indeed, this also points to the fact that as manufacturing firms intensify collaboration with best-of-breed in the supply chain, the benefits of information sharing consequentially materialize as well. Conversely, the varying significance across sample groups, suggests the indirect influence of AI Technology, Information Sharing, and Supply Chain Resilience, where larger organizations are likely to benefit more from the combined effect of the three (Rahi, Khan, & Alghizzawi, 2021). As a result of this, the significant related relationship across all sample groups, emphasizes that the implicated association being detected between supply chain collaboration, information sharing, and supply chain resilience, withstands the collaborative interplay across different sizes of manufacturing organizations (Dubey et al., 2019). If we are to understand the relationship between the impact of AI technology and supply chain collaboration on supply chain resilience it must dissect these variables in their entirety. It is necessary to understand the composite of AI technology and collaborative labor in the supply chain to strengthen resilience. In addition, by emphasizing the mediator role of information sharing, the mechanisms by which these factors influence are clarified. Combining case studies with best practices will not only offer specific examples of effective implementations but will also provide recognition of the various problems and important factors to be considered with an impartial attitude. As well, the identification of possible areas for research offers chances to further explore questions of supply chain resilience development. This paper may offer concrete, scientific advice that is of practical and pragmatic help to those trying to be resilient in the face of the complicated difficulties encountered by today's supply chains when it comes to meeting all of these desires. For these reasons, both the system dynamics approach and case research should be used to evaluate the effectiveness of supply chain responses.

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